Name

iGCSE CAIE 0620 Chemistry Revision Booklet

Papers 3/4 (704marks) & Paper 2 (231marks)

Contents

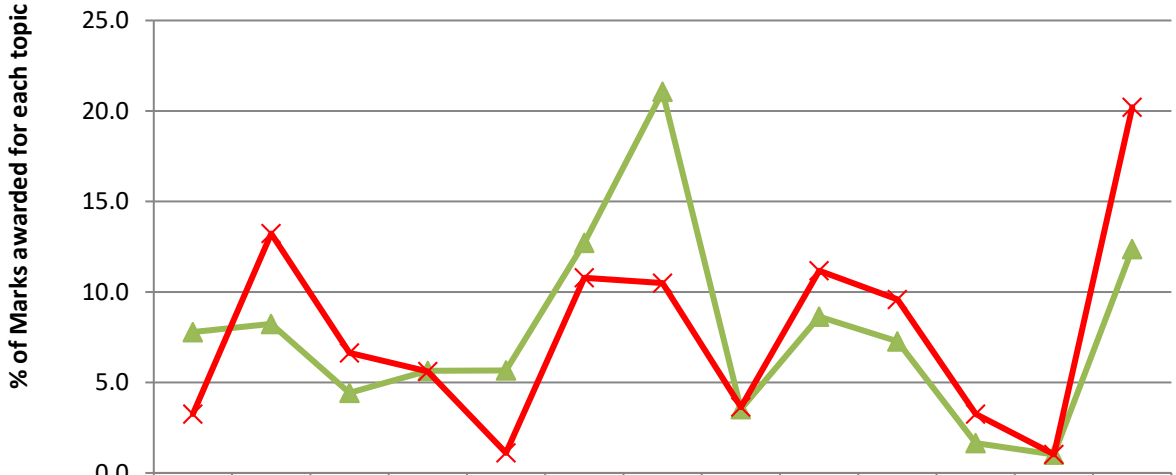
For an electronic version of this booklet

From my main website: www.SmashingScinece.org

From my mirror site (still being built): https://patrickbrannac2.wixsite.com/smashingscicn/igcse-chemistry-caie-0620

PAPERS 1, 3 and 6

Percentage of all WEIGHTED marks awarded for each topic from w2001 to w2015 (green) and % of Paper 3 marks (red)

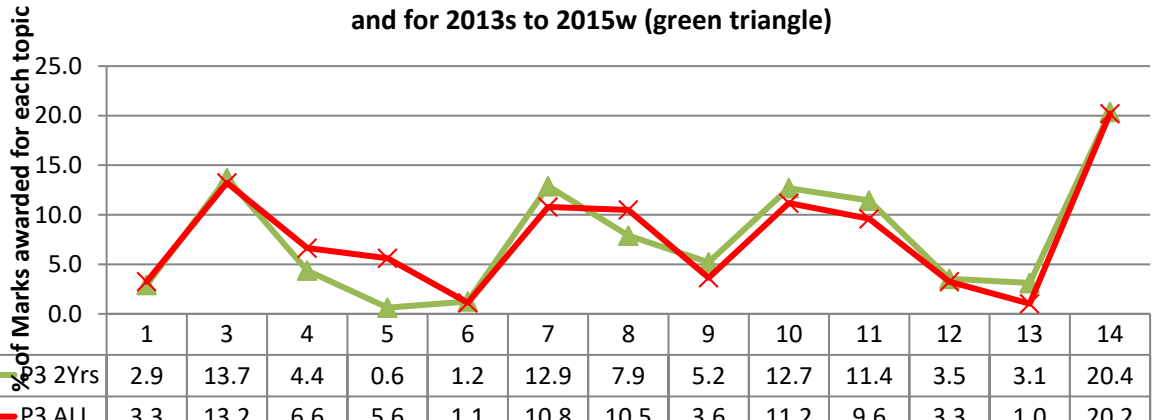


	1	3	4	5	6	7	8	9	10	11	12	13	14
% Marks	7.8	8.2	4.4	5.6	5.7	12.7	21.1	3.5	8.6	7.3	1.7	1.0	12.4
Paper 3 %	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2

ALL PAPERS Topic Number

PAPER 3

Percentage of all marks awarded for each topic from w2001 to w2015 (red cross) and for 2013s to 2015w (green triangle)



	1	3	4	5	6	7	8	9	10	11	12	13	14
P3 2Yrs	2.9	13.7	4.4	0.6	1.2	12.9	7.9	5.2	12.7	11.4	3.5	3.1	20.4
P3 ALL	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2

Paper 3 Topic Number

	Total	Chem 1	Chem 3	Chem 4	Chem 5	Chem 6	Chem 7	Chem 8	Chem 9	Chem 10	Chem 11	Chem 12	Chem 13	Chem 14
Total Marks	2320	74	312	155	81	26	256	246	85	296	231	76	24	474
% of Marks	2336	3.2	13.4	6.6	3.5	1.1	11.0	10.5	3.6	12.7	9.9	3.3	1.0	20.3

Topic	**14**	**3**	**10**	**7**	**8**	**11**	**4**	**5**	**9**	**1**	**12**	**6**	**13**
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

Topic	**14**	**3**	**10**	**7**	**8**	**11**	**4**	**5**	**9**	**1**	**12**	**6**	**13**
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

Textbook Chapters Mapped To CAIE 0620 Topic Numbers And Teaching Weeks

Textbook: Complete Chemistry for Cambridge iGCSE 3rd Ed. RM Galagher P Ingram (ISBN: 978-0-19-839914-8)

CAIE Topic ID	My topic ID	Textbook Chapter	PhysC OrgC?	Teaching Week #	Topic name
1	Heading				The particulate nature of matter
1.1	1.1	1	OrgC	5	The particulate nature of matter
2	Heading				Experimental techniques
2.1	2.1&2	19	PhysC	1	Measurement
2.2	Heading				Purity
2.2.1	2.2.1&2	2	PhysC	2	Criteria of purity
2.2.2	2.2.1&2	2	PhysC	2	Methods of purification
3	Heading				Atoms, elements and compounds
3.1	3.1	3	OrgC	1	Atomic structure and the Periodic Table
3.2	Heading				Structure and bonding
3.2.1	3.2.1&2	4	OrgC	3	Bonding: the structure of matter
3.2.2	3.2.1&2	4	OrgC	4	Ions and ionic bonds
3.2.3	3.2.3&4	4	OrgC	4	Molecules and covalent bonds
3.2.4		4	OrgC	7	Macromolecules
3.2.5	3.2.5	4	OrgC	7	Metallic bonding
4	Heading				Stoichiometry
4.1	4.1	5	OrgC	9	Stoichiometry
4.2	4.2	6	OrgC	10	The mole concept
5					Electricity and chemistry
5.1	5.1	8	PhysC	7	Electricity and chemistry
6	Heading				Chemical energetics
6.1	6.1&2	9	PhysC	9	Energetics of a reaction
6.2	6.1&2	9	PhysC	10	Energy transfer

CAIE Topic ID	My topic ID	Textbook Chapter	PhysC OrgC?	Teaching Week #	Topic name
7	Heading				Chemical reactions
7.1	7.1&2	4	OrgC	3	Physical and chemical changes
7.2	7.1&2	10	PhysC	11	Rate (speed) of reaction
7.3	7.3	9	PhysC	13	Reversible reactions
7.4	7.4	7	PhysC	5	Redox
8	Heading				Acids, bases and salts
8.1	8.1&2	11	PhysC	16	The characteristic properties of acids and bases
8.2	8.1&2	11	PhysC	16	Types of oxides
8.3	8.3	11	PhysC	17	Preparation of salts
8.4	8.4	19	PhysC	20	Identification of ions and gases
9	Heading				The Periodic Table
9.1	9.1&2	12	OrgC	12	The Periodic Table
9.2	9.1&2	12	OrgC	12	Periodic trends
9.3	9.3	12	OrgC	13	Group properties
9.4	9.4	12	OrgC	14	Transition elements
9.5	9.5	12	OrgC	14	Noble gases
10	Heading				Metals
10.1	10.1	13	PhysC	21	Properties of metals
10.2	10.2	13	PhysC	22	Reactivity series
10.3	10.3	14	PhysC	23	Extraction of metals
10.4	10.4	14	PhysC	24	Uses of metals
11	Heading				Air and water
11.1	11.1	15	OrgC	16	Water
11.2	11.2	15	OrgC	17	Air
11.3	11.3	16	OrgC	20	Nitrogen and fertilisers
11.4	11.4	16	OrgC	15	Carbon dioxide and methane
12	Heading				Sulfur
12.1	12.1	16	PhysC	14	Sulfur
13	13				Carbonates
13.1	13.1	16	OrgC	15	Carbonates
14	Heading				Organic chemistry
14.1	14.1&2	17	OrgC	21	Names of compounds
14.2	14.1&2	17	OrgC	21	Fuels
14.3	14.3&4	17	OrgC	22	Homologous series
14.4	14.3&4	17	OrgC	22	Alkanes
14.5	14.5	17	OrgC	23	Alkenes
14.6	14.6	17	OrgC	23	Alcohols
14.7	14.7	17	OrgC	23	Carboxylic acids
14.8	Heading				Polymers
14.8.1	14.8.1&2	18	OrgC	24	Polymers
14.8.2	14.8.1&2	18	OrgC	25	Synthetic polymers
14.8.3	14.8.3	18	OrgC	26	Natural polymers

The core material is examined in all three exam papers (papers 1,3 and 6) and is intended to assess understanding up to a grade C level. From 2016, the Supplement material is **examined in all three papers**, however, before 2016 papers 1 and 6 did not contain any Supplement material. If the number of marks that can be awarded above a C grade will remain the same, in practice this means that:

1. Paper 3 will contain fewer Supplement marks, so more core marks so will be easier (if you can answer the Paper 3 questions from before 2016 then you will be fine)
2. Papers 1 and 3 will contain Supplement marks, unlike in all papers before 2016, so will assess material they have not done before, so will be harder because of the questions and as there are no previous questions to practice on, will be harder because of the newness.

Material that is new or changed in 2016 is highlighted with BLACK LINES next to it.

1. The particulate nature of matter	
Core	**Supplement**
• State the distinguishing properties of solids, liquids and gases	
• Describe the structure of solids, liquids and gases in terms of particle separation, arrangement and types of motion	
• Describe changes of state in terms of melting, boiling, evaporation, freezing, condensation and sublimation	• Explain changes of state in terms of the kinetic theory
• Describe qualitatively the pressure and temperature of a gas in terms of the motion of its particles	
• Show an understanding of the random motion of particles in a suspension (sometimes known as Brownian motion) as evidence for the kinetic particle (atoms, molecules or ions) model of matter	• Describe and explain Brownian motion in terms of random molecular bombardment
• Describe and explain diffusion	• State evidence for Brownian motion • Describe and explain dependence of rate of diffusion on molecular mass
2. Experimental techniques	
2.1 Measurement **Core**	
• Name appropriate apparatus for the measurement of time, temperature, mass and volume, including burettes, pipettes and measuring cylinders	

2.2.1 Criteria of purity **Core**	**Supplement**
• Demonstrate knowledge and understanding of paper chromatography	• Interpret simple chromatograms, including the use of R_f values
• Interpret simple chromatograms	• Outline how chromatography techniques can be applied to colourless substances by exposing chromatograms to substances called locating agents (Knowledge of *specific* locating agents is **not** required.)
• Identify substances and assess their purity from melting point and boiling point information	
• Understand the importance of purity in substances in everyday life, e.g. foodstuffs and drugs	
2.2.2 Methods of purification **Core**	
• Describe and explain methods of purification by the use of a suitable solvent, filtration, crystallisation and distillation (including use of fractionating column). (Refer to the fractional distillation of petroleum in section 14.2 and products of fermentation in section 14.6.)	
• Suggest suitable purification techniques, given information about the substances involved	

3. Atoms, elements and compounds

3.1 Atomic structure and the Periodic Table

Core

- State the relative charges and approximate relative masses of protons, neutrons and electrons
- Define *proton number* (atomic number) as the number of protons in the nucleus of an atom
- Define *nucleon number* (mass number) as the total number of protons and neutrons in the nucleus of an atom
- Use proton number and the simple structure of atoms to explain the basis of the Periodic Table (see section 9), with special reference to the elements of proton number 1 to 20
- Define *isotopes* as atoms of the same element which have the same proton number but a different nucleon number
- State the two types of isotopes as being radioactive and non-radioactive
- State one medical and one industrial use of radioactive isotopes
- Describe the build-up of electrons in 'shells' and understand the significance of the noble gas electronic structures and of the outer shell electrons (The ideas of the distribution of electrons in s and p orbitals and in d block elements are **not** required.)

  Note: a copy of the Periodic Table, as shown in the Appendix, will be available in Papers 1, 2, 3 and 4.

Supplement

- Understand that isotopes have the same properties because they have the same number of electrons in their outer shell

3.2.1 Bonding: the structure of matter

Core

- Describe the differences between elements, mixtures and compounds, and between metals and non-metals
- Describe an alloy, such as brass, as a mixture of a metal with other elements

3.2.2 Ions and ionic bonds

Core

- Describe the formation of ions by electron loss or gain
- Describe the formation of ionic bonds between elements from Groups I and VII

Supplement

- Describe the formation of ionic bonds between metallic and non-metallic elements
- Describe the lattice structure of ionic compounds as a regular arrangement of alternating positive and negative ions

3.2.3 Molecules and covalent bonds

Core

- Describe the formation of single covalent bonds in H_2, Cl_2, H_2O, CH_4, NH_3 and HCl as the sharing of pairs of electrons leading to the noble gas configuration
- Describe the differences in volatility, solubility and electrical conductivity between ionic and covalent compounds

Supplement

- Describe the electron arrangement in more complex covalent molecules such as N_2, C_2H_4, CH_3OH and CO_2
- Explain the differences in melting point and boiling point of ionic and covalent compounds in terms of attractive forces

3.2.4 Macromolecules

Core

- Describe the giant covalent structures of graphite and diamond
- Relate their structures to their uses, e.g. graphite as a lubricant and a conductor, and diamond in cutting tools

Supplement

- Describe the macromolecular structure of silicon(IV) oxide (silicon dioxide)
- Describe the similarity in properties between diamond and silicon(IV) oxide, related to their structures

3.2.5 Metallic bonding	**Supplement** • Describe metallic bonding as a lattice of positive ions in a 'sea of electrons' and use this to describe the electrical conductivity and malleability of metals

4. Stoichiometry	
4.1 Stoichiometry **Core** • Use the symbols of the elements and write the formulae of simple compounds • Deduce the formula of a simple compound from the relative numbers of atoms present • Deduce the formula of a simple compound from a model or a diagrammatic representation • Construct word equations and simple balanced chemical equations • Define *relative atomic mass*, A_r, as the average mass of naturally occurring atoms of an element on a scale where the ^{12}C atom has a mass of exactly 12 units • Define *relative molecular mass*, M_r, as the sum of the relative atomic masses (*Relative formula mass* or M_r will be used for ionic compounds.) (Calculations involving reacting masses in simple proportions may be set. Calculations will **not** involve the mole concept.)	**Supplement** • Determine the formula of an ionic compound from the charges on the ions present • Construct equations with state symbols, including ionic equations • Deduce the balanced equation for a chemical reaction, given relevant information
4.2 The mole concept	**Supplement** • Define the *mole* and the *Avogadro constant* • Use the molar gas volume, taken as 24 dm^3 at room temperature and pressure • Calculate stoichiometric reacting masses, volumes of gases and solutions, and concentrations of solutions expressed in g/dm^3 and mol/dm^3 (Calculations involving the idea of limiting reactants may be set. Questions on the gas laws and the conversion of gaseous volumes to different temperatures and pressures will **not** be set.) • Calculate empirical formulae and molecular formulae • Calculate percentage yield and percentage purity

5. Electricity and chemistry

Core	Supplement
• Define electrolysis as the breakdown of an ionic compound, molten or in aqueous solution, by the passage of electricity • Describe the electrode products and the observations made during the electrolysis of: – molten lead(II) bromide – concentrated hydrochloric acid – concentrated aqueous sodium chloride – dilute sulfuric acid between inert electrodes (platinum or carbon) • State the general principle that metals or hydrogen are formed at the negative electrode (cathode), and that non-metals (other than hydrogen) are formed at the positive electrode (anode)	• Relate the products of electrolysis to the electrolyte and electrodes used, exemplified by the specific examples in the Core together with aqueous copper(II) sulfate using carbon electrodes and using copper electrodes (as used in the refining of copper) • Describe electrolysis in terms of the ions present and reactions at the electrodes in the examples given
• Predict the products of the electrolysis of a specified binary compound in the molten state • Describe the electroplating of metals • Outline the uses of electroplating • Describe the reasons for the use of copper and (steel-cored) aluminium in cables, and why plastics and ceramics are used as insulators	• Predict the products of electrolysis of a specified halide in dilute or concentrated aqueous solution • Construct ionic half-equations for reactions at the cathode • Describe the transfer of charge during electrolysis to include: – the movement of electrons in the metallic conductor – the removal or addition of electrons from the external circuit at the electrodes – the movement of ions in the electrolyte • Describe the production of electrical energy from simple cells, i.e. two electrodes in an electrolyte. (This should be linked with the reactivity series in section 10.2 and redox in section 7.4.) • Describe, in outline, the manufacture of: – aluminium from pure aluminium oxide in molten cryolite (refer to section 10.3) – chlorine, hydrogen and sodium hydroxide from concentrated aqueous sodium chloride (Starting materials and essential conditions should be given but not technical details or diagrams.)

6. Chemical energetics

6.1 Energetics of a reaction **Core**	**Supplement**
• Describe the meaning of *exothermic* and *endothermic* reactions • Interpret energy level diagrams showing exothermic and endothermic reactions	• Describe bond breaking as an endothermic process and bond forming as an exothermic process • Draw and label energy level diagrams for exothermic and endothermic reactions using data provided • Calculate the energy of a reaction using bond energies

6. Chemical energetics	
6.1 Energetics of a reaction **Core** • Describe the meaning of *exothermic* and *endothermic* reactions • Interpret energy level diagrams showing exothermic and endothermic reactions	**Supplement** • Describe bond breaking as an endothermic process and bond forming as an exothermic process • Draw and label energy level diagrams for exothermic and endothermic reactions using data provided • Calculate the energy of a reaction using bond energies
6.2 Energy transfer **Core** • Describe the release of heat energy by burning fuels • State the use of hydrogen as a fuel • Describe radioactive isotopes, such as ^{235}U, as a source of energy	**Supplement** • Describe the use of hydrogen as a fuel reacting with oxygen to generate electricity in a fuel cell (Details of the construction and operation of a fuel cell are **not** required.)
7. Chemical reactions	
7.1 Physical and chemical changes **Core** • Identify physical and chemical changes, and understand the differences between them	
7.2 Rate (speed) of reaction **Core** • Describe and explain the effect of concentration, particle size, catalysts (including enzymes) and temperature on the rate of reactions • Describe the application of the above factors to the danger of explosive combustion with fine powders (e.g. flour mills) and gases (e.g. methane in mines) • Demonstrate knowledge and understanding of a practical method for investigating the rate of a reaction involving gas evolution • Interpret data obtained from experiments concerned with rate of reaction Note: Candidates should be encouraged to use the term *rate* rather than *speed*.	**Supplement** • Devise and evaluate a suitable method for investigating the effect of a given variable on the rate of a reaction • Describe and explain the effects of temperature and concentration in terms of collisions between reacting particles (An increase in temperature causes an increase in collision rate **and** more of the colliding molecules have sufficient energy (activation energy) to react whereas an increase in concentration only causes an increase in collision rate.) *cont.*
7.2 Rate (speed) of reaction continued	• Describe and explain the role of light in photochemical reactions and the effect of light on the rate of these reactions (This should be linked to section 14.4.) • Describe the use of silver salts in photography as a process of reduction of silver ions to silver; and photosynthesis as the reaction between carbon dioxide and water in the presence of chlorophyll and sunlight (energy) to produce glucose and oxygen

7.3 Reversible reactions **Core** • Understand that some chemical reactions can be reversed by changing the reaction conditions (Limited to the effects of heat and water on hydrated and anhydrous copper(II) sulfate and cobalt(II) chloride.) (Concept of equilibrium is **not** required.)	**Supplement** • Predict the effect of changing the conditions (concentration, temperature and pressure) on other reversible reactions • Demonstrate knowledge and understanding of the concept of equilibrium
7.4 Redox **Core** • Define *oxidation* and *reduction* in terms of oxygen loss/gain. (Oxidation state limited to its use to name ions, e.g. iron(II), iron(III), copper(II), manganate(VII).)	**Supplement** • Define *redox* in terms of electron transfer • Identify redox reactions by changes in oxidation state and by the colour changes involved when using acidified potassium manganate(VII), and potassium iodide. (Recall of equations involving $KMnO_4$ is **not** required.) • Define *oxidising agent* as a substance which oxidises another substance during a redox reaction. Define *reducing agent* as a substance which reduces another substance during a redox reaction. • Identify oxidising agents and reducing agents from simple equations

9. The Periodic Table	
9.1 The Periodic Table **Core** • Describe the Periodic Table as a method of classifying elements and its use to predict properties of elements	
9.2 Periodic trends **Core** • Describe the change from metallic to non-metallic character across a period	**Supplement** • Describe and explain the relationship between Group number, number of outer shell electrons and metallic/non-metallic character
9.3 Group properties **Core** • Describe lithium, sodium and potassium in Group I as a collection of relatively soft metals showing a trend in melting point, density and reaction with water • Predict the properties of other elements in Group I, given data, where appropriate • Describe the halogens, chlorine, bromine and iodine in Group VII, as a collection of diatomic non-metals showing a trend in colour and density and state their reaction with other halide ions • Predict the properties of other elements in Group VII, given data where appropriate	**Supplement** • Identify trends in Groups, given information about the elements concerned
9.4 Transition elements **Core** • Describe the transition elements as a collection of metals having high densities, high melting points and forming coloured compounds, and which, as elements and compounds, often act as catalysts	**Supplement** • Know that transition elements have variable oxidation states

9.5 Noble gases **Core** • Describe the noble gases, in Group VIII or 0, as being unreactive, monoatomic gases and explain this in terms of electronic structure • State the uses of the noble gases in providing an inert atmosphere, i.e. argon in lamps, helium for filling balloons	
11. Air and water	
11.3 Nitrogen and fertilisers **Core** • Describe the need for nitrogen-, phosphorus- and potassium-containing fertilisers • Describe the displacement of ammonia from its salts	**Supplement** • Describe and explain the essential conditions for the manufacture of ammonia by the Haber process including the sources of the hydrogen and nitrogen, i.e. hydrocarbons or steam and air
12. Sulfur	
Core • Name some sources of sulfur • Name the use of sulfur in the manufacture of sulfuric acid • State the uses of sulfur dioxide as a bleach in the manufacture of wood pulp for paper and as a food preservative (by killing bacteria)	**Supplement** • Describe the manufacture of sulfuric acid by the Contact process, including essential conditions and reactions • Describe the properties and uses of dilute and concentrated sulfuric acid
13. Carbonates	
Core • Describe the manufacture of lime (calcium oxide) from calcium carbonate (limestone) in terms of thermal decomposition • Name some uses of lime and slaked lime such as in treating acidic soil and neutralising acidic industrial waste products, e.g. flue gas desulfurisation • Name the uses of calcium carbonate in the manufacture of iron and cement	

iGCSE Chemistry Paper 3/4 704marks

Topic Chem 1 **Q# 1/** IGCSE Chemistry/2017/w/Paper 42/

1 **(a)** Dust particles in the air move around in a random way.

(i) What term describes the random movement of the dust particles?

..... [1]

(ii) Identify the particles in the air which cause the random movement of the dust particles.

..... [2]

(iii) Explain why the dust particles move in this way.

.....

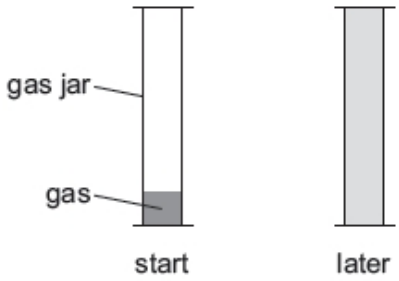
.....

..... [2]

(b) When chlorine gas, Cl_2, is put into a gas jar, it spreads out to fill the gas jar.

When bromine gas, Br_2, is put into a gas jar, it also spreads out to fill the gas jar.

The process takes longer for bromine gas than for chlorine gas.



(i) What term describes the way that the gas particles spread out?

..... [1]

(ii) Use **data** from the Periodic Table to explain why bromine gas takes longer to fill a gas jar than chlorine gas.

.....

.....

..... [2]

(iii) Explain why increasing the temperature increases the rate at which the gas particles spread out.

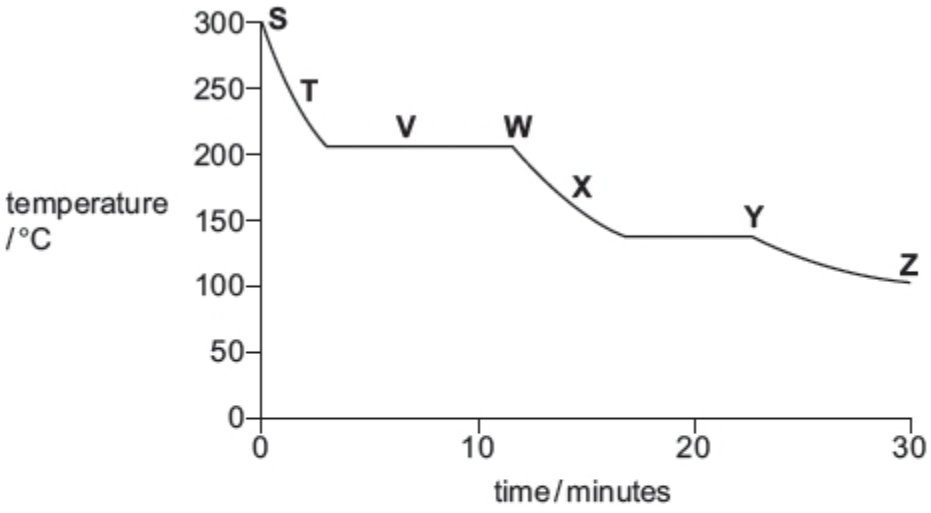
.....

..... [1]

[Total: 9]

Topic Chem1 **Q# 2/** IGCSE Chemistry/2017/w/Paper 41/

2 The graph shows how the temperature of a substance changes as it is cooled over a period of 30 minutes. The substance is a gas at the start.



Each letter on the graph may be used once, more than once or not at all.

(a) Which letter, **S**, **T**, **V**, **W**, **X**, **Y** or **Z**, shows when

(i) the particles in the substance have the most kinetic energy,

..... [1]

(ii) the particles in the substance are furthest apart,

..... [1]

(iii) the substance exists as both a gas and a liquid?

..... [1]

(b) Use the graph to estimate the freezing point of the substance.

..... °C [1]

(c) Name the change of state directly from a solid to a gas.

..... [1]

(d) When smoke is viewed through a microscope, the smoke particles in the air appear to jump around.

(i) What term describes this movement of the smoke particles?

..... [1]

(ii) Explain why the smoke particles move in this way.

.....

.....

..... [2]

Topic Chem1 **Q# 3/** IGCSE Chemistry/2017/s/Paper 42/

1 **(a)** State the name of the process that is used to

(ii) separate the individual dyes in ink,

..... [1]

(iv) obtain water from aqueous sodium chloride,

..... [1]

(v) separate the precipitate formed when aqueous silver nitrate is added to aqueous sodium chloride.

..... [1]

Topic Chem1 **Q# 4/** IGCSE Chemistry/2017/s/Paper 41/

3 Magnesium sulfate and lead(II) sulfate are examples of salts.

(a) A student prepared magnesium sulfate crystals starting from magnesium carbonate. The student carried out the experiment in four steps.

step 1 The student added excess magnesium carbonate to a small volume of dilute sulfuric acid until no more magnesium carbonate would react.

step 2 The student filtered the mixture.

step 3 The student heated the filtrate obtained from **step 2** until it was saturated.

step 4 The student allowed the hot filtrate to cool to room temperature and then removed the crystals which formed.

(iii) A saturated solution forms in **step 3**.

What is a saturated solution?

.....

..... [2]

(iv) Explain why magnesium sulfate crystals form during **step 4**.

.....

..... [1]

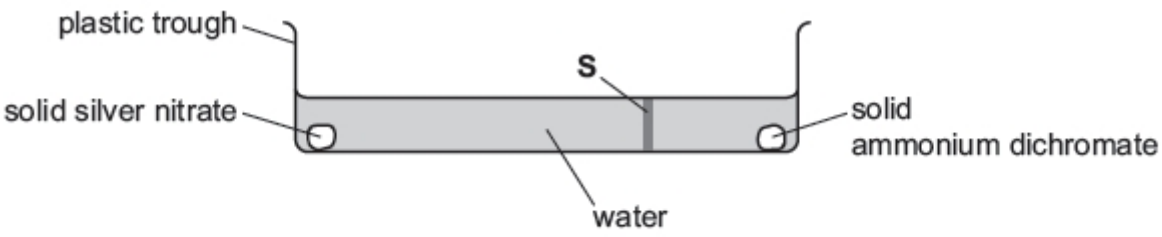
Topic Chem1 **Q# 5/** IGCSE Chemistry/2017/m/Paper 42/

2 Silver dichromate, $Ag_2Cr_2O_7$, is a red insoluble salt.

Silver dichromate can be made by reacting silver nitrate solution with ammonium dichromate solution. The chemical equation for the reaction is shown.

$$2AgNO_3(aq) + (NH_4)_2Cr_2O_7(aq) \rightarrow 2NH_4NO_3(aq) + Ag_2Cr_2O_7(s)$$

(d) The apparatus shown was set up.



After five minutes, a red solid appeared along the line marked **S** on the diagram.

(i) Explain why a red solid appeared along the line marked **S**.

.....

.....

.....

..... [3]

(ii) The experiment was repeated at a higher temperature.

What effect, if any, would this have on the time taken for the red solid to appear? Explain your answer.

.....

..... [2]

Topic Chem1.1 **Q# 6/** iGCSE Chemistry/2014/s/Paper 31/Q3 (c)

(iii) Suggest another method, other than diffusion, by which helium could be separated from the mixture of gases in natural gas.

..... [1]

Topic Chem1.1 **Q# 7/** iGCSE Chemistry/2014/s/Paper 31/

3 **(a)** Different gases diffuse at different speeds.

(i) What is meant by the term *diffusion*?

.....

..... [1]

(ii) What property of a gas molecule affects the speed at which it diffuses?

..... [1]

(b) Helium is a gas used to fill balloons. It is present in the air in very small quantities. Diffusion can be used to separate it from the air.

Air at 1000 °C is on one side of a porous barrier. The air which passes through the barrier has a larger amount of helium in it.

(i) Why does the air on the other side of the barrier contain more helium?

..... [1]

(ii) Why is it an advantage to have the air at a high temperature?

.....

..... [1]

Topic Chem1.1 **Q# 8/** iGCSE Chemistry/2012/w/Paper 31/

7 Both strontium and sulfur have chlorides of the type XCl_2. The table below compares some of their properties.

	strontium chloride	sulfur chloride
appearance	white crystals	red liquid
formula	$SrCl_2$	SCl_2
melting point / °C	874	–120
boiling point / °C	1250	59
conductivity of liquid	good	poor
solubility in water	dissolves to form a neutral solution	reacts to form a solution of pH 1

(a) (i) Use the data in the table to explain why sulfur chloride is a liquid at room temperature, 25 °C.

.....

..... [2]

Topic Chem 2.2 **Q# 9/** iGCSE Chemistry/2014/s/Paper 31/ Q2

(b) In many regions, drinking water is obtained by the distillation of sea-water. Explain how distillation separates the water from sea-water.

.....

.....

..... [2]

Topic Chem2.2 **Q# 10/** iGCSE Chemistry/2012/w/Paper 31/

Butane and propane are both gases, silver chloride is a salt that is insoluble in water, glucose and maltose are both sugars.

1 A list of techniques used to separate mixtures is given below.

filtration

diffusion

fractional distillation

simple distillation

crystallisation

chromatography

From this list, choose the most suitable technique to separate the following mixtures.
A technique may be used once, more than once or not at all.

(a) butane from a mixture of propane and butane ..... [1]

(b) oxygen from liquid air ..... [1]

(c) water from aqueous magnesium sulfate ..... [1]

(d) potassium chloride from aqueous potassium chloride ..... [1]

(e) silver chloride from a mixture of silver chloride and water ..... [1]

(f) glucose from a mixture of glucose and maltose ..... [1]

[Total: 6]

Topic Chem2.2 **Q# 11/** iGCSE Chemistry/2011/s/Paper 31/

1 The following techniques are used to separate mixtures.

A simple distillation	**B** fractional distillation	**C** evaporation
D chromatography	**E** filtration	**F** diffusion

From this list, choose the most suitable technique to separate the following.

(a) methane from a mixture of the gases, methane and ethane ..... [1]

(b) water from aqueous magnesium sulfate ..... [1]

(c) glycine from a mixture of the amino acids, glycine and lysine ..... [1]

(d) iron filings from a mixture of iron filings and water ..... [1]

(e) zinc sulfate crystals from aqueous zinc sulfate ..... [1]

(f) hexane from a mixture of the liquids, hexane and octane ..... [1]

[Total: 6]

Topic Chem 3 **Q# 12/** IGCSE Chemistry/2017/w/Paper 43/Q3

(c) (i) Describe the bonding in iron. Include a diagram in your answer.

.....

..... [3]

(ii) Use your diagram in **(c)(i)** to explain why iron is malleable.

.....

..... [2]

Topic Chem3 **Q# 13/** IGCSE Chemistry/2017/w/Paper 43/

1 Substances can be classified as elements, compounds or mixtures.

State whether each of the following is an element, a compound or a mixture.

(b) gold ..... [1]

(d) air ..... [1]

Topic Chem3 **Q# 14/** IGCSE Chemistry/2017/w/Paper 43/

2 (a) (i) Define the term *molecule*.

.....

..... [2]

(ii) Define the term *element*.

.....

..... [1]

(b) The table shows the composition of four atoms or ions, **A**, **B**, **C** and **D**.

	number of protons	number of neutrons	number of electrons
A	10	10	10
B	10	12	10
C	12	10	10
D	13	14	10

(i) What is the atomic number of **A**?

..... [1]

(ii) What is the nucleon number of **B**?

..... [1]

(iii) Which of **A**, **B**, **C** and **D** are isotopes of each other?

..... [1]

(iv) Which of **A**, **B**, **C** and **D** are atoms?

..... [1]

(v) Which of **A**, **B**, **C** and **D** are positive ions?

..... [1]

(c) Complete the table.

	number of protons	number of electrons
Na		
S^{2-}		
Cl_2		

[3]

Topic Chem3 **Q# 15/** IGCSE Chemistry/2017/w/Paper 42/

2 **(a)** Complete the table to show the electronic structure of the atoms and ions.

	electronic structure
F	2,7
Si	
Ca^{2+}	
N^{3-}	

[3]

(b) Predict the formula of the compound formed between Ca^{2+} and N^{3-}.

..... [1]

(c) Draw a dot-and-cross diagram to show the electron arrangements in the **two** ions present in lithium chloride, LiCl.
Show outer shell electrons only. Include the charges on the ions.

[3]

(d) Sulfur dichloride, SCl_2, is a covalent compound. It has the structure Cl–S–Cl.

Draw a dot-and-cross diagram to show the electron arrangement in a molecule of sulfur dichloride.
Show outer shell electrons only.

[3]

(e) In terms of attractive forces, explain why LiCl has a higher melting point than SCl_2.

.....

.....

.....

.....

..... [3]

(f) Suggest the identity of a **covalent compound** with a higher melting point than LiCl.

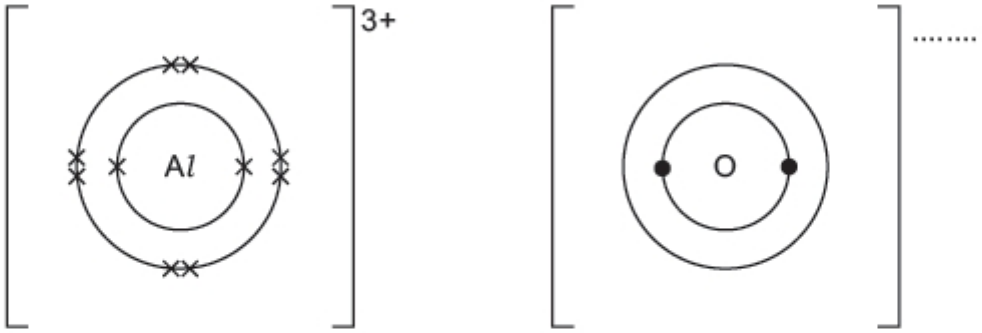
..... [1]

[Total: 14]

Topic Chem3 **Q# 16/** IGCSE Chemistry/2017/w/Paper 41/Q6

(b) Aluminium oxide is an ionic compound with a high melting point.

(i) Complete the dot-and-cross diagram to show the electron arrangement in **one** of the oxide ions present in aluminium oxide. Include the charge on the oxide ion.
One of the aluminium ions is shown.



[2]

(ii) The melting point of aluminium oxide is above 2000 °C.

Explain why aluminium oxide has a high melting point.

.....

.....

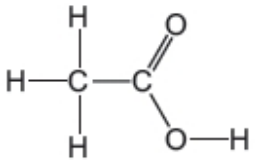
..... [2]

Topic Chem3 **Q# 17/** IGCSE Chemistry/2017/w/Paper 41/

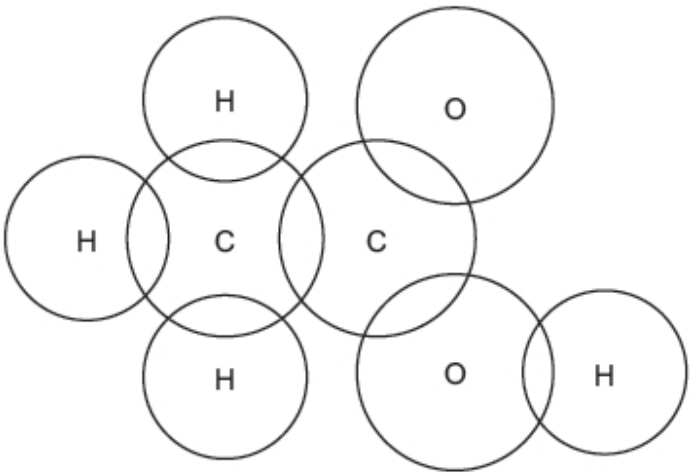
4 **(a)** Ethanol, C_2H_5OH, can be made by fermentation.

(c)

(ii) A molecule of ethanoic acid has the structure shown.



Complete the dot-and-cross diagram to show the electron arrangement in ethanoic acid.
Show outer shell electrons only.



[3]

Topic Chem3 **Q# 18/** IGCSE Chemistry/2017/w/Paper 41/

1 The table gives information about five particles. The particles are all atoms or ions.

particle	number of protons	number of neutrons	number of electrons
A	6	8	6
B	12	12	12
C	13	14	10
D	8	8	10
E	11	12	11

Answer the following questions using the information in the table.
Each particle may be used once, more than once or not at all.

(a) Which particle, **A**, **B**, **C**, **D** or **E**,

(i) is an atom with atomic number 12,

..... [1]

(ii) is an atom with nucleon number 14,

..... [1]

(iii) is an ion with a positive charge,

..... [1]

(iv) has only **one** electron in its outer shell?

..... [1]

(b) **D** is an ion of an element.

Identify the element and write the formula of **D**.

..... [2]

Topic Chem3 **Q# 19/** IGCSE Chemistry/2017/s/Paper 43/Q

(c) The boiling point of bromine is 59 °C and the boiling point of iodine is 184 °C.

Explain why iodine has a higher boiling point than bromine.

.....

.....

.....

.....

..... [2]

1 Six different atoms can be represented as follows.

$^{3}_{1}A$ $^{3}_{2}D$ $^{12}_{6}E$ $^{13}_{6}G$ $^{14}_{7}J$ $^{19}_{9}L$

(a) Answer the following questions using atoms from the list. Each atom may be used once, more than once or not at all.

Select **one** atom from the six shown which

(i) has exactly seven protons,

..... [1]

(ii) has exactly six neutrons,

..... [1]

(iii) has more protons than neutrons,

..... [1]

(iv) has the electronic structure [2,5],

..... [1]

(b) Two of the six atoms shown are isotopes of each other.

(i) What is meant by the term *isotopes*?

.....

..... [2]

(ii) Which **two** of the six atoms shown are isotopes of each other?

..... [1]

(iii) Why do isotopes have identical chemical properties?

.....

..... [1]

3 Magnesium is a metal.

(a) Describe the structure and bonding in magnesium.

.....

.....

.....

..... [3]

(b) Why can magnesium conduct electricity when solid?

.....

.....

.....

..... [2]

(c) Why is magnesium malleable?

.....

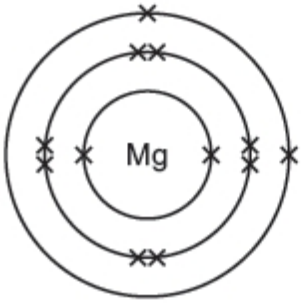
.....

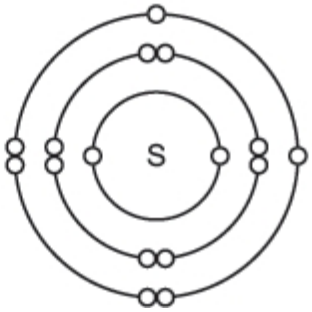
.....

..... [2]

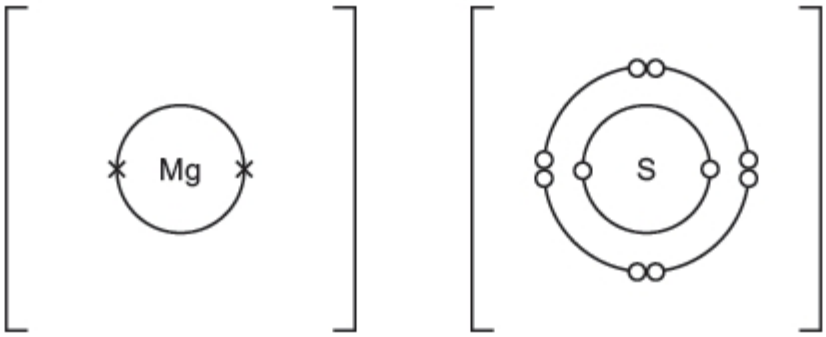
(d) Magnesium reacts with sulfur to form the ionic compound magnesium sulfide, MgS.

The diagrams show the electronic structures of atoms of magnesium and sulfur.





(i) Complete the diagrams to show the electronic structures of the ions in magnesium sulfide. Show the charges on the ions.



[3]

(ii) Ionic compounds, such as magnesium sulfide, do **not** conduct electricity when solid.
Magnesium sulfide does **not** dissolve in water.
Magnesium sulfide **does** conduct electricity under certain conditions.

State the conditions needed for magnesium sulfide to conduct electricity. Explain why magnesium sulfide conducts electricity under these conditions.

.....

.....

.....

..... [2]

Topic Chem3 **Q# 22/** IGCSE Chemistry/2017/s/Paper 42/Q1

(b) State what is meant by the terms

(i) *element*,

.....

..... [1]

(ii) *compound*,

.....

..... [1]

(iii) *ion*.

.....

..... [1]

2 Carbon and silicon are elements in Group IV of the Periodic Table. Both carbon and silicon exist as more than one isotope.

(a) Define the term *isotopes*.

.....

..... [2]

(b) Complete the following table which gives information about carbon atoms and silicon atoms.

	carbon	silicon
proton number		
electronic structure		
nucleon number	12	28
number of neutrons in one atom		

[3]

(c) Silicon has a giant structure which is similar to the structure of diamond.

(i) Name the type of bond which is present between silicon atoms in silicon.

..... [1]

(ii) Suggest **two** physical properties of silicon.
Use your knowledge of structure and bonding to explain why silicon has these physical properties.

property 1 .....

reason 1 .....

property 2 .....

reason 2 .....

[4]

(e) Carbon dioxide, CO_2, is a gas at room temperature and pressure, whereas silicon(IV) oxide, SiO_2, is a solid.

(i) Name the type of structure which the following compounds have.

carbon dioxide ..... [1]

silicon(IV) oxide ..... [1]

(ii) Use your knowledge of structure and bonding to explain why carbon dioxide is a gas at room temperature and pressure, whereas silicon(IV) oxide is a solid.

.....

.....

.....

..... [3]

Topic Chem3 **Q# 24/** IGCSE Chemistry/2017/s/Paper 41/

1 This question is about subatomic particles.

(a) Define the terms

proton number, ...

.....

nucleon number. .....

.....

[3]

(b) Why is the $^{1}_{1}H$ hydrogen atom the **only** atom to have an identical proton number and nucleon number?

.....

..... [1]

(c) Complete the table to show the number of protons, neutrons and electrons in the atoms and ions given.

	number of protons	number of neutrons	number of electrons
^{19}F			9
^{26}Mg	12		
$^{31}P^{3-}$			
$^{87}Sr^{2+}$			

[6]

(d) (i) Write the formula of the compound formed from fluorine and magnesium.

..... [1]

(ii) Write the formula of the compound formed from Sr^{2+} and P^{3-}.

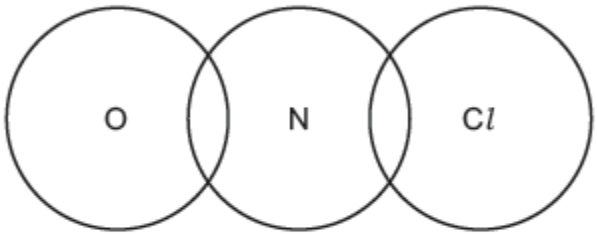
..... [1]

Topic Chem3 **Q# 25/** IGCSE Chemistry/2017/m/Paper 42/Q3

(e) Nitrosyl chloride, NO*Cl*, is a gas at room temperature. It has the structure shown.

O═N—*Cl*

(i) Complete the dot-and-cross diagram to show the arrangement of the outer shell electrons in nitrosyl chloride.



[2]

(ii) Nitrosyl chloride has a boiling point of –6 °C.

Explain why nitrosyl chloride has a low boiling point.

.....

.....

..... [2]

Topic Chem3.1 **Q# 26/** iGCSE Chemistry/2012/w/Paper 31/ Q2

(b) A radioactive isotope of iodine, $^{131}_{53}I$, is used to treat cancer.

(i) Define the term *isotope*.

.....

..... [2]

(ii) How many protons, electrons and neutrons are there in one atom of $^{131}_{53}I$?

number of protons .....

number of electrons .....

number of neutrons ..... [2]

(iii) When this isotope, $^{131}_{53}I$, emits radiation, a different element with a proton number of 54 is formed.
What is the name of this element?

..... [1]

Topic Chem3.1 **Q# 27/** iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state.
The element and its compounds are often used as catalysts.

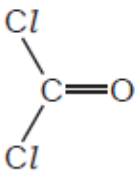
(a) Complete the electron distribution of vanadium by inserting one number.

2 + 8 + ... + 2

[1]

Topic Chem3.21-2 **Q# 28/** iGCSE Chemistry/2012/w/Paper 31/ Q5

(c) The structural formula of carbonyl chloride is given below.



Draw a diagram showing the arrangement of the outer (valency) electrons in one molecule of this covalent compound.

Use o to represent an electron from a carbon atom.
Use x to represent an electron from a chlorine atom.
Use • to represent an electron from an oxygen atom.

[3]

Topic Chem3.21-2 **Q# 29/** iGCSE Chemistry/2012/w/Paper 31/

7 Both strontium and sulfur have chlorides of the type XCl_2. The table below compares some of their properties.

	strontium chloride	sulfur chloride
appearance	white crystals	red liquid
formula	$SrCl_2$	SCl_2
melting point / °C	874	–120
boiling point / °C	1250	59
conductivity of liquid	good	poor
solubility in water	dissolves to form a neutral solution	reacts to form a solution of pH 1

(ii) Strontium is a metal and sulfur is a non-metal. Explain why both have chlorides of the type XCl_2.
The electron distribution of a strontium atom is 2 + 8 + 18 + 8 + 2.

.....

.....

..... [2]

Topic Chem3.23-4 **Q# 30/** iGCSE Chemistry/2012/w/Paper 31/

7 Both strontium and sulfur have chlorides of the type XCl_2. The table below compares some of their properties.

	strontium chloride	sulfur chloride
appearance	white crystals	red liquid
formula	$SrCl_2$	SCl_2
melting point / °C	874	–120
boiling point / °C	1250	59
conductivity of liquid	good	poor
solubility in water	dissolves to form a neutral solution	reacts to form a solution of pH 1

(iv) Explain the difference in the electrical conductivity of liquid strontium chloride and liquid sulfur chloride.

.....

.....

..... [3]

Topic Chem3.23-4 **Q# 31/** iGCSE Chemistry/2012/w/Paper 31/

4 Silicon(IV) oxide, SiO_2, and zirconium(IV) oxide, ZrO_2, are both macromolecules.
They have similar physical properties but silicon(IV) oxide is acidic and zirconium(IV) oxide is amphoteric.

(a) Define the term *macromolecule*.

.....

..... [1]

(b) **(i)** Predict **three** physical properties of these two oxides.

.....

.....

..... [3]

(ii) Name an element which has the same physical properties as these two oxides.

..... [1]

Topic Chem3.21-2 **Q# 32/** iGCSE Chemistry/2012/s/Paper 31/Q3

(b) Lithium reacts with nitrogen to form the ionic compound, lithium nitride.

(i) State the formula of the lithium ion. ..... [1]

(ii) Deduce the formula of the nitride ion. ..... [1]

(iii) In all solid ionic compounds, the ions are held together in a lattice.
Explain the term *lattice*.

.....

..... [1]

(iv) What is the ratio of lithium ions to nitride ions in the lattice of lithium nitride?
Give a reason for your answer.

..... lithium ions : ..... nitride ions

.....

..... [2]

Topic Chem3.21-2 **Q# 33/** iGCSE Chemistry/2011/w/Paper 31/

1 This question is concerned with the following oxides.

sulfur dioxide
carbon monoxide
lithium oxide
aluminium oxide
nitrogen dioxide
strontium oxide

(this list is referred to in the next question)

(c) Lithium oxide is an ionic compound.

(i) Identify another ionic oxide in the list on page 3.

..... [1]

(ii) Draw a diagram which shows the formula of lithium oxide, the charges on the ions and the arrangement of the valency electrons around the negative ion.
Use x to represent an electron from an atom of oxygen.
Use o to represent an electron from an atom of lithium.

[2]

Topic Chem3.21-2 **Q# 34/** iGCSE Chemistry/2011/s/Paper 31/ Q2

(b) The electron distribution of a selenium atom is 2 + 8 + 18 + 6.

(i) Selenium forms an ionic compound with potassium. Draw a diagram which shows the formula of this ionic compound, the charges on the ions and the arrangement of the **valency** electrons around the negative ion.
Use o to represent an electron from an atom of potassium.
Use x to represent an electron from an atom of selenium.

[3]

Topic Chem3.23-4 **Q# 35/** iGCSE Chemistry/2011/s/Paper 31/ Q2

(b) The electron distribution of a selenium atom is 2 + 8 + 18 + 6.

(ii) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound selenium chloride.
Use x to represent an electron from an atom of selenium.
Use o to represent an electron from an atom of chlorine.

[3]

(iii) Predict **two** differences in the physical properties of these two compounds.

.....

..... [2]

Topic Chem3.25 **Q# 36/** iGCSE Chemistry/2011/s/Paper 31/ Q3

(c) Both iron and steel have typical metallic structures - a lattice of positive ions and a sea of electrons.

(i) Suggest an explanation for why they have high melting points.

.....

.....

..... [2]

(ii) Explain why, when a force is applied to a piece of steel, it does not break but just changes its shape.

.....

..... [2]

Topic Chem 4 **Q# 37/** IGCSE Chemistry/2017/w/Paper 42/Q5

(b) Hydrogen can be manufactured using a reversible reaction between methane and steam.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

At 900 °C, in the presence of a nickel catalyst, the yield of hydrogen is 70%.

(i) What volume of hydrogen is produced from 100 cm^3 of methane under these conditions?

..... cm^3 [2]

Topic Chem4 **Q# 38/** IGCSE Chemistry/2017/w/Paper 41/

7 Copper(II) oxide reacts with dilute hydrochloric acid.

$$CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$$

6.00 g of copper(II) oxide were added to 50.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid. This was an excess of copper(II) oxide.

(b) (i) Calculate the number of moles of copper(II) oxide added to the hydrochloric acid.

moles of copper(II) oxide = ... mol [2]

(ii) Calculate the number of moles of hydrochloric acid used.

moles of hydrochloric acid = ... mol [1]

(iii) Calculate the mass of copper(II) oxide that did **not** react.

mass of copper(II) oxide that did **not** react = ... g [2]

(c) Crystals of hydrated copper(II) chloride were obtained from the solution at the end of the reaction.

The crystals had the following composition by mass: Cl, 41.52%; Cu, 37.43%; H, 2.34%; O, 18.71%.

Calculate the empirical formula of the crystals.

empirical formula = ... [2]

Topic Chem4 **Q# 39/** IGCSE Chemistry/2017/s/Paper 43/

6 Barium carbonate, $BaCO_3$, is an insoluble solid.

(c) Barium carbonate reacts with dilute hydrochloric acid.

$$BaCO_3 + 2HCl \rightarrow BaCl_2 + CO_2 + H_2O$$

9.85 g of barium carbonate were added to 250 cm^3 of 1.00 mol/dm^3 hydrochloric acid. This is an excess of hydrochloric acid.

(i) Calculate how many moles of barium carbonate were used in this experiment.

moles of barium carbonate = ... mol [2]

(ii) Deduce how many moles of carbon dioxide were made when all the barium carbonate had reacted.

moles of carbon dioxide = ... mol [1]

(iii) Calculate the volume of carbon dioxide formed in **(c)(ii)** at room temperature and pressure, in dm^3.

volume of carbon dioxide = ... dm^3 [1]

(iv) Calculate how many moles of hydrochloric acid there were **in excess**.

excess moles of hydrochloric acid = ... mol [2]

Topic Chem4 **Q# 40/** IGCSE Chemistry/2017/s/Paper 42/Q5

(b) A sample of vanadium chloride was weighed and dissolved in water. An excess of aqueous silver nitrate, acidified with dilute nitric acid, was added. A precipitate of silver chloride was formed. The ionic equation for this reaction is shown.

$$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$$

The mass of silver chloride formed was 2.87 g.

(ii) The relative formula mass of silver chloride, AgCl, is 143.5.

Calculate the number of moles in 2.87 g of AgCl.

moles of AgCl = ... mol [1]

(iii) Use your answer to **(b)(ii)** and the ionic equation to deduce the number of moles of chloride ions, Cl^-, that produced 2.87 g of AgCl.

moles of Cl^- = ... mol [1]

(iv) The amount of vanadium chloride in the sample was 0.01 moles.

Use this and your answer to **(b)(iii)** to deduce the **whole number** ratio of moles of vanadium chloride : moles of chloride ions.
Deduce the formula of vanadium chloride.

moles of vanadium chloride : moles of chloride ions ..... : .....

formula of vanadium chloride .....
[2]

(b) Magnesium sulfate crystals are hydrated. Another student heated some hydrated magnesium sulfate crystals in a crucible and obtained the following results.

mass of hydrated magnesium sulfate crystals = 4.92 g

mass of water removed = 2.52 g

(i) Calculate the number of moles of water removed.

moles of water = ... mol [1]

(ii) Calculate the number of moles of anhydrous magnesium sulfate remaining in the crucible. The M_r of anhydrous magnesium sulfate is 120.

moles of anhydrous magnesium sulfate = ... mol [1]

(iii) Calculate the ratio of moles of anhydrous magnesium sulfate : moles of water. Give your answer as whole numbers.

ratio = ... : ..... [1]

(iv) Suggest the formula of hydrated magnesium sulfate crystals.

formula of hydrated magnesium sulfate crystals = ... [2]

5 When barium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is formed.

A student carried out an experiment to measure the volume of gas formed as a reaction proceeds. The student added a small mass of powdered barium carbonate to an excess of 0.1 mol/dm^3 hydrochloric acid. A graph of the results was drawn.

(c) The total volume of gas collected was 180 cm^3 at room temperature and pressure.

Calculate the mass, in grams, of barium carbonate used.

$$BaCO_3 + 2HCl \rightarrow BaCl_2 + H_2O + CO_2$$

mass of barium carbonate = ... g [3]

(f) The experiment is changed and the mass of powdered barium carbonate is doubled. All other conditions are the same as in the original experiment. The acid is still in excess.

Deduce the volume of gas formed at room temperature and pressure, in cm^3, in this experiment.

volume of gas = ... cm^3 [1]

Topic Chem4 **Q# 43/** IGCSE Chemistry/2017/m/Paper 42/Q7

(c) Hydrolysis of a polymer gave a compound with the following composition by mass: C, 34.61%; H, 3.85%; O, 61.54%.

(i) Calculate the empirical formula of the compound.

empirical formula = ... [3]

(ii) What additional information is needed to calculate the molecular formula of the compound?

.....

..... [1]

Topic Chem4 **Q# 44/** IGCSE Chemistry/2017/m/Paper 42/

2 Silver dichromate, $Ag_2Cr_2O_7$, is a red insoluble salt.

Silver dichromate can be made by reacting silver nitrate solution with ammonium dichromate solution. The chemical equation for the reaction is shown.

$$2AgNO_3(aq) + (NH_4)_2Cr_2O_7(aq) \rightarrow 2NH_4NO_3(aq) + Ag_2Cr_2O_7(s)$$

(b) (i) The charge on a silver ion is +1.

Deduce the charge on the dichromate ion in $Ag_2Cr_2O_7$.

..... [1]

(ii) Write the ionic equation for the formation of silver dichromate in this reaction.
State symbols are **not** required.

..... [1]

Topic Chem4 **Q# 45/** IGCSE Chemistry/2017/m/Paper 42/

6 Barium carbonate decomposes when heated.

$$BaCO_3(s) \rightarrow BaO(s) + CO_2(g)$$

(a) A student heated a 10.0 g sample of barium carbonate until it was fully decomposed.

(i) Calculate the number of moles of barium carbonate the student used.

moles of barium carbonate = ... mol [2]

(ii) Calculate the volume of carbon dioxide gas produced at room temperature and pressure.
Give your answer in dm^3.

volume of carbon dioxide = ... dm^3 [1]

(b) The student added 2.00 g of the barium oxide produced to water.

$$BaO + H_2O \rightarrow Ba(OH)_2$$

Calculate the mass of barium hydroxide that can be made from 2.00 g of barium oxide. The M_r of $Ba(OH)_2$ is 171.

mass of barium hydroxide = ... g [1]

(c) A 1.50 g sample of barium hydroxide was dissolved in water. The total volume of the solution was 100 cm^3.

A 25.0 cm^3 portion of the barium hydroxide solution was titrated against hydrochloric acid. The volume of hydrochloric acid required was 18.75 cm^3.

$$Ba(OH)_2 + 2HCl \rightarrow BaCl_2 + 2H_2O$$

(i) Calculate how many moles of barium hydroxide were in the 25.0 cm^3 portion used in the titration.

moles of barium hydroxide = ... mol [1]

(ii) Calculate the concentration of the hydrochloric acid used.

concentration of hydrochloric acid = ... mol/dm³ [2]

Topic Chem4.1 **Q# 46/** iGCSE Chemistry/2014/w/Paper 31/

7 Nitrogen can form ionic compounds with reactive metals and covalent compounds with non-metals.

(a) Nitrogen reacts with lithium to form the ionic compound lithium nitride, Li_3N.

(i) Write the equation for the reaction between lithium and nitrogen.

..... [2]

Topic Chem4.1 **Q# 47/** iGCSE Chemistry/2013/s/Paper 31/ Q6

Ammonia is a compound with the molecular formula NH_3

(c) Another compound which contains only nitrogen and hydrogen is hydrazine, N_2H_4.

Complete the equation for the preparation of hydrazine from ammonia.

$$.....NH_3 + NaClO \rightarrow N_2H_4 + ... + H_2O$$ [2]

Topic Chem4.1 **Q# 48/** iGCSE Chemistry/2013/s/Paper 31/

3 A small piece of marble, $CaCO_3$, was added to 5.0 cm³ of hydrochloric acid, concentration 1.0 mol/dm³, at 25 °C. The time taken for the reaction to stop was measured. The experiment was repeated using 5.0 cm³ of different solutions of acids. The acid was in excess in all of the experiments.

Typical results are given in the table.

experiment	temperature / °C	acid solution	time / min
1	25	hydrochloric acid 1.0 mol/dm³	3

(b) The equation for the reaction in experiment 1 is:

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Complete the following ionic equation.

$$CaCO_3(s) + 2H^+(aq) \rightarrow ..... + ... + ...$$

[1]

Topic Chem4.2 **Q# 49/** iGCSE Chemistry/2014/s/Paper 31/

6 Hydrogen peroxide decomposes to form water and oxygen. This reaction is catalysed by manganese(IV) oxide.

(d) In the first experiment, the maximum volume of oxygen produced was 96 cm^3 measured at r.t.p. Calculate the concentration of the aqueous hydrogen peroxide in mol/dm^3.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

number of moles of O_2 formed = ... [1]

number of moles of H_2O_2 in 40 cm^3 of solution = ... [1]

concentration of the aqueous hydrogen peroxide in mol/dm^3 = ...

..... [1]

Topic Chem4.2 **Q# 50/** iGCSE Chemistry/2013/w/Paper 31/ Q4

(d) Calculate the maximum mass of carbon dioxide given off when 20.0 g of small lumps of calcium carbonate react with 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

number of moles of HCl used =

mass of carbon dioxide = ... g [4]

Topic Chem4.2 **Q# 51/** iGCSE Chemistry/2013/w/Paper 31/

(c) Basic lead(II) carbonate has a formula of the type $xPbCO_3.yPb(OH)_2$ where x and y are whole numbers.
Determine x and y from the following information.

$$PbCO_3 \rightarrow PbO + CO_2$$

$$Pb(OH)_2 \rightarrow PbO + H_2O$$

When heated, the basic lead(II) carbonate gave 2.112 g of carbon dioxide and 0.432 g of water.

Mass of one mole of CO_2 = 44 g
Mass of one mole of H_2O = 18 g

Number of moles of CO_2 formed = ... [1]

Number of moles of H_2O formed = ... [1]

x = ... and y = ...

Formula of basic lead(II) carbonate is ..... [1]

Topic Chem4.2 **Q# 52/** iGCSE Chemistry/2012/w/Paper 31/ Q7

Strontium chloride-6-water can be made from the insoluble compound, strontium carbonate, by the following reactions.

$SrCO_3(s) + 2HCl(aq) \rightarrow SrCl_2(aq) + CO_2(g) + H_2O(l)$

$SrCl_2(aq) + 6H_2O(l) \rightarrow SrCl_2.6H_2O(s)$

The following method was used to prepare the crystals.

(c) In the above experiment, 50.0 cm^3 of hydrochloric acid of concentration 2.0 mol/dm^3 was used. 6.4 g of $SrCl_2.6H_2O$ was made.
Calculate the percentage yield.

number of moles of HCl used = ...

number of moles of $SrCl_2.6H_2O$ which could be formed = ...

mass of one mole of $SrCl_2.6H_2O$ is 267 g

theoretical yield of $SrCl_2.6H_2O$ = ...g

percentage yield = ...% [4]

Topic Chem4.2 **Q# 53/** iGCSE Chemistry/2012/w/Paper 31/ Q2

(c) Fluorine, the most reactive halogen, forms compounds with the other halogens. It forms two compounds with bromine.
Deduce their formulae from the following information.

compound 1
The mass of one mole of this compound is 137 g.

Its formula is ..... [1]

compound 2
0.02 moles of this compound contain 0.02 moles of bromine atoms and 0.1 moles of fluorine atoms.

Its formula is ..... [1]

Topic Chem4.2 **Q# 54/** iGCSE Chemistry/2012/s/Paper 31/

8 Iron and steel rust when exposed to water and oxygen. Rust is hydrated iron(III) oxide.

(b) A sample of rust had the following composition:

51.85 g of iron 22.22 g of oxygen 16.67 g of water.

Calculate the following and then write the formula for this sample of rust.

number of moles of iron atoms, Fe = ... [1]

number of moles of oxygen atoms, O = ... [1]

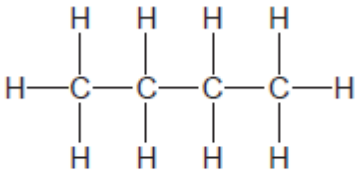
number of moles of water molecules, H_2O = ... [1]

simplest mole ratio Fe : O : H_2O is ..... : ..... : .....

formula for this sample of rust is ..... [1]

Topic Chem4.2 **Q# 55/** iGCSE Chemistry/2012/s/Paper 31/

6 Butane is an alkane. It has the following structural formula.



(a) The equation for the complete combustion of butane is given below. Insert the two missing volumes.

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(g)$$

.... 40 volume of gas / cm^3

[2]

Topic Chem4.2 **Q# 56/** iGCSE Chemistry/2011/w/Paper 31/ Q7

(c) There are three possible equations for the thermal decomposition of sodium hydrogencarbonate.

$2NaHCO_3(s) \rightarrow Na_2O(s) + 2CO_2(g) + H_2O(g)$ **equation 1**

$NaHCO_3(s) \rightarrow NaOH(s) + CO_2(g)$ **equation 2**

$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$ **equation 3**

The following experiment was carried out to determine which one of the above is the correct equation.

A known mass of sodium hydrogencarbonate was heated for ten minutes. It was then allowed to cool and weighed.

Results
Mass of sodium hydrogencarbonate = 3.36 g
Mass of the residue = 2.12 g

Calculation
M_r for $NaHCO_3$ = 84 g; M_r for Na_2O = 62 g; M_r for NaOH = 40 g
M_r for Na_2CO_3 = 106 g

(i) Number of moles of $NaHCO_3$ used = ... [1]

(ii) If residue is Na_2O, number of moles of Na_2O = ...

If residue is NaOH, number of moles of NaOH = ...

If residue is Na_2CO_3, number of moles of Na_2CO_3 = ... [2]

(iii) Use the number of moles calculated in **(i)** and **(ii)** to decide which one of the three equations is correct. Explain your choice.

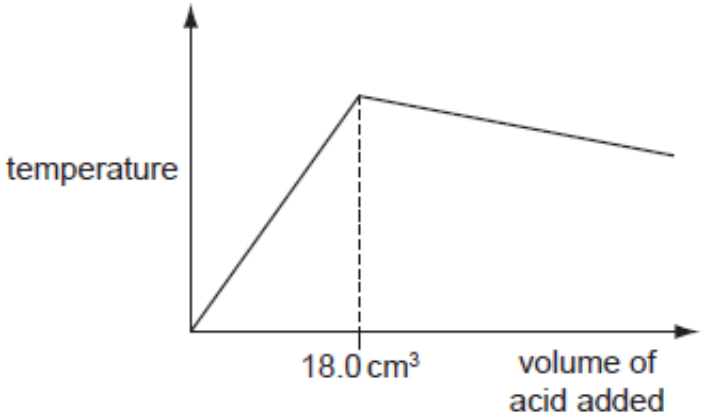
.....

.....

..... [2]

Topic Chem4.2 **Q# 57/** iGCSE Chemistry/2011/s/Paper 31/ Q5

(d) 20.0 cm^3 of aqueous sodium hydroxide, 2.00 mol / dm^3, was placed in a beaker. The temperature of the alkali was measured and 1.0 cm^3 portions of hydriodic acid were added. After each addition, the temperature of the mixture was measured. Typical results are shown on the graph.



$$NaOH(aq) + HI(aq) \rightarrow NaI(aq) + H_2O(l)$$

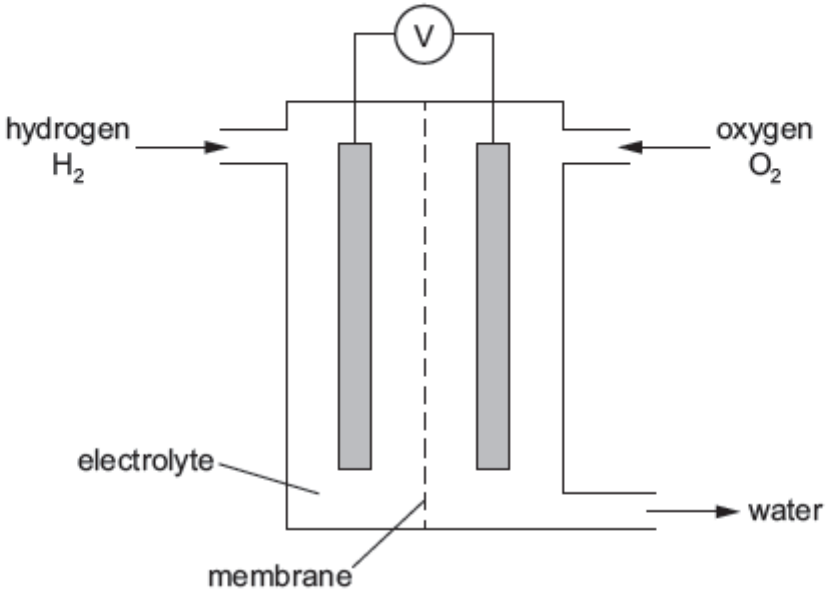
(iii) In another experiment, it was shown that 15.0 cm^3 of the acid neutralised 20.0 cm^3 of aqueous sodium hydroxide, 1.00 mol / dm^3. Calculate the concentration of the acid.

.....

..... [2]

Topic Chem 5 **Q# 58/** IGCSE Chemistry/2017/w/Paper 43/

4 Hydrogen and oxygen react together in a hydrogen fuel cell. A hydrogen fuel cell is shown in the diagram.



(b) (i) In a hydrogen fuel cell, the hydrogen molecules are converted into hydrogen ions, H^+, according to the ionic half-equation shown.

$$H_2 \rightarrow 2H^+ + 2e^-$$

What type of reaction does this ionic half-equation represent?

..... [1]

(c) Write a chemical equation for the overall reaction that occurs in a hydrogen fuel cell.

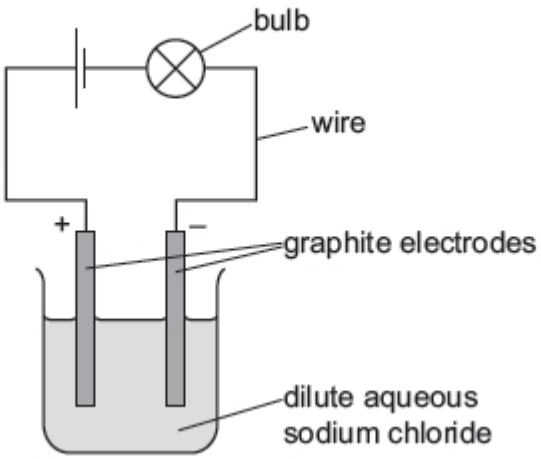
..... [1]

(f) Name the process occurring when electrical energy is used to break down an ionic compound.

..... [1]

Topic Chem5 **Q# 59/** IGCSE Chemistry/2017/w/Paper 42/

4 A student sets up the following electrolysis experiment.



(a) Define the term *electrolysis*.

.....

..... [2]

(b) The student observes bubbles of colourless gas forming at each electrode.

(i) Name the main gas produced at the positive electrode (anode).

..... [1]

(ii) Describe a test for the gas produced in **(b)(i)**.

test .....

result .....

[2]

(iii) Write the ionic half-equation for the reaction taking place at the negative electrode (cathode).

..... [2]

(c) Charge is transferred during electrolysis.

Name the type of particle responsible for the transfer of charge in

the wires, ...

the electrolyte. .....

[2]

(d) The student replaces the dilute aqueous sodium chloride with **concentrated** aqueous sodium chloride.

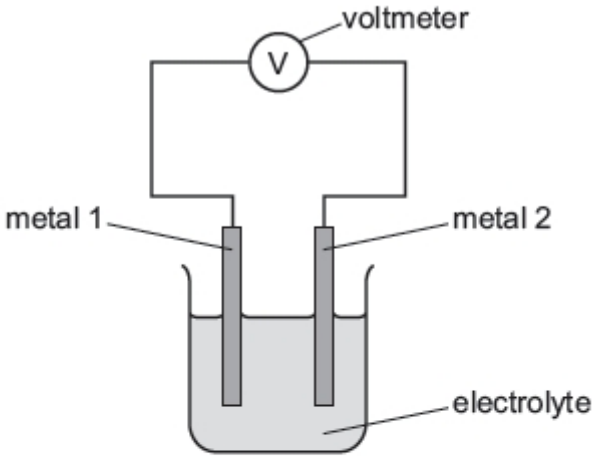
Suggest **two** differences that the student observes.

1 .....

2 .....

[2]

5 The diagram shows a simple cell.



The simple cell was used with different metals as electrodes. The voltages were recorded in the table.

- If the voltage measured is positive then metal 2 is more reactive than metal 1.
- If the voltage measured is negative then metal 1 is more reactive than metal 2.

		metal 2				
		beryllium	cobalt	nickel	silver	vanadium
metal 1	beryllium	0.0 V	–1.6 V	–1.6 V	not measured	–0.7 V
	cobalt		0.0 V	0.0 V	–1.1 V	0.9 V
	nickel			0.0 V	–1.1 V	0.9 V
	silver				0.0 V	2.0 V
	vanadium					0.0 V

- The more reactive metal is oxidised.
- The bigger the difference in reactivity of the metals, the larger the reading on the voltmeter.

(a) In a simple cell using nickel and silver, the nickel is oxidised.

(i) Define *oxidation* in terms of electrons.

..... [1]

(ii) Nickel forms ions with a charge of +2.

Write an ionic half-equation to show the oxidation of nickel.

..... [1]

(iii) What will happen to the mass of the nickel electrode when the nickel is oxidised?

.....

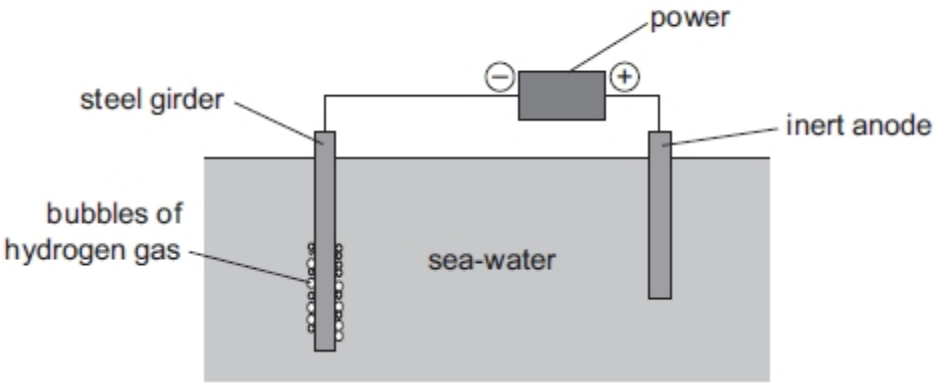
..... [1]

Topic Chem5.1 **Q# 61/** iGCSE Chemistry/2014/w/Paper 31/ Q4

(d) There are two electrochemical methods of rust prevention.

(i) The first method is sacrificial protection.

The second method is to make the steel article the cathode in a circuit for electrolysis.



(ii) Mark on the diagram the direction of the electron flow. [1]

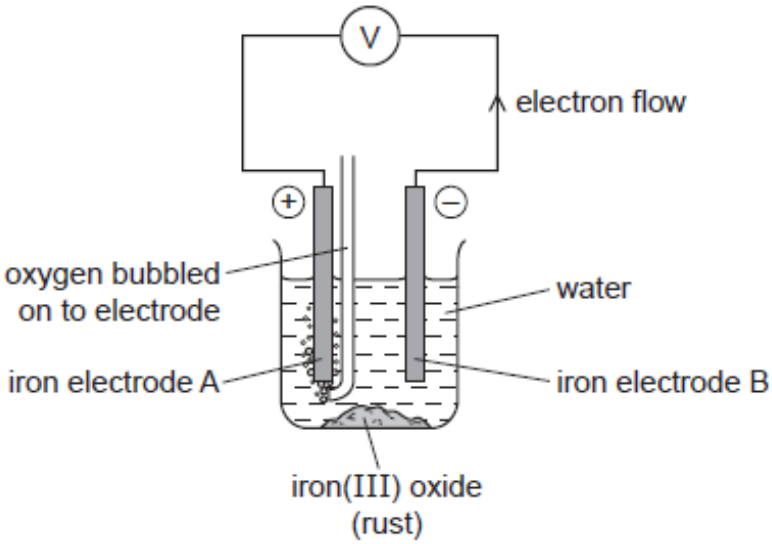
(iii) The steel girder does not rust because it is the cathode. Reduction takes place at the cathode. Give the equation for the reduction of hydrogen ions.

..... [2]

Topic Chem5.1 **Q# 62/** iGCSE Chemistry/2012/s/Paper 31/

8 Iron and steel rust when exposed to water and oxygen. Rust is hydrated iron(III) oxide.

(a) The following cell can be used to investigate rusting.



(i) What is a cell?

.....

..... [2]

(ii) Which electrode will be oxidised and become smaller? Explain your choice.

.....

.....

..... [3]

(iii) What measurements would you need make to find the rate of rusting of the electrode you have chosen in **(ii)**?

.....

..... [2]

(iv) Suggest an explanation why the addition of salt to the water increases the rate of rusting.

..... [1]

Topic Chem5.1 **Q# 63/** iGCSE Chemistry/2011/s/Paper 31/ Q2 (a)

(ii) Name a device which can change chemical energy into electrical energy.

..... [2]

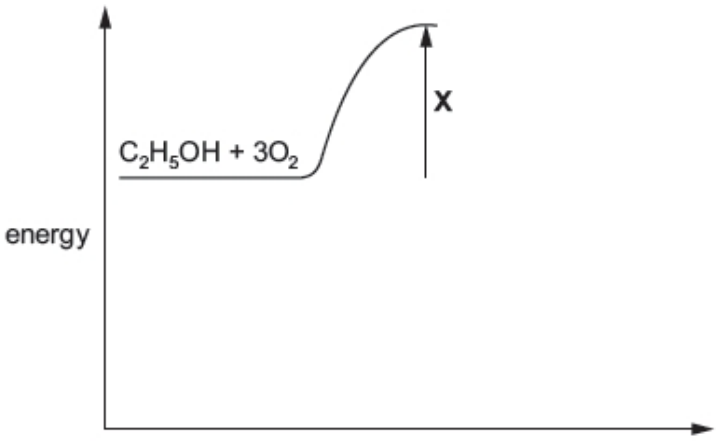
Topic Chem 6 **Q# 64/** IGCSE Chemistry/2017/w/Paper 42/

3 The chemical equation for the complete combustion of ethanol, C_2H_5OH, is shown.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$

The energy released when one mole of ethanol undergoes complete combustion is 1280 kJ.

Part of the energy level diagram for this reaction is shown.



(a) Complete the energy level diagram to show
- the products of the reaction,
- the overall energy change of the reaction.

[3]

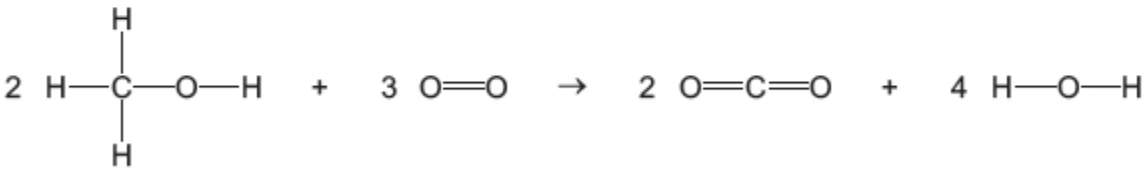
(b) What does **X** represent?

..... [1]

(c) The chemical equation for the complete combustion of methanol, CH_3OH, is shown.

$$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$$

The equation can be represented as shown.



Use the bond energies in the table to determine the energy change, ΔH, for the complete combustion of **one** mole of methanol.

bond	bond energy in kJ/mol
C–H	410
C–O	360
O–H	460
O=O	500
C=O	805

- energy needed to break bonds

..... kJ

- energy released when bonds are formed

..... kJ

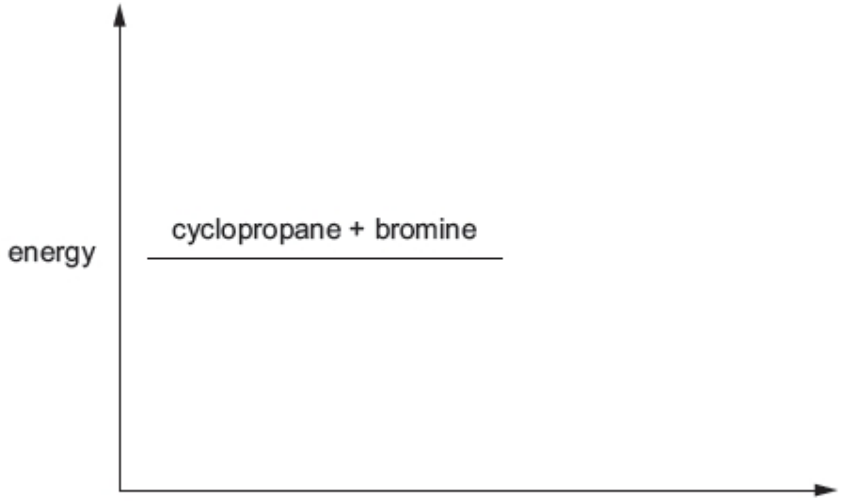
- energy change, ΔH, for the complete combustion of **one** mole of methanol

..... kJ/mol
[4]

(b) The reaction of cyclopropane with bromine is exothermic.

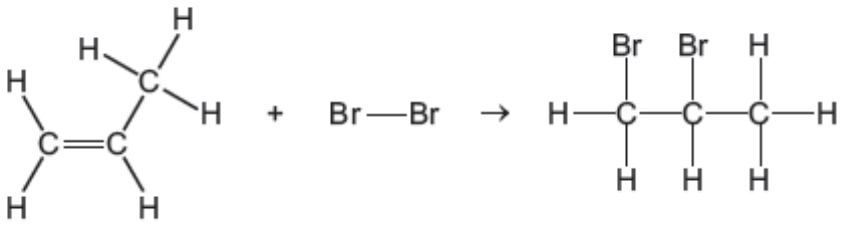
(i) Complete the energy level diagram for this reaction by

- adding the product of the reaction,
- labelling the energy change, ΔH.



[2]

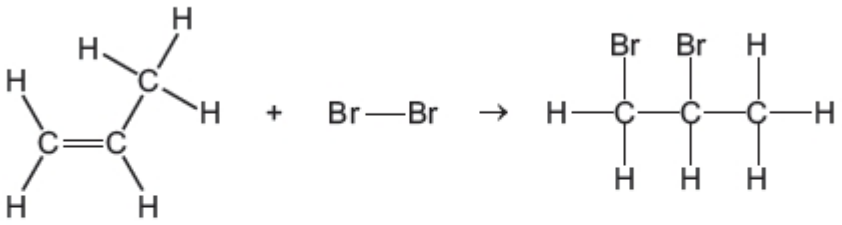
(ii) Propene also reacts with bromine.



Use the bond energies in the table to calculate the energy change, ΔH, for the reaction.

	C–H	C–C	Br–Br	C–Br	C=C
bond energy in kJ/mol	412	348	193	285	611

(ii) Propene also reacts with bromine.



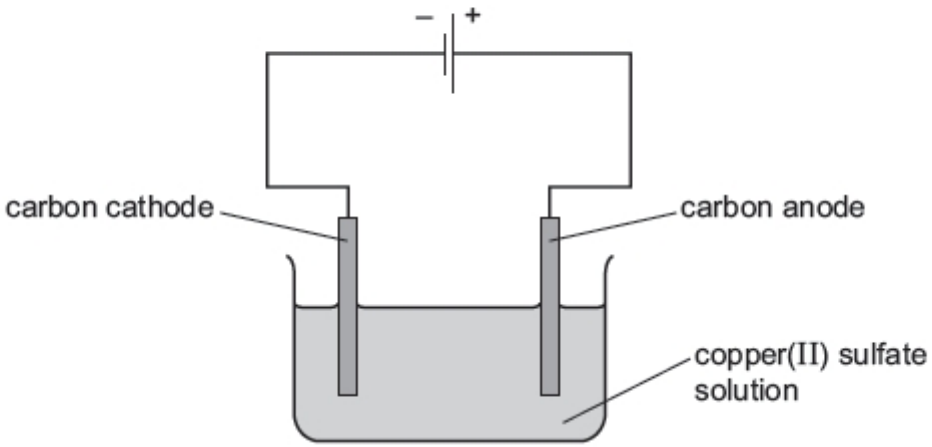
Use the bond energies in the table to calculate the energy change, ΔH, for the reaction.

	C–H	C–C	Br–Br	C–Br	C=C
bond energy in kJ/mol	412	348	193	285	611

energy change = ... kJ/mol [3]

Topic Chem6 **Q# 66/** IGCSE Chemistry/2017/m/Paper 42/

4 Copper(II) sulfate solution was electrolysed using the apparatus shown.



(a) (i) Draw an arrow on the diagram to show the direction of movement of electrons in the wire. Label the arrow **A**. [1]

(ii) Draw an arrow on the diagram to show the direction of movement of positive ions in the copper(II) sulfate solution. Label the arrow **B**. [1]

(b) Oxygen was formed at the anode and copper was formed at the cathode.

(i) The ionic half-equation for the formation of oxygen is shown.

$$4OH^- \rightarrow O_2 + 2H_2O + 4e^-$$

(ii) Write the ionic half-equation for the formation of copper at the cathode.

..... [2]

(c) The electrolysis was repeated using copper electrodes in place of carbon electrodes.

State and explain what happens to the masses of the anode and the cathode during this electrolysis.

.....

.....

.....

.....

..... [4]

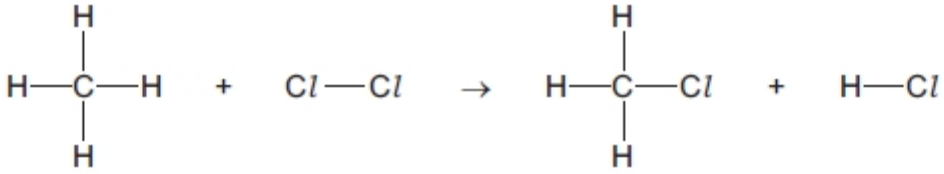
Topic Chem6.1 **Q# 67/** iGCSE Chemistry/2013/w/Paper 31/ Q7

(b) Bond forming is exothermic, bond breaking is endothermic. Explain the difference between an exothermic reaction and an endothermic reaction.

.....

..... [2]

(c) Use the bond energies to show that the following reaction is exothermic.
Bond energy is the amount of energy (kJ / mol) which must be supplied to break one mole of the bond.



Bond energies in kJ / mol

C*l*–C*l*	+242
C–C*l*	+338
C–H	+412
H–C*l*	+431

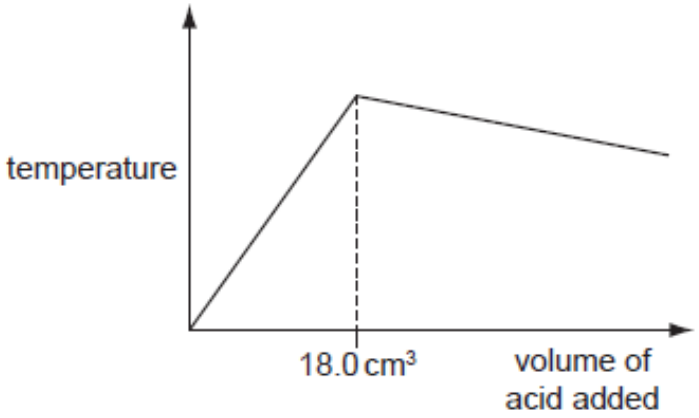
bonds broken	energy in kJ / mol
.....	.....
.....	.....
total energy =	.....

bonds formed	energy in kJ / mol
.....	.....
.....	.....
total energy =	.....

.....

..... [4]

(d) 20.0 cm^3 of aqueous sodium hydroxide, 2.00 mol / dm^3, was placed in a beaker. The temperature of the alkali was measured and 1.0 cm^3 portions of hydriodic acid were added. After each addition, the temperature of the mixture was measured. Typical results are shown on the graph.



$$NaOH(aq) + HI(aq) \rightarrow NaI(aq) + H_2O(l)$$

(i) Explain why the temperature increases rapidly at first then stops increasing.

.....

..... [2]

(ii) Suggest why the temperature drops after the addition of 18.0 cm^3 of acid.

..... [1]

Topic Chem 7 **Q# 69/** IGCSE Chemistry/2017/w/Paper 43/

(b) The chemical equation shows the equilibrium between dinitrogen tetroxide (N_2O_4, a colourless gas) and nitrogen dioxide (NO_2, a brown gas).

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

colourless brown

A mixture of dinitrogen tetroxide and nitrogen dioxide is allowed to reach equilibrium in a closed gas syringe.

(i) In chemistry, what is meant by the term *equilibrium*?

.....

.....

..... [2]

(ii) If the equilibrium mixture is heated at constant pressure, a darker brown colour is seen inside the gas syringe.

What does this information indicate about the decomposition of dinitrogen tetroxide?
Explain your answer in terms of the position of the equilibrium.

.....

.....

..... [2]

(iii) Suggest what you would see if the pressure on the equilibrium mixture were increased at constant temperature.
Explain your answer in terms of the position of the equilibrium.

.....

.....

..... [2]

Topic Chem7 **Q# 70/** IGCSE Chemistry/2017/w/Paper 42/

5 Some chemical reactions are reversible.

(a) Aqueous potassium chromate(VI), K_2CrO_4, is a yellow solution.

Aqueous potassium dichromate(VI), $K_2Cr_2O_7$, is an orange solution.

The two compounds interconvert when the pH of the solution changes.

$$\underset{\text{yellow}}{2K_2CrO_4} + H_2SO_4 \rightleftharpoons \underset{\text{orange}}{K_2Cr_2O_7} + K_2SO_4 + H_2O$$

Solution **Y** is a mixture of aqueous potassium chromate(VI) and aqueous potassium dichromate(VI) at equilibrium.

- Explain, in terms of the position of the equilibrium, what you would **see** if sulfuric acid were added to solution **Y**.

.....

.....

.....

- Explain, in terms of the position of the equilibrium, what you would **see** if sodium hydroxide were added to solution **Y**.

.....

.....

.....

..... [5]

(b) Hydrogen can be manufactured using a reversible reaction between methane and steam.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

At 900 °C, in the presence of a nickel catalyst, the yield of hydrogen is 70%.

Under different conditions, different yields of hydrogen are obtained.

(ii) If the pressure is increased, the yield of hydrogen becomes less than 70%.

Explain why, in terms of the position of the equilibrium.

.....

..... [1]

(iii) If the temperature is decreased, the yield of hydrogen decreases.

What does this information indicate about the reaction between methane and steam?

..... [1]

(iv) Why is a catalyst used in this reaction?

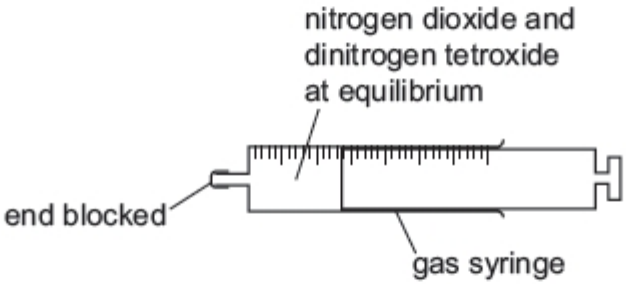
..... [1]

Topic Chem7 **Q# 71/** IGCSE Chemistry/2017/w/Paper 41/Q5

(c) Nitrogen dioxide, NO_2, exists in equilibrium with dinitrogen tetroxide, N_2O_4.
Nitrogen dioxide is brown and dinitrogen tetroxide is colourless.

$$\underset{\text{brown}}{2NO_2(g)} \rightleftharpoons \underset{\text{colourless}}{N_2O_4(g)}$$

(i) A sample of nitrogen dioxide and dinitrogen tetroxide at equilibrium was placed in a closed gas syringe.
The syringe plunger was pushed in. This increased the pressure in the gas syringe. The temperature was kept constant.



State how the colour of the gas in the syringe changed. Explain your answer in terms of the position of the equilibrium.

.....

.....

.....

..... [3]

(ii) A sealed tube containing nitrogen dioxide and dinitrogen tetroxide at equilibrium was cooled in an ice bath at constant pressure. The contents of the tube became paler.

Suggest an explanation for this observation in terms of the position of the equilibrium.

.....

.....

..... [2]

Topic Chem7 **Q# 72/** IGCSE Chemistry/2017/w/Paper 41/

3 **(a)** When magnesium is added to aqueous copper(II) sulfate a reaction occurs. The ionic equation for the reaction is shown.

$$Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$$

(i) Give **one** change you would observe during this reaction.

..... [1]

(ii) Explain why this is a redox reaction.

.....

..... [1]

(iii) Identify the oxidising agent in this reaction. Give a reason for your answer.

.....

..... [2]

Topic Chem7 **Q# 73/** IGCSE Chemistry/2017/w/Paper 41/

7 Copper(II) oxide reacts with dilute hydrochloric acid.

$$CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$$

6.00 g of copper(II) oxide were added to 50.0 cm^3 of 1.00 mol/dm^3 hydrochloric acid. This was an excess of copper(II) oxide.

(a) The rate of the reaction can be increased by increasing the concentration of the hydrochloric acid or by heating it.

(i) In terms of collisions, explain why increasing the concentration of the hydrochloric acid increases the rate of the reaction.

.....

.....

.....

..... [2]

(ii) In terms of collisions, explain why heating the hydrochloric acid increases the rate of the reaction.

.....

.....

.....

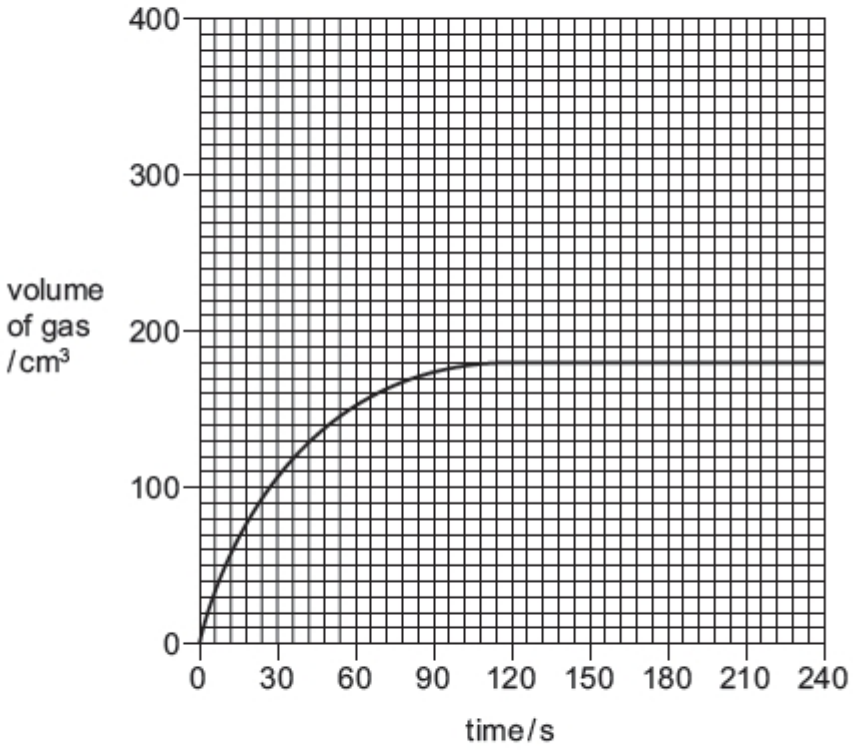
..... [2]

Topic Chem7 **Q# 74/** IGCSE Chemistry/2017/s/Paper 41/

5 When barium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is formed.

A student carried out an experiment to measure the volume of gas formed as a reaction proceeds. The student added a small mass of powdered barium carbonate to an excess of 0.1 mol/dm^3 hydrochloric acid. A graph of the results was drawn.

The graph is shown.



(a) Name the **two** pieces of apparatus needed to take the measurements shown on the graph.

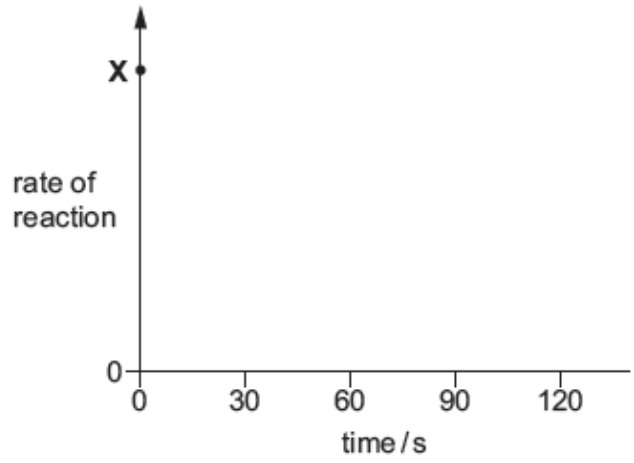
1 .....

2 .....

[1]

(b) On the axes below, sketch a graph to show how the rate of reaction changes as the reaction proceeds.

Assume the initial rate of reaction is represented by the point at **X**.

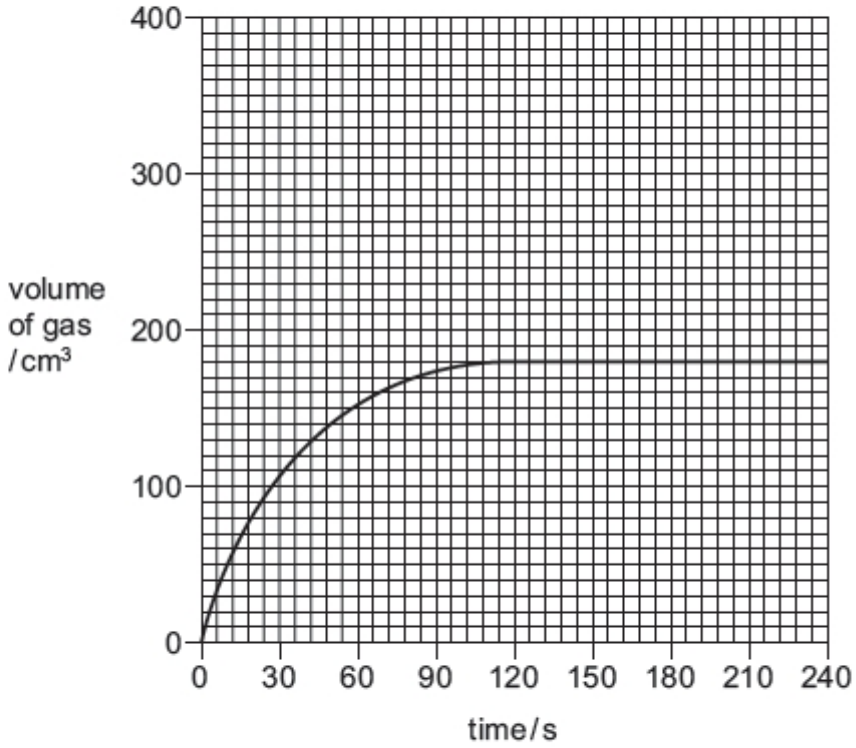


[2]

(d) The original graph has been drawn again.

On the grid, draw the graph expected if the same mass of barium carbonate is added as large lumps instead of as a powder. All other conditions are the same as in the original experiment.

Explain why your graph is different from the original graph.



.....

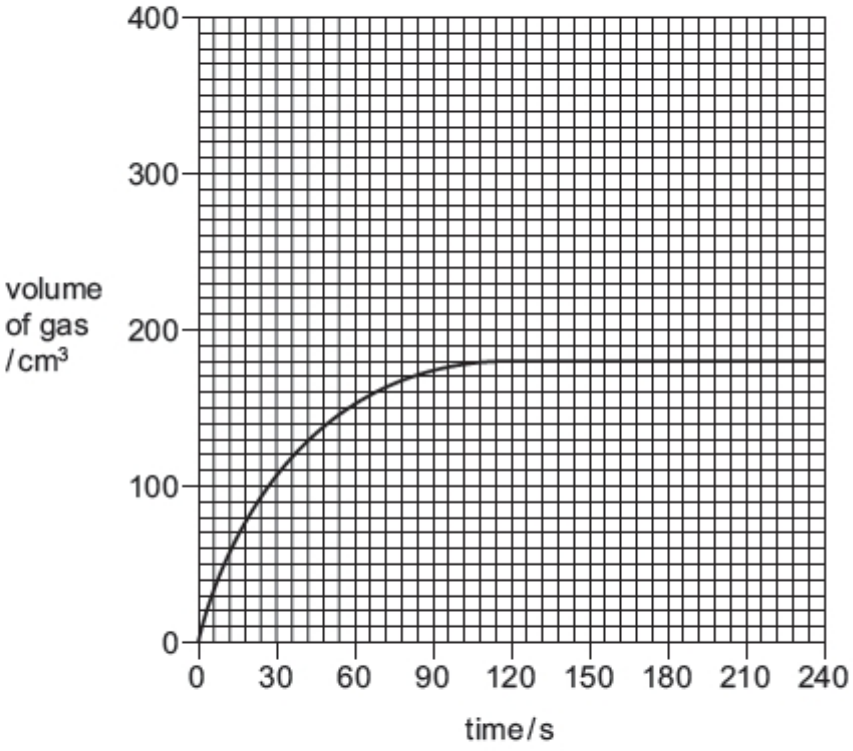
.....

..... [2]

(e) The original graph has been drawn again.

On the grid, draw the graph expected if the concentration of dilute hydrochloric acid is changed from 0.1 mol / dm^3 to 0.2 mol / dm^3. All other conditions are the same as in the original experiment.

Explain, in terms of particles, why your graph is different from the original graph.



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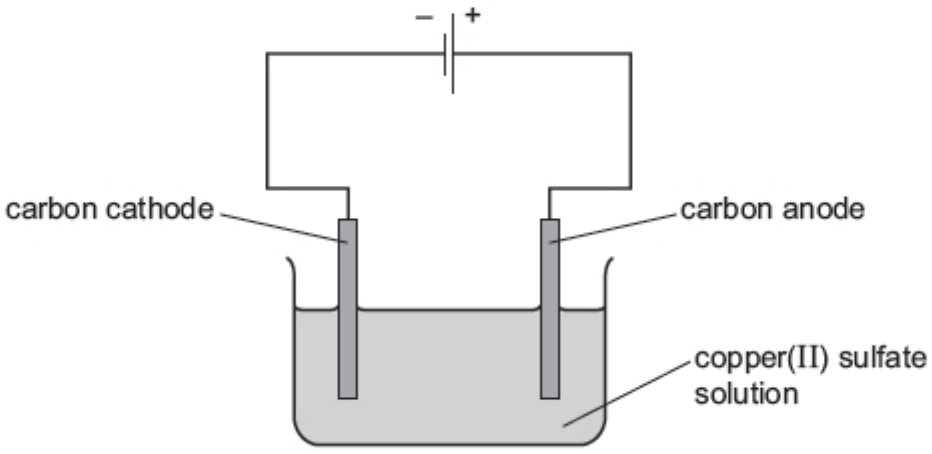
..... [4]

Topic Chem7 **Q# 75/** IGCSE Chemistry/2017/m/Paper 42/

4 Copper(II) sulfate solution was electrolysed using the apparatus shown.



(b) Oxygen was formed at the anode and copper was formed at the cathode.

(i) The ionic half-equation for the formation of oxygen is shown.

$$4OH^- \rightarrow O_2 + 2H_2O + 4e^-$$

Explain why this reaction is oxidation.

..... [1]

(ii) Write the ionic half-equation for the formation of copper at the cathode.

..... [2]

Topic Chem7 **Q# 76/** IGCSE Chemistry/2017/m/Paper 42/

3 Nitryl chloride, NO_2Cl, reacts with nitric oxide, NO. The forward reaction is exothermic.

$$NO_2Cl(g) + NO(g) \rightleftharpoons NO_2(g) + NOCl(g)$$

The reaction can reach equilibrium.

(a) What is meant by the term *equilibrium* for a reversible reaction?

.....

.....

..... [2]

(b) Explain why increasing the temperature increases the rate of reaction.

.....

.....

..... [3]

(c) State and explain the effect, if any, of increasing the temperature on the position of equilibrium.

.....

.....

..... [2]

(d) State and explain the effect, if any, of decreasing the pressure on the position of equilibrium.

.....

.....

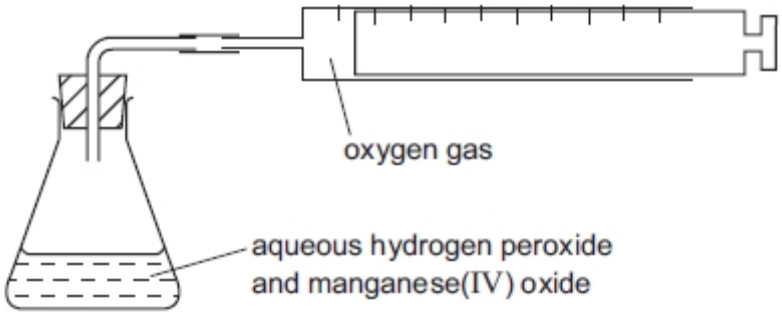
..... [2]

Topic Chem7.1 &2 **Q# 77/** iGCSE Chemistry/2014/s/Paper 31/

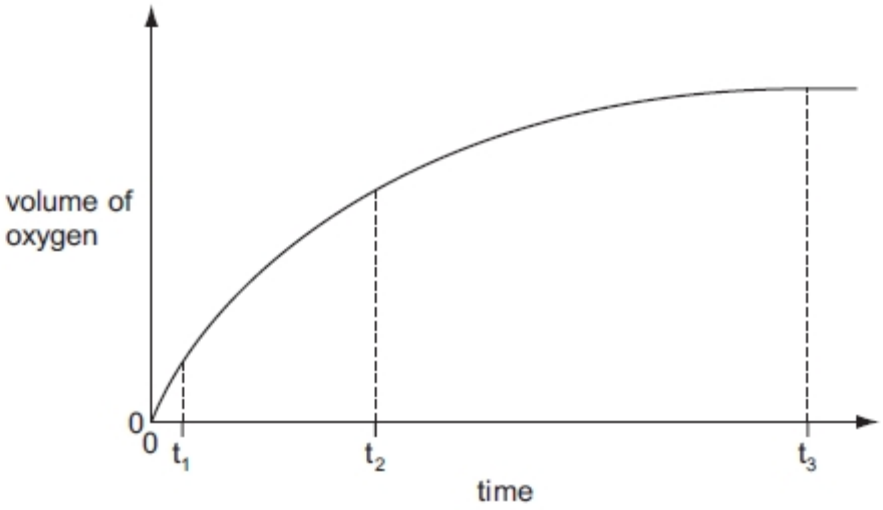
6 Hydrogen peroxide decomposes to form water and oxygen. This reaction is catalysed by manganese(IV) oxide.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The rate of this reaction can be investigated using the following apparatus.



40 cm^3 of aqueous hydrogen peroxide was put in the flask and 0.1 g of small lumps of manganese(IV) oxide was added. The volume of oxygen collected was measured every 30 seconds. The results were plotted to give the graph shown below.



(a) (i) How do the rates at times t_1, t_2 and t_3 differ?

.....

..... [2]

(ii) Explain the trend in reaction rate that you described in **(a)(i)**.

.....

.....

..... [2]

(b) The experiment was repeated using 0.1 g of finely powdered manganese(IV) oxide. All the other variables were kept the same.

(i) On the axes opposite, sketch the graph that would be expected. [2]

(ii) Explain the shape of this graph. .....

.....

.....

..... [2]

(c) Describe how you could show that the catalyst, manganese(IV) oxide, was not used up in the reaction. Manganese(IV) oxide is insoluble in water.

.....

.....

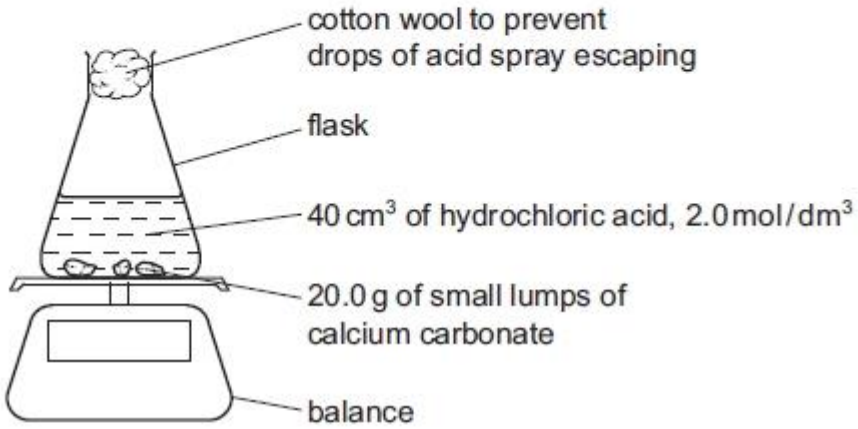
.....

.....

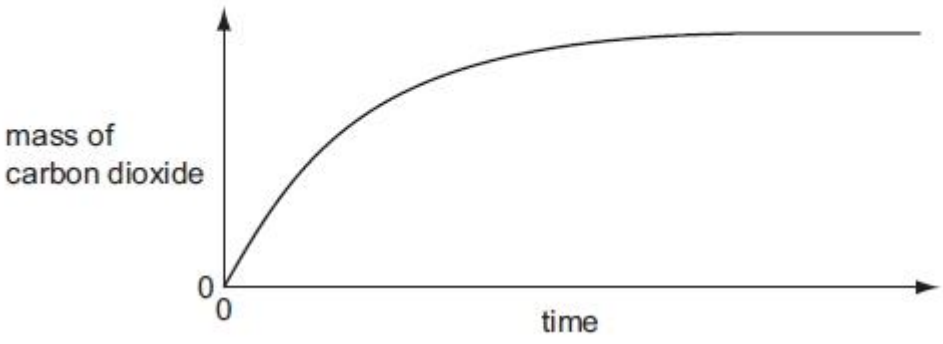
..... [4]

Topic Chem7.1 &2 **Q# 78/** iGCSE Chemistry/2013/w/Paper 31/

4 20.0 g of small lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3, were placed in a flask on a top pan balance. The mass of the flask and contents was recorded every minute.



The mass of carbon dioxide given off was plotted against time.



$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

In all the experiments mentioned in this question, the calcium carbonate was in excess.

(a) **(i)** Explain how you could determine the mass of carbon dioxide given off in the first five minutes.

..... [1]

(ii) Label the graph **F** where the reaction rate is the fastest, **S** where it is slowing down and **0** where the rate is zero. [2]

(iii) Explain how the shape of the graph shows where the rate is fastest, where it is slowing down and where the rate is zero.

.....

.....

..... [2]

(b) Sketch on the same graph, the line which would have been obtained if 20.0 g of small lumps of calcium carbonate and 80 cm^3 of hydrochloric acid, concentration 1.0 mol/dm^3, had been used. [2]

(c) Explain in terms of collisions between reacting particles each of the following.

(i) The reaction rate would be slower if 20.0 g of larger lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3, were used.

.....

.....

..... [2]

(ii) The reaction rate would be faster if the experiment was carried out at a higher temperature.

.....

.....

..... [2]

3 A small piece of marble, $CaCO_3$, was added to 5.0 cm^3 of hydrochloric acid, concentration 1.0 mol / dm^3, at 25 °C. The time taken for the reaction to stop was measured. The experiment was repeated using 5.0 cm^3 of different solutions of acids. The acid was in excess in all of the experiments.

Typical results are given in the table.

experiment	temperature / °C	acid solution	time / min
1	25	hydrochloric acid 1.0 mol / dm^3	3
2	25	hydrochloric acid 0.5 mol / dm^3	7
3	25	ethanoic acid 1.0 mol / dm^3	10
4	15	hydrochloric acid 1.0 mol / dm^3	8

(a) (i) Explain why it is important that the pieces of marble are the same size and the same shape.

.....

.....

..... [2]

(ii) How would you know when the reaction had stopped?

..... [1]

(c) (i) Explain why the reaction in experiment 1 is faster than the reaction in experiment 2.

.....

..... [1]

(iii) Explain in terms of collisions between reacting particles why experiment 4 is slower than experiment 1.

.....

.....

..... [3]

Topic Chem7.1 &2 **Q# 80/** iGCSE Chemistry/2012/w/Paper 31/

5 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(a) Carbonyl chloride was first made in 1812 by exposing a mixture of carbon monoxide and chlorine to bright sunlight. This is a photochemical reaction.

$$CO(g) + Cl_2(g) \rightarrow COCl_2(g)$$

(i) Explain the phrase *photochemical reaction*.

.....

..... [2]

(ii) Give another example of a photochemical reaction and explain why it is important either to the environment or in industry.

.....

.....

..... [3]

Topic Chem7.1 &2 **Q# 81/** iGCSE Chemistry/2012/w/Paper 31/

5 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(iii) Explain why a catalyst is used.

..... [1]

Topic Chem7.1 &2 **Q# 82/** iGCSE Chemistry/2012/w/Paper 31/

3 The speed (rate) of a chemical reaction depends on a number of factors which include temperature and the presence of a catalyst.

(a) Reaction speed increases as the temperature increases.

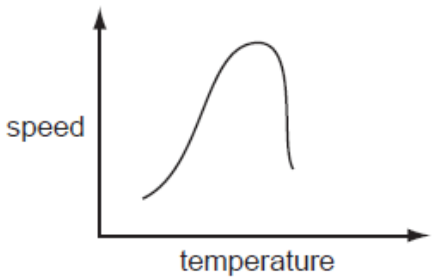
(i) Explain why reaction speed increases with temperature.

.....

.....

..... [3]

(ii) Reactions involving enzymes do not follow the above pattern.
The following graph shows how the speed of such a reaction varies with temperature.



3 The speed (rate) of a chemical reaction depends on a number of factors which include temperature and the presence of a catalyst.

(a) Reaction speed increases as the temperature increases.

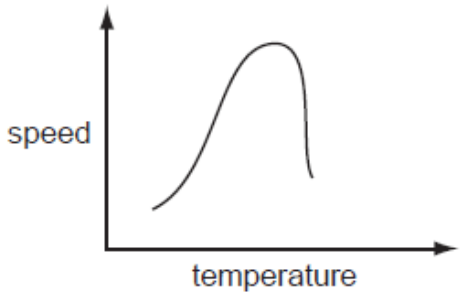
(i) Explain why reaction speed increases with temperature.

.....

.....

..... [3]

(ii) Reactions involving enzymes do not follow the above pattern.
The following graph shows how the speed of such a reaction varies with temperature.



Suggest an explanation why initially the reaction speed increases then above a certain temperature the speed decreases.

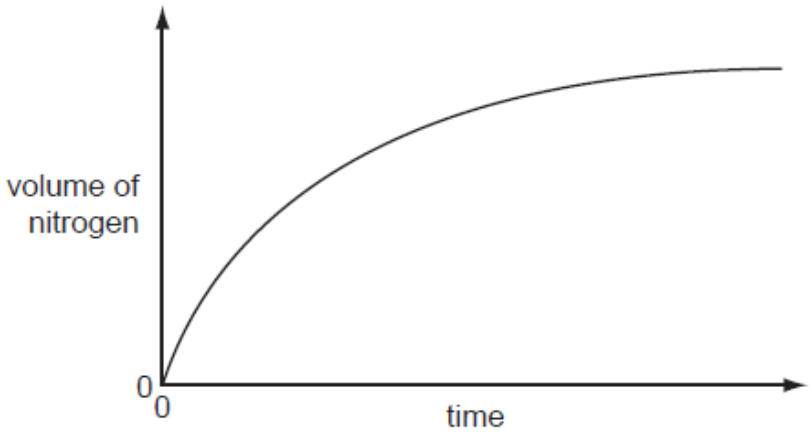
.....

..... [2]

(b) An organic compound decomposes to give off nitrogen.

$$C_6H_5N_2Cl(aq) \rightarrow C_6H_5Cl(l) + N_2(g)$$

The speed of this reaction can be determined by measuring the volume of nitrogen formed at regular intervals. Typical results are shown in the graph below.



(i) The reaction is catalysed by copper.
Sketch the graph for the catalysed reaction on the diagram above. [2]

(ii) How does the speed of this reaction vary with time?

..... [1]

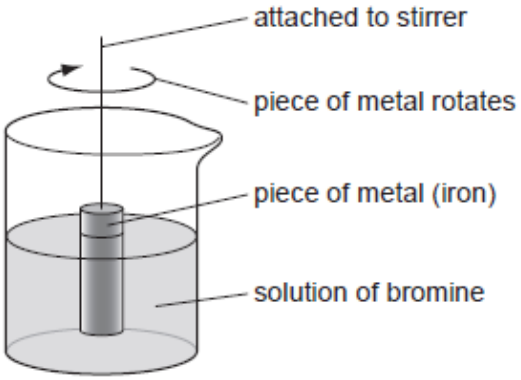
(iii) Why does the speed of reaction vary with time?

.....

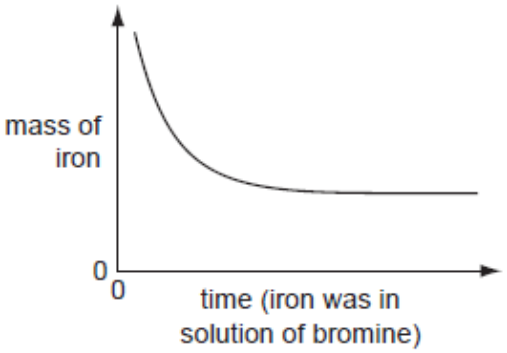
..... [2]

Topic Chem7.1 &2 **Q# 83/** iGCSE Chemistry/2011/w/Paper 31/

5 The rate of the reaction between iron and aqueous bromine can be investigated using the apparatus shown below.



(a) A piece of iron was weighed and placed in the apparatus. It was removed at regular intervals and the clock was paused. The piece of iron was washed, dried, weighed and replaced. The clock was restarted.
This was continued until the solution was colourless.
The mass of iron was plotted against time. The graph shows the results obtained.



(i) Suggest an explanation for the shape of the graph.

.....

.....

..... [3]

(ii) Predict the shape of the graph if a similar piece of iron with a much rougher surface had been used.
Explain your answer.

.....

..... [2]

(iii) Describe how you could find out if the rate of this reaction depended on the speed of stirring.

.....

.....

..... [2]

Topic Chem7.3 **Q# 84/** iGCSE Chemistry/2012/w/Paper 31/

5 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(b) Carbonyl chloride is now made by the reversible reaction given below.

$$CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$$

The forward reaction is exothermic.
The reaction is catalysed by carbon within a temperature range of 50 to 150 °C.

(i) Predict the effect on the yield of carbonyl chloride of increasing the pressure. Explain your answer.

.....

..... [2]

(ii) If the temperature is allowed to increase to above 200 °C, very little carbonyl chloride is formed. Explain why.

.....

..... [2]

(iii) Explain why a catalyst is used.

..... [1]

Topic Chem7.3 **Q# 85/** iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state. The element and its compounds are often used as catalysts.

(c) Vanadium(V) oxide is used to catalyse the exothermic reaction between sulfur dioxide and oxygen in the Contact Process.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

The rate of this reaction can be increased either by using a catalyst or by increasing the temperature. Explain why a catalyst is used and not a higher temperature.

.....

.....

..... [2]

4 Reversible reactions can come to equilibrium. The following are three examples of types of gaseous equilibria.

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ **reaction 1**

$A_2(g) + 3B_2(g) \rightleftharpoons 2AB_3(g)$ **reaction 2**

$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$ **reaction 3**

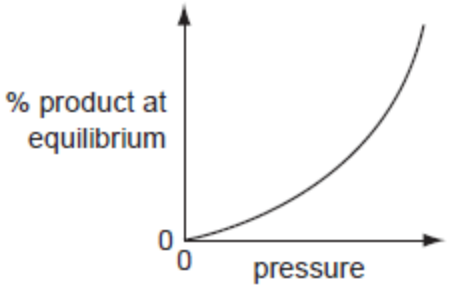
(a) Explain the term *equilibrium*.

.....

..... [2]

(b) The following graphs show how the percentage of products of a reversible reaction at equilibrium could vary with pressure.
For each graph, decide whether the percentage of products decreases, increases or stays the same when the pressure is **increased**, then match each graph to one of the above reactions and give a reason for your choice.

(i)



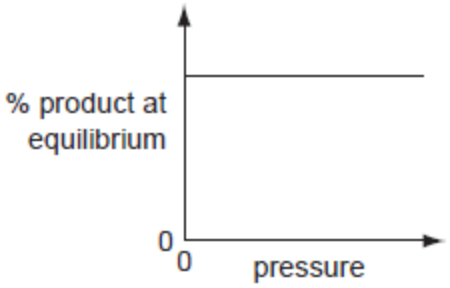
effect on percentage of products .....

reaction .....

reason .....

..... [3]

(ii)



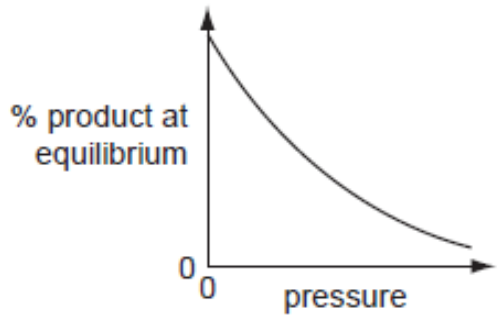
effect on percentage of products .....

reaction .....

reason .....

..... [3]

(iii)



effect on percentage of products .....

reaction .....

reason .....

..... [3]

Topic Chem7.4 **Q# 87/** iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state. The element and its compounds are often used as catalysts.

(d) The oxidation states of vanadium in its compounds are V(+5), V(+4), V(+3) and V(+2). The vanadium(III) ion can behave as a reductant or an oxidant.

(i) Indicate on the following equation which reactant is the oxidant.

$$2V^{3+} + Zn \rightarrow 2V^{2+} + Zn^{2+}$$

[1]

(ii) Which change in the following equation is oxidation? Explain your choice.

$$V^{3+} + Fe^{3+} \rightarrow V^{4+} + Fe^{2+}$$

.....

..... [2]

Topic Chem7.4 **Q# 88/** iGCSE Chemistry/2011/w/Paper 31/ Q5

(b) Iron has two oxidation states +2 and +3. There are two possible equations for the redox reaction between iron and bromine.

$$Fe + Br_2 \rightarrow Fe^{2+} + 2Br^-$$

$$2Fe + 3Br_2 \rightarrow 2Fe^{3+} + 6Br^-$$

(i) Indicate, on the first equation, the change which is oxidation. Give a reason for your choice.

.....

..... [2]

(ii) Which substance in the first equation is the reductant (reducing agent)?

..... [1]

Topic Chem 9 **Q# 89/** IGCSE Chemistry/2017/s/Paper 43/

1 Six different atoms can be represented as follows.

$^{3}_{1}A$ $^{3}_{2}D$ $^{12}_{6}E$ $^{13}_{6}G$ $^{14}_{7}J$ $^{19}_{9}L$

(a) Answer the following questions using atoms from the list. Each atom may be used once, more than once or not at all.

(v) is an atom of an element from Group VII of the Periodic Table,

..... [1]

(vi) is an atom of a noble gas.

..... [1]

Topic Chem9 **Q# 90/** IGCSE Chemistry/2017/s/Paper 42/

4 Nickel, copper and zinc are three consecutive elements in the Periodic Table.

(a) Nickel and copper are transition elements.

State **three** chemical properties of transition elements.

.....

.....

..... [3]

Topic Chem9 **Q# 91/** IGCSE Chemistry/2017/s/Paper 42/

5 **(a)** The elements in Group VII are known as the halogens. Some halogens react with aqueous solutions of halides.

(i) Complete the table by adding a ✓ to indicate when a reaction occurs and a ✗ to indicate when no reaction occurs.

	aqueous potassium chloride	aqueous potassium bromide	aqueous potassium iodide
chlorine	✗	✓	
bromine		✗	
iodine			✗

[3]

(ii) Write a chemical equation for the reaction between chlorine and aqueous potassium bromide.

..... [1]

(c) Astatine is at the bottom of Group VII. Use your knowledge of the properties of the halogens to

(i) predict the physical state of astatine at room temperature and pressure,

..... [1]

(ii) write a chemical equation for the reaction between sodium and astatine.

..... [2]

Topic Chem9 **Q# 92/** IGCSE Chemistry/2017/s/Paper 41/

2 Some oxides of some elements are listed.

CO CO_2 Na_2O MgO Al_2O_3

SiO_2 P_4O_{10} SO_2 Cl_2O_7 Cr_2O_3

(a) Answer the following questions using only oxides from the list. Each oxide may be used once, more than once or not at all.

Give the formula of an oxide

(iii) which is coloured, ...

4 In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) (i) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons							
valency							

[2]

(ii) What is the relationship between the group number and the number of valency electrons?

.....

..... [1]

(iii) Explain the relationship between the number of valency electrons and the valency

for the elements Na to Al,

.....

.....

.....

for the elements P to Cl.

.....

.....

.....

[4]

(b) Across a period, the elements change from metallic to non-metallic.

(ii) Describe how the type of bonding in the chlorides formed by these elements changes across this period.

.....

..... [2]

Topic Chem9 **Q# 94/** iGCSE Chemistry/2013/w/Paper 31/

1 For each of the following, name an element which matches the description.

(a) It is used as a fuel in nuclear reactors.

..... [1]

(b) It is the only non-metal which is a good conductor of electricity.

..... [1]

(c) Inert electrodes are made from this metal.

..... [1]

(d) This gaseous element is used to fill balloons in preference to hydrogen.

..... [1]

(e) An element which can form an ion of the type X^{3-}.

..... [1]

(f) It has the same electron distribution as the calcium ion, Ca^{2+}.

..... [1]

(g) The element is in Period 5 and Group VI.

..... [1]

Topic Chem9 **Q# 95/** iGCSE Chemistry/2013/s/Paper 31/

2 An element, **M**, has the electron distribution 2 + 8 + 18 + 3.

(a) Which group in the Periodic Table is element **M** likely to be in?

..... [1]

(b) Predict whether element **M** is a poor or a good conductor of electricity.
Give a reason for your answer.

..... [1]

(c) Binary compounds contain two atoms per molecule, for example HCl.
Identify an element which could form a binary compound with element **M**.

..... [1]

(d) Predict the formula of the sulfate of **M**. The formula of the sulfate ion is SO_4^{2-}.

..... [1]

Topic Chem9 **Q# 96/** iGCSE Chemistry/2012/w/Paper 31/

2 Three of the halogens in Group VII are listed below.

chlorine
bromine
iodine

(a) (i) How does their colour change down the Group?

..... [1]

(ii) How do their melting points and boiling points change down the Group?

..... [1]

(iii) Predict the colour and physical state (solid, liquid or gas) of astatine, At.

colour .....

physical state ..... [2]

Topic Chem9 **Q# 97/** iGCSE Chemistry/2012/s/Paper 31/

3 The Group I metals show trends in both their physical and chemical properties.

(a) (i) How do their melting points vary down the Group?

..... [1]

(ii) Which element in the Group has the highest density?

..... [1]

(iii) All Group I metals react with cold water. Complete the following equation.

.....Rb + ...H_2O → ..... + ...

[2]

Topic Chem9 **Q# 98/** iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state.
The element and its compounds are often used as catalysts.

(b) Predict **three** physical properties of vanadium which are typical of transition elements.

1. .....

2. .....

3. ..... [2]

Topic Chem9 **Q# 99/** iGCSE Chemistry/2011/s/Paper 31/ Q5

(c) Describe how you could distinguish between hydriodic, HI(aq), and hydrobromic, HBr(aq) acids, by bubbling chlorine through these two acids.

result with hydriodic acid .....

result with hydrobromic acid ..... [2]

Topic Chem 11 **Q# 100/** IGCSE Chemistry/2017/s/Paper 42/

3 This question is about nitrogen and some of its compounds.

(a) Nitrogen in the air can be converted into ammonia by the Haber process. The chemical equation for the reaction is shown.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

(i) State the temperature and pressure used in the Haber process.

temperature .....

pressure .....

[2]

(ii) Name the catalyst used in the Haber process.

..... [1]

(b) The ammonia produced in the Haber process can be oxidised to nitrogen(II) oxide at 900 °C. The reaction is exothermic.

(i) Balance the chemical equation for this reaction.

$$4NH_3 + ...O_2 \rightleftharpoons .....NO + ...H_2O$$

[2]

(ii) Suggest a reason, other than cost, why a temperature greater than 900 °C is **not** used.

..... [1]

(iii) Suggest a reason why a temperature less than 900 °C is **not** used.

..... [1]

3 Ammonia is manufactured by the Haber process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

(a) Describe how the reactants are obtained.

(i) Nitrogen

.....

..... [2]

(ii) Hydrogen

.....

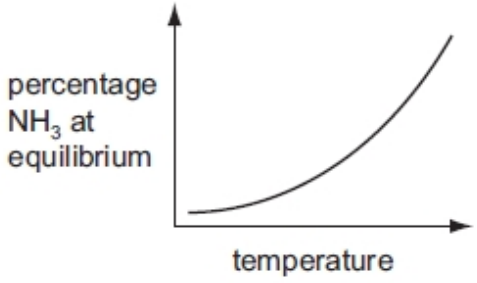
.....

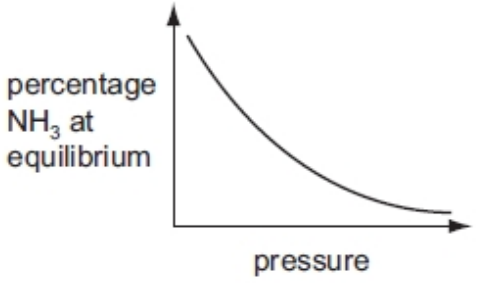
..... [3]

(b) The percentage of ammonia in the equilibrium mixture varies with temperature and pressure.

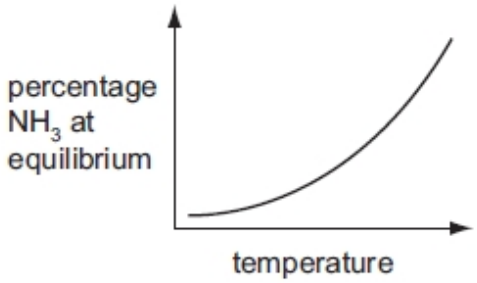
(i) Which pair of graphs, **A**, **B** or **C**, shows correctly how the percentage of ammonia at equilibrium varies with temperature and pressure?

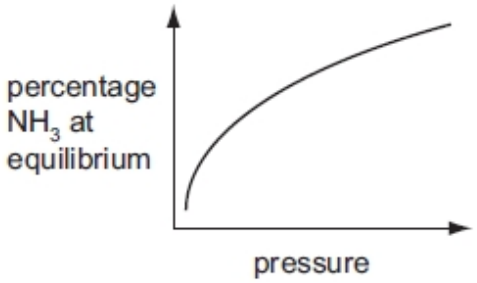
pair **A**



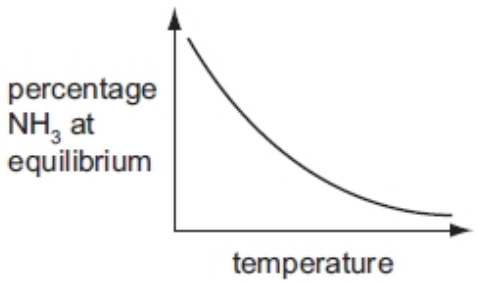


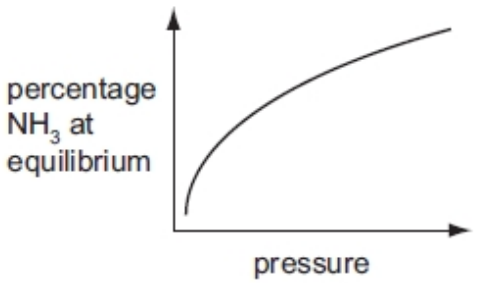
pair **B**





pair **C**





The pair with **both graphs correct** is ..... [1]

(ii) Give a full explanation of why the pair of graphs you have chosen in **(i)** is correct.

.....

.....

.....

.....

.....

.....

..... [6]

(iii) Catalysts do not alter the position of equilibrium. Explain why a catalyst is used in this process.

.....

.....

.....

..... [2]

Topic Chem11.3 **Q# 102/** iGCSE Chemistry/2013/s/Paper 31/ Q6

(b) Ammonia is manufactured by the Haber Process. The economics of this process require that as much ammonia as possible is made as quickly as possible.
Explain how this can be done using the following information.

The conditions for the following reversible reaction are:

- 450 °C
- 200 atmospheres pressure
- iron catalyst

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ the reaction is exothermic

.....

.....

.....

.....

.....

..... [5]

Topic Chem11.3 **Q# 103/** iGCSE Chemistry/2010/w/Paper 31/ Q4

(b) Ammonia is made by the Haber Process.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ forward reaction is exothermic

The percentage of ammonia in the equilibrium mixture varies with conditions.

pressure / atmospheres	100	200	300	400
% ammonia at 300 °C	45	65	72	78
% ammonia at 500 °C	9	18	25	31

The conditions actually used are 200 atmospheres, 450 °C and an iron catalyst.

(i) The original catalyst was platinum. Suggest a reason why it was changed to iron.

..... [1]

(ii) Explain why the highest pressure gives the highest percentage of ammonia in the equilibrium mixture.

.....

..... [2]

(iii) What happens to the unreacted nitrogen and hydrogen?

.....

..... [1]

(iv) State **one** advantage and **one** disadvantage of using a lower temperature.

advantage .....

..... [1]

disadvantage .....

..... [1]

Topic Chem11.3 **Q# 104/** iGCSE Chemistry/2009/s/Paper 31/

6 Ammonia is manufactured by the Haber process.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ the forward reaction is exothermic

(a) (i) Name the raw materials from which nitrogen and hydrogen are obtained.

nitrogen from ..... [1]

hydrogen from ..... [1]

(ii) Name the catalyst used in this process.

.....

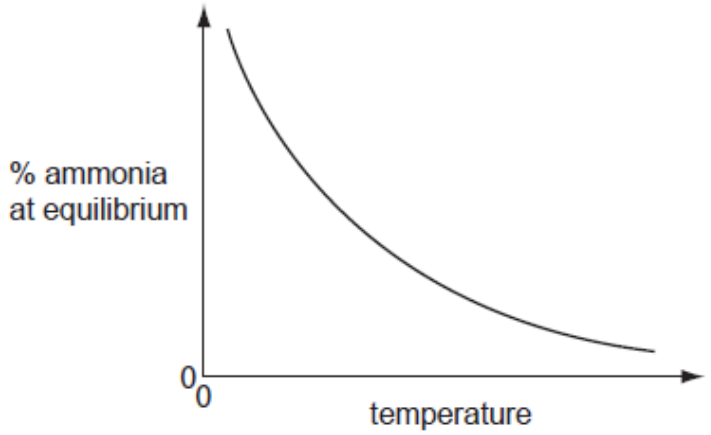
[1]

(iii) What is the most important use of ammonia?

.....

[1]

(b) The following graph shows how the percentage of ammonia in the equilibrium mixture changes with temperature.



(i) Explain the term *equilibrium*.

.....

.....

.....

.....

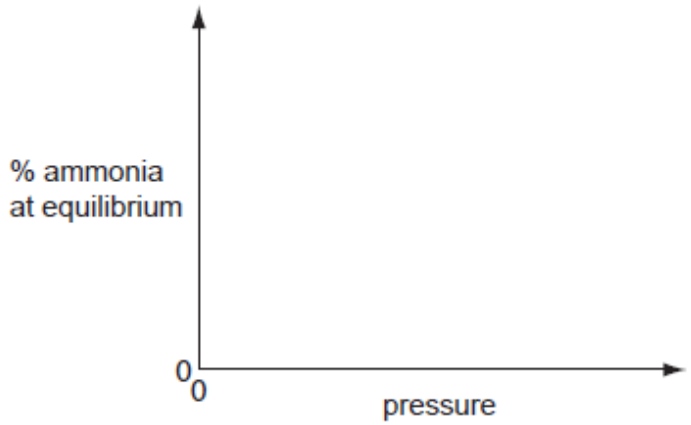
[2]

(ii) How does the percentage of ammonia vary with temperature?

.....

[1]

(c) (i) Sketch a graph which shows how the percentage of ammonia in the equilibrium mixture varies with pressure.



[1]

(ii) Explain why the graph has the shape shown.

.....

.....

..... [2]

Topic Chem11.3 **Q# 105/** iGCSE Chemistry/2008/w/Paper 31/ Q5b

(ii) Name an important chemical that is made from hydrogen.

..... [1]

Topic Chem11.3 **Q# 106/** iGCSE Chemistry/2008/s/Paper 31/

8 Large areas of the Amazon rain forest are cleared each year to grow soya beans. The trees are cut down and burnt.

(a) Why do these activities increase the percentage of carbon dioxide in the atmosphere?

.....

..... [2]

Topic Chem11.3 **Q# 107/** iGCSE Chemistry/2007/w/Paper 3/ Q6

(c) Methanol is made from carbon monoxide.

$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ the forward reaction is exothermic

(i) Describe how hydrogen is obtained from alkanes.

.....

..... [2]

Topic Chem11.3 **Q# 108/** iGCSE Chemistry/2006/w/Paper 3/

5 Ammonia is manufactured by the Haber Process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$
200 atmospheres
450°C

The forward reaction is exothermic.

(a) (i) What is the catalyst for this reaction?

..... [1]

(ii) Newer catalysts have been discovered for this process. Using these catalysts, the operating temperature is lowered from 450°C to 400°C. What is the advantage of using a lower temperature?
Explain your answer.

advantage .....

explanation .....

..... [2]

(b) After passing over the catalyst, the mixture contains 15% of ammonia. It is cooled and the ammonia liquefies and is separated from the unreacted nitrogen and hydrogen. They are recycled.

(i) How are the gases recycled?

..... [1]

(ii) Only ammonia gas liquefies. Suggest an explanation for this.

..... [1]

(c) Urea, $CO(NH_2)_2$, is one of the fertilisers manufactured from ammonia. Ammonia is heated with carbon dioxide.

(i) Write an equation for the manufacture of urea.

..... [2]

(ii) Explain why urea on its own might not be very effective in promoting crop growth.

..... [1]

Topic Chem11.3 **Q# 109/** iGCSE Chemistry/2005/w/Paper 3/

7 In 1909, Haber discovered that nitrogen and hydrogen would react to form ammonia. The yield of ammonia was 8%.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$ the forward reaction is exothermic

catalyst platinum
temperature 600 °C
pressure 200 atm

(a) Describe how hydrogen is obtained for the modern process.

.....

..... [2]

(b) (i) What is the catalyst in the modern process?

..... [1]

(ii) Explain why the modern process, which uses a lower temperature, has a higher yield of 15%.

.....

..... [2]

Topic Chem11.3 **Q# 110/** iGCSE Chemistry/2004/s/Paper 3/ Q2

(b) About one third of this production of acid is used to make nitrogen and phosphorus-containing fertilisers.

(i) Name the third element that is essential for plant growth and is present in most fertilisers.

..... [1]

(ii) Name a nitrogen-containing fertiliser that is manufactured from sulphuric acid.

..... [1]

Topic Chem11.3 **Q# 111/** iGCSE Chemistry/2003/w/Paper 3/

1 Ammonia contains the elements nitrogen and hydrogen. It is manufactured from these elements in the Haber process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

(ii) Name **two** raw materials from which hydrogen is manufactured.

.....

.....

[2]

(b) The table shows how the percentage of ammonia in the equilibrium mixture varies with pressure at 600 °C.

percentage ammonia	8	12	15	20
pressure/atm	200	300	400	500

(i) Explain why the percentage of ammonia increases as the pressure increases.

.....

.....[2]

(ii) How would the percentage of ammonia change if the measurements had been made at a lower temperature?
Explain your answer.

.....

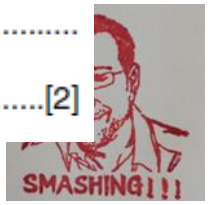
.....

.....[2]

(iii) State **two** of the reaction conditions used in the Haber Process.

.....

.....[2]



3 The main use of sulfur dioxide is the manufacture of sulfuric acid.

(a) State **two** other uses of sulfur dioxide.

.....

..... [2]

(b) One source of sulfur dioxide is burning sulfur in air.
Describe how sulfur dioxide can be made from the ore zinc sulfide.

.....

..... [2]

(c) The Contact process changes sulfur dioxide into sulfur trioxide.

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

the forward reaction is exothermic

temperature 400 to 450 °C

low pressure 1 to 10 atmospheres

catalyst vanadium(V) oxide

(i) What is the formula of vanadium(V) oxide?

..... [1]

(ii) Vanadium(V) oxide is an efficient catalyst at any temperature in the range 400 to 450 °C.
Scientists are looking for an alternative catalyst which is efficient at 300 °C.
What would be the advantage of using a lower temperature?

.....

.....

..... [2]

(iii) The process does not use a high pressure because of the extra expense.
Suggest **two** advantages of using a high pressure?
Explain your suggestions.

.....

.....

.....

.....

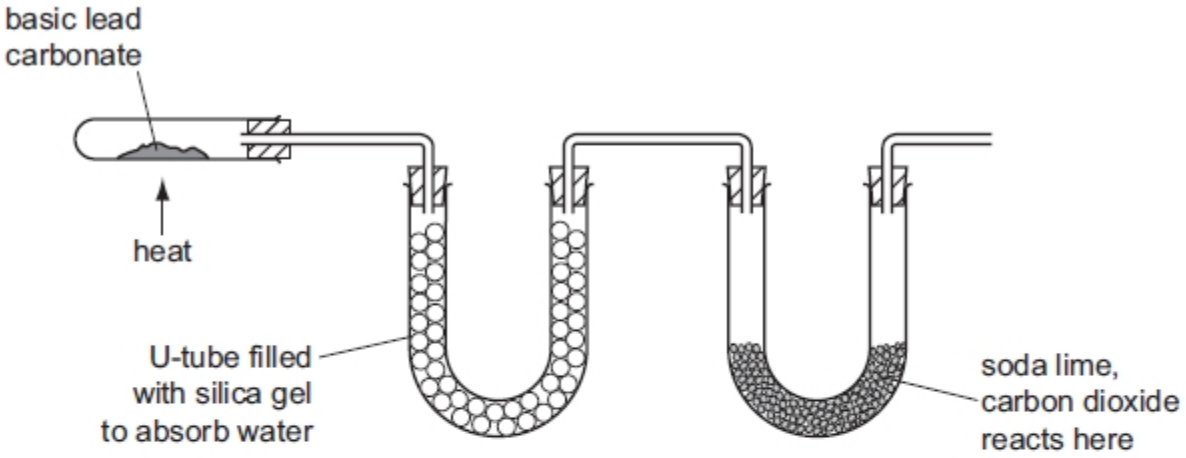
..... [4]

(d) Sulfuric acid is made by dissolving sulfur trioxide in concentrated sulfuric acid to form oleum. Water is reacted with oleum to form more sulfuric acid.
Why is sulfur trioxide not reacted directly with water?

..... [1]

Topic Chem12 **Q# 113/** iGCSE Chemistry/2013/w/Paper 31/ Q6

(b) Basic lead(II) carbonate is heated in the apparatus shown below. Water and carbon dioxide are produced.



(i) Silica gel absorbs water. Silica gel often contains anhydrous cobalt(II) chloride. When this absorbs water it changes from blue to pink.
Suggest a reason.

..... [1]

(ii) Soda lime is a mixture of sodium hydroxide and calcium oxide. Why do these two substances react with carbon dioxide?

.....

..... [2]

(iii) Name **two** substances formed when soda lime reacts with carbon dioxide.

..... [2]

Topic Chem12 **Q# 114/** iGCSE Chemistry/2011/s/Paper 31/ Q4

(b) Sulfur dioxide is used to make sulfur trioxide in the Contact Process.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic. The conditions used are:

temperature: 450 °C
pressure: 2 atmospheres
catalyst: vanadium(V) oxide

Explain, mentioning both position of equilibrium and rate, why these conditions give the most economic yield.

.....

.....

.....

..... [4]

Topic Chem12 **Q# 115/** iGCSE Chemistry/2009/w/Paper 3/ Q6

(b) Sulfuric acid was first made in the Middle East by heating the mineral, green vitriol, $FeSO_4.7H_2O$. The gases formed were cooled.

$FeSO_4.7H_2O(s) \rightarrow FeSO_4(s) + 7H_2O(g)$
green crystals yellow powder

$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

On cooling

$SO_3 + H_2O \rightarrow H_2SO_4$ sulfuric acid
$SO_2 + H_2O \rightarrow H_2SO_3$ sulfurous acid

(ii) Sulfurous acid is a reductant. What would you see when acidified potassium manganate(VII) is added to a solution containing this acid?

.....

..... [2]

(iii) Suggest an explanation why sulfurous acid in contact with air changes into sulfuric acid.

..... [1]

Topic Chem12 **Q# 116/** iGCSE Chemistry/2009/w/Paper 3/

6 **(a)** Sulfuric acid is made by the Contact process.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

This is carried out in the presence of a catalyst at 450 °C and 2 atmospheres pressure.

(i) How is the sulfur dioxide made?

.....

..... [1]

(ii) Give another use of sulfur dioxide.

..... [1]

(iii) Name the catalyst used.

..... [1]

(iv) If the temperature is decreased to 300 °C, the yield of sulfur trioxide increases. Explain why this lower temperature is not used.

.....

..... [1]

(v) Sulfur trioxide is dissolved in concentrated sulfuric acid. This is added to water to make more sulfuric acid. Why is sulfur trioxide not added directly to water?

.....

..... [1]

Topic Chem12 **Q# 117/** iGCSE Chemistry/2008/s/Paper 31/

1 For each of the following select an element from Period 4, potassium to krypton, that matches the description.

(g) One of its oxides is the catalyst in the Contact Process. .....

[iGCSE Chemistry/201]

Topic Chem12 **Q# 118/** iGCSE Chemistry/2007/w/Paper 3/

4 Zinc is extracted from zinc blende, ZnS.

(a) Zinc blende is heated in air to give zinc oxide and sulphur dioxide. Most of the sulphur dioxide is used to make sulphur trioxide. This is used to manufacture sulphuric acid. Some of the acid is used in the plant, but most of it is used to make fertilisers.

(i) Give another use of sulphur dioxide.

..... [1]

(ii) Describe how sulphur dioxide is converted into sulphur trioxide.

.....

.....

..... [3]

(iii) Name a fertiliser made from sulphuric acid.

..... [1]

Topic Chem12 **Q# 119/** iGCSE Chemistry/2006/s/Paper 3/ Q5 (b)

(iii) Explain, mentioning both rate and percentage yield, why the temperature used in the Contact process is 450°C.

.....

..... [2]

(iv) Describe how the sulphur trioxide is changed into concentrated sulphuric acid.

.....

..... [2]

Topic Chem12 **Q# 120/** iGCSE Chemistry/2006/s/Paper 3/

5 Sulphuric acid is made by the Contact process in the following sequence of reactions.

sulphur → sulphur dioxide → sulphur trioxide → sulphuric acid

(a) (i) How is sulphur dioxide made from sulphur?

..... [1]

(ii) Sulphur dioxide has other uses.
Why is it used in the manufacture of paper?

..... [1]

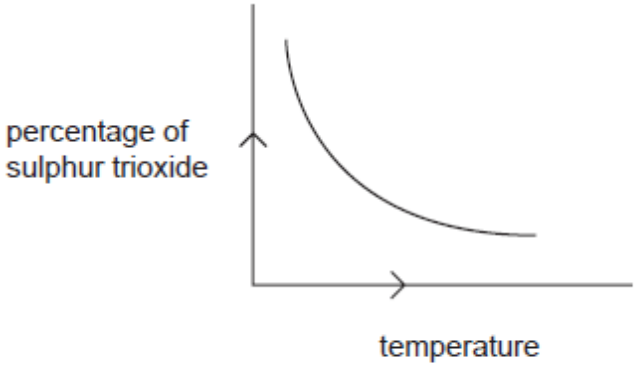
(iii) How does it preserve food?

..... [1]

(b) The equation for a stage of the Contact process is

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

The percentage of sulphur trioxide in the equilibrium mixture varies with temperature.



(i) How does the percentage of sulphur trioxide in the equilibrium mixture vary as the temperature increases? Circle the correct answer.

increases **stays the same** **decreases** [1]

(ii) Is the forward reaction in the equilibrium $2SO_2 + O_2 \rightleftharpoons 2SO_3$ exothermic or endothermic? Give a reason for your choice.

.....

..... [2]

Topic Chem12 **Q# 121/** iGCSE Chemistry/2005/s/Paper 3/Q4

(c) Sulphuric acid is manufactured by the Contact Process. Sulphur dioxide is oxidised to sulphur trioxide by oxygen.

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

(i) Name the catalyst used in this reaction.

..... [1]

(ii) What temperature is used for this reaction?

..... [1]

(iii) Describe how sulphur trioxide is changed into sulphuric acid.

.....

..... [2]

4 The Carlsbad caverns in New Mexico are very large underground caves. Although the walls of these caves are coated with gypsum (hydrated calcium sulphate), the caves have been formed in limestone.

(a) It is believed that the caves were formed by sulphuric acid reacting with the limestone.

(i) Complete the word equation.

calcium carbonate + sulphuric acid → calcium sulphate + ... + ...

[1]

(ii) Describe how you could test the water entering the cave to show that it contained sulphate ions.

test .....

result ..... [2]

(iii) How could you show that the water entering the cave has a high concentration of hydrogen ions?

..... [1]

(b) Hydrogen sulphide gas which was escaping from nearby petroleum deposits was being oxidised to sulphuric acid.

(i) Complete the equation for this reaction forming sulphuric acid.

H_2S + ...O_2 → ..... [2]

(ii) Explain why all the hydrogen sulphide should be removed from the petroleum before it is used as a fuel.

.....

..... [1]

2 Sulphur is used to make sulphuric acid. In the UK, the annual production of the acid is about 2.5 million tonnes.

(a) The reactions in the manufacture of sulphuric acid by the Contact Process are shown below.

Sulphur	⟶	Sulphur dioxide
S	**reaction 1**	SO_2
Sulphur dioxide + oxygen	⟶	Sulphur trioxide
$2SO_2 + O_2$	**reaction 2**	$2SO_3$
Sulphur trioxide	⟶	Oleum
SO_3	**reaction 3**	$H_2S_2O_7$
Oleum + water	⟶	Sulphuric acid
$H_2S_2O_7$	**reaction 4**	H_2SO_4

(i) Give a large scale source of the element sulphur.

..... [1]

(ii) State another use of sulphur dioxide.

..... [1]

(iii) How is sulphur changed into sulphur dioxide?

..... [1]

(iv) Name the catalyst used in reaction **2**.

..... [1]

(v) Reaction **2** is exothermic. Why is a catalyst, rather than a higher temperature, used to increase the rate of this reversible reaction?

.....

..... [2]

(vi) Write a word equation for reaction **3**.

..... [1]

(vii) Write a symbol equation for reaction **4**.

..... [1]

Topic Chem12 **Q# 124/** iGCSE Chemistry/2003/w/Paper 3/

5 Sulphur dioxide, SO_2, and sulphur trioxide, SO_3, are the two oxides of sulphur.

(a) Sulphur dioxide can kill bacteria and has bleaching properties. Give a use of sulphur dioxide that depends on each of these properties.

(i) ability to kill bacteria .....[1]

(ii) bleaching properties .....[1]

(b) Sulphur trioxide can be made from sulphur dioxide.

(i) Why is this reaction important industrially?

.....[1]

(ii) Complete the word equation.

sulphur dioxide + ... → sulphur trioxide [1]

(iii) What are the conditions for this reaction?

.....

.....[2]

Topic Chem12 **Q# 125/** iGCSE Chemistry/2002/w/Paper 3/

1 **(a)** Sulphuric acid is made by the Contact Process.

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ forward reaction is exothermic

(i) What are the reaction conditions for the Contact Process?

.....

.....[3]

(ii) Would the yield of sulphur trioxide increase, decrease or stay the same when the temperature is increased? Explain your answer.

.....

.....

.....[2]

(iii) Describe how sulphur trioxide is changed into concentrated sulphuric acid.

.....

.....[2]

5 **(a)** In the USA, sulphur is obtained from underground deposits. It burns to form sulphur dioxide. This is used in paper making, to preserve food and in the manufacture of sulphuric acid.

(i) Why is sulphur dioxide needed in paper making?

.....[1]

(ii) How does sulphur dioxide preserve food?

.....[1]

Mark Scheme for Paper 3/4 simple answer questions

Q# 1/ IGCSE Chemistry/2017/w/Paper 42/

1(a)(i)	Brownian (motion)	1
1(a)(ii)	molecules	1
	nitrogen / N_2 / N OR oxygen / O_2 / O	1
1(a)(iii)	nitrogen OR oxygen (particles) collide with / bombard / hit the dust (particles)	1
	(the bombarding particles) move **randomly**	1
1(b)(i)	diffusion	1
1(b)(ii)	Br_2 has an M_r of 160 **AND** Cl_2 has an M_r of 71 / bromine has an A_r of 80 **AND** chlorine has an A_r of 35.5	1
	(heavier) bromine (molecules / particles) diffuses more slowly	1
1(b)(iii)	particles have more energy / move faster	1

Q# 2/ IGCSE Chemistry/2017/w/Paper 41/

Question	Answer	Marks
1(a)(i)	B	1
1(a)(ii)	A	1
1(a)(iii)	C	1
1(a)(iv)	E	1
1(b)	O^{2-} **M1** O **M2** $^{2-}$	2

Question	Answer	Marks
2(a)(i)	**S**	1
2(a)(ii)	**S**	1
2(a)(iii)	**V**	1
2(b)	any value in the range 130–145 °C	1
2(c)	sublimation	1
2(d)(i)	Brownian motion	1
2(d)(ii)	nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles	1
	(the bombarding particles) move randomly	1

Q# 3/ IGCSE Chemistry/2017/s/Paper 42/

1(a)(ii)	chromatography	1
1(a)(iii)	fermentation / ferment	1
1(a)(iv)	(simple) distillation / distil	1
1(a)(v)	filtration / decantation / centrifugation	1

Q# 4/ IGCSE Chemistry/2017/s/Paper 41/

3(a)(iii)	(a solution in which) no more solute will dissolve	1
	at that temperature	1
3(a)(iv)	the solubility deceases as the temperature decreases	1

Q# 5/ IGCSE Chemistry/2017/m/Paper 42/

2(d)(i)	**M1** dichromate ions / particles are heavier (than silver ions)	**1**
	M2 so dichromate ions diffuse / move more slowly **ORA**	**1**
	M3 (where they meet they react and) silver dichromate is made	**1**
2(d)(ii)	**M1** red solid forms in less than five minutes **or** red solid forms faster / sooner	**1**
	M2 particles / ions move faster	**1**
2(e)(i)	**M1** breaking down	**1**
	M2 when heated	**1**

Q# 6/ iGCSE Chemistry/2014/s/Paper 31/Q3c

(iii) fractional distillation (1) [1]

Q# 7/ iGCSE Chemistry/2014/s/Paper 31/

3 **(a) (i)** (particles) spread to fill total available volume / move from high concentration to low concentration / moves down a concentration gradient (1) [1]

(ii) mass or M_r (1) [1]

(b) (i) helium atoms / molecules are lighter than molecules in air or N_2 **and** O_2
or helium is less dense than air or N_2 **and** O_2.
or helium diffuses (through the porous barrier) faster than air or N_2 **and** O_2. (1) [1]

(ii) faster rate of diffusion / molecules move faster (at high temperatures). (1) [1]

(iii) fractional distillation (1) [1]

Q# 8/ iGCSE Chemistry/2012/w/Paper 31/

7 **(a) (i)** melting point is below 25°C; [1]
boiling point above 25°C; [1]
accept: argument based on actual values
note: 25°C is between mp and bp = [2]

Q# 9/ iGCSE Chemistry/2014/s/Paper 31/ Q2

(b) boiling or turning to steam (1)

then condensing / condensation (1) [2]

Q# 10/ iGCSE Chemistry/2012/w/Paper 31/

1 **(a)** diffusion or fractional distillation;

(b) fractional distillation;

(c) simple distillation;

(d) crystallisation;

(e) filtration;

(f) chromatography;

Q# 11/ iGCSE Chemistry/2011/s/Paper 31/

1 **(a)** **F or B** diffusion / fractional distillation [1]

(b) A simple distillation [1]

(c) D chromatography [1]

(d) E filtration [1]

(e) C evaporation [1]

(f) B fractional distillation [1]

Q# 12/ IGCSE Chemistry/2017/w/Paper 43/

3(c)(i)	positive ions / cations	1
	sea of electrons / mobile electrons / delocalised electrons / moving electrons / flowing electrons	1
	attraction between positive ions and electrons	1
3(c)(ii)	layers / rows / sheets of ions	1
	slide / slip / shift (over each other or past each other)	1

Q# 13/ IGCSE Chemistry/2017/w/Paper 43/

1(b)	element	1
1(d)	mixture	1

Q# 14/ IGCSE Chemistry/2017/w/Paper 43/

2(a)(i)	(two or more) **atoms**	1
	combined / joined / sharing electrons (by a covalent bond) / bonded	1
2(a)(ii)	substance that cannot be split up / broken down / decomposed (into anything simpler) OR (substance) made of **atoms** with the same atomic number / number of protons / proton number	1
2(b)(i)	10	1
2(b)(ii)	22	1
2(b)(iii)	A **AND** B	1
2(b)(iv)	A **AND** B	1
2(b)(v)	C **AND** D	1
2(c)		3

	number of protons	number of electrons
Na	11	11
S^{2-}	16	18
Cl_2	34	34

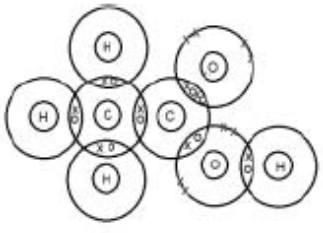
Q# 15/ IGCSE Chemistry/2017/w/Paper 42/

2(a)	*Si*: 2: 8 : 4	1
	Ca^{2+}: 2 : 8: 8	1
	N^{3-}: 2 : 8	1
2(b)	Ca_3N_2	1
2(c)	Li shown as having one shell with 2 electrons OR no electrons OR no outer shell	1
	Cl shown as having an outer shell of 7 electrons of one type, plus one different electron which matches Li electrons	1
	'+' charge on Li **AND** '–' charge on *Cl*	1
2(d)	two shared pairs of electrons	1
	both *Cl* with complete outer shells	1
	S with complete outer shell	1
2(e)	SCl_2 has intermolecular forces (of attraction)	1
	LiCl has (electrostatic) forces (of attraction) between ions	1
	intermolecular forces are weaker / less energy is needed to break intermolecular forces	1
2(f)	silicon(IV) oxide	1

Q# 16/ IGCSE Chemistry/2017/w/Paper 41/

6(b)(i)	oxide ion has an outer shell with six dots and two crosses	1
	oxide ion has a charge of 2^-	1
6(b)(ii)	(electrostatic) forces of attraction between ions	1
	(are) strong OR require lots of energy to overcome	1

Q# 17/ IGCSE Chemistry/2017/w/Paper 41/

4(c)(ii)		3

M1 all shared pairs of electrons correct for single bonds
M2 2 shared pairs of electrons for the C=O bond
M3 total of 8 electrons on each O including 4 non-bonding electrons and no additional non-bonding electrons

Q# 18/ IGCSE Chemistry/2017/w/Paper 41/

Question	Answer	Marks
1(a)(i)	B	1
1(a)(ii)	A	1
1(a)(iii)	C	1
1(a)(iv)	E	1
1(b)	O^{2-} M1 O M2 $^{2-}$	2

Question	Answer	Marks
2(a)(i)	S	1
2(a)(ii)	S	1
2(a)(iii)	V	1
2(b)	any value in the range 130–145 °C	1
2(c)	sublimation	1
2(d)(i)	Brownian motion	1
2(d)(ii)	nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles	1
	(the bombarding particles) move randomly	1

Q# 19/ IGCSE Chemistry/2017/s/Paper 43/

2(c)	(attractive) forces between molecules	1
	(forces of attraction) are stronger in iodine	1

Q# 20/ IGCSE Chemistry/2017/s/Paper 43/

1(a)(i)	J	1
1(a)(ii)	E	1
1(a)(iii)	D	1
1(a)(iv)	J	1
1(a)(v)	L	1
1(a)(vi)	D	1
1(b)(i)	(atoms with) same **number** of protons / atomic number / of same element	1
	different **number** of neutrons / different mass number / different nucleon number	1
1(b)(ii)	E AND G	1
1(b)(iii)	they have the same number of electrons in their outer shell	1

Q# 21/ IGCSE Chemistry/2017/s/Paper 43/

3(a)	regular arrangement / lattice of positive ions / magnesium ions / Mg^{2+} ions	1
	sea of electrons OR delocalised electrons	1
	attraction between (positive) ions and (delocalised / sea of) electrons	1
3(b)	electrons	1
	move / flow (throughout / through the structure)	1
3(c)	layers (of atoms or ions)	1
	layers / atoms / ions can slide / slip / glide (over each other) (without breaking the metallic bonds)	1
3(d)(i)	magnesium shown as (2, 8) using crosses	1
	sulfide shown as (2, 8, 8), with the two gained electrons in the outer shell of sulfur shown as crosses and all other electrons on sulfur shown as dots	1
	magnesium ion charge as 2^+ **AND** sulfide charge as 2^-	1
3(d)(ii)	melt / fused	1
	ions can move OR are mobile	1

Q# 22/ IGCSE Chemistry/2017/s/Paper 42/

1(b)(i)	(substance that) cannot be split up / broken down into (two or more) simpler substances by chemical means OR (substance) made of **atoms** with the same atomic number / number of protons / proton number	1
1(b)(ii)	(two or more) **elements** joined or combined or bonded (together)	1
1(b)(iii)	(particle) containing different numbers of protons and electrons OR atom or group of atoms that has gained or lost an electron / electrons	1

Q# 23/ IGCSE Chemistry/2017/s/Paper 42/

Question	Answer	Marks
2(a)	atoms of the same element / atoms with the same proton number / atoms with the same atomic number	1
	different neutron **number** / different nucleon **number** / different mass number	1
2(b)		3
2(c)(i)	covalent	1
2(c)(ii)	award 1 mark for each correct property and one mark for each correct matching reason.	4
	property: high melting point / high boiling point reason: bonds between atoms are strong OR covalent bonds are strong / **bonds** need large amount of energy to break	
	property: non-conductor / poor conductor(of electricity) / insulator reason: no moving charged particles / no moving ions / no moving electrons / all (outer shell) electrons used in bonding	
	property: hard reason: bonds between atoms are strong OR covalent bonds are strong	
	property: brittle reason: bonds between atoms are strong OR covalent bonds are strong / bonds are directional	
	property: insoluble reason: does not form hydrogen bonds with water / no ions that can be hydrated	
2(d)(i)	incomplete combustion / incomplete burning / combustion in insufficient air / oxygen	1
	of **fossil** fuels / named fossil fuel / named petroleum fraction / name or formula of a type of substance containing carbon	1
2(d)(ii)	toxic / poisonous / combines with or binds to haemoglobin	1

	carbon	silicon	
proton number	6	14	**M1**
electronic structure	2,4	2,8,4	**M2**
nucleon number	12	28	
number of neutrons in one atom	6	14	**M3**

2(e)(i)	carbon dioxide: (simple) molecular / simple covalent	1
	silicon(IV) dioxide: macromolecular / giant molecular / giant covalent / giant atomic	1
2(e)(ii)	carbon dioxide: weak (force of) attraction between molecules / weak intermolecular forces / weak van der Waals' forces / weak dispersion forces / weak London forces	1
	silicon(IV) dioxide: covalent bonds are strong / force of attraction between atoms is strong / no weak bonds (are present) / all bonds are strong	1
	(weak) forces of attraction in carbon dioxide need small amounts of energy or heat to break / less energy or heat needed to break forces of attraction in carbon dioxide OR (strong) bonds in silicon(IV) dioxide need large amounts of energy or heat to break / more energy or heat needed to break bonds in silicon(IV) dioxide	1

Q# 24/ IGCSE Chemistry/2017/s/Paper 41/

1(a)	*proton number*: the number of protons	1
	nucleon number: the total number of protons and neutrons	1
	nucleon number: in the nucleus / nuclei (of an atom)	1
1(b)	(hydrogen is the only atom to have) no neutrons	1
1(c)		

	number of protons	number of neutrons	number of electrons
^{19}F	9	10	9
^{26}Mg	12	14	12
$^{31}P^{3-}$	15	16	18
$^{87}Sr^{2+}$	38	49	36

	fluorine protons **AND** neutrons correct	1
	magnesium neutrons **AND** electrons correct	1
	phosphorus protons **AND** neutrons correct	1
	phosphorus electrons correct	1
	strontium protons **AND** neutrons correct	1
	strontium electrons correct	1
1(d)(i)	MgF_2	1
1(d)(ii)	Sr_3P_2	1

Q# 25/ IGCSE Chemistry/2017/m/Paper 42/

3(e)(ii)	**M1** weak forces (of attraction)	1
	M2 between molecules / intermolecular	1

Q# 26/ iGCSE Chemistry/2012/w/Paper 31/ Q22

(b) (i) same Z / same number of protons; [1]
accept: atoms of the same element
different number of neutrons / different nucleon number / different mass number; [1]

(ii) 53 protons and 53 electrons; [1]

78 neutrons; [1]

(iii) xenon; [1]

Q# 27/ iGCSE Chemistry/2012/s/Paper 31/

4 (a) 2 + 8 + 11 + 2 [1]

Q# 28/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(c) each chlorine 1 bp and 3 nbps; [1]
4 e between carbon atom and oxygen atom; [1]
2 nbps on oxygen atom; [1]

Q# 29/ iGCSE Chemistry/2012/w/Paper 31/

(ii) strontium loses 2e; [1]
sulfur gains 2e; [1]

Q# 30/ iGCSE Chemistry/2012/w/Paper 31/

(iv) molten strontium chloride has ions / ionic compound; [1]
which can move; [1]
sulfur chloride has no ions / only molecules / molecular / covalent; [1]

Q# 31/ iGCSE Chemistry/2012/w/Paper 31/

4 (a) giant covalent; [1]
or: polymer made from monomers;

(b) (i) any three from:
high mp / bp;
hard;
brittle;
insoluble (in water);
poor conductor of electricity / heat; [3]

(ii) carbon / diamond / silicon / boron; [1]
not: graphite

Q# 32/ iGCSE Chemistry/2012/s/Paper 31/Q3

(b) (i) Li^+ [1]

(ii) N^{3-} [1]

(iii) regular arrangement of ions / particles / positive and negative ions alternate; [1]
not: atoms

(iv) 3:1; [1]
ratio to balance charges / reason in terms of valency; [1]

Q# 33/ iGCSE Chemistry/2011/w/Paper 31/
iGCSE Chemistry/201

(c) (i) strontium oxide [1]
accept: aluminium oxide

(ii) use correct formula [1]
cond: charges on ions
6x and 2o around oxygen [1]
ignore: electrons around Li

Q# 34/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(b) (i) correct formula [1]

cond following marks conditional on correct formula
If covalent mark 1 only
correct charges [1]
6x and 2o around anion [1]
do **NOT** penalise for incorrect coding
ignore electrons around potassium

Q# 35/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(ii) correct formula [1]

If ionic mark 1 only
cond
2 bp and 2 nbp around selenium [1]
1 bp and 3 nbp around both chlorine atoms [1]

(iii) the ionic compound
higher melting point / boiling point / less volatile
conducts when molten or aqueous, covalent compound does not
is soluble in water, covalent is not / ionic insoluble in organic solvents, covalent soluble in organic solvents
harder
any **two** [2]
note there has to be comparison between the ionic compound and the covalent compound
not density

Q# 36/ iGCSE Chemistry/2011/s/Paper 31/ Q3

(c) (i) strong attractive forces / strong bonds / bonds hard to break / requires a lot of energy to break bonds [1]
not between ions, **not** between positive and negative ions,
not between electrons

between positive ions and (negative) electrons / opposite charges attract [1]

(ii) because the layers, lattice or rows of ions/cations [1]
accept sheets of ions
not atoms / molecules / protons / nuclei

can move / slip / slide past each other [1]

Q# 37/ IGCSE Chemistry/2017/w/Paper 42/

5(b)(i)	210 cm^3 **M1** expected volume of hydrogen = 300 cm^3 **M2** 70% of **M1**	2

Q# 38/ IGCSE Chemistry/2017/w/Paper 41/

7(b)(i)	0.075 If full credit is not awarded, allow 1 mark for M_r of CuO = 80	2
7(b)(ii)	0.05	1
7(b)(iii)	4 (g) **M1** moles copper(II) oxide that reacted = (0.05 / 2) = 0.025 mol **M2** mass copper(II) oxide = ((0.075 – 0.025) × 80) = 4 g	2
7(c)	$C_2CuH_4O_2$ **M1** 41.52 / 35.5; 37.43 / 64; 2.34 / 1; 18.71 / 16 OR 1.17 : 0.58 : 2.34 : 1.17 **M2** appropriate scaling to give whole number ratios	2

Q# 39/ IGCSE Chemistry/2017/s/Paper 43/

6(c)(i)	M_r = 197	1
	(9.85 / 197 =) 0.05 (mol)	1
6(c)(ii)	0.05 (mol)	1
6(c)(iii)	(0.05 × 24) = 1.2 (dm_3)	1
6(c)(iv)	moles of HCl at the start = (250 / 1000 × 1.00) = 0.25	1
	moles HCl in excess = 0.25 – (2 × 0.05) = 0.15 (mol)	1

Q# 40/ IGCSE Chemistry/2017/s/Paper 42/

5(b)(ii)	0.02 (mol)	1
5(b)(iii)	0.02 (mol)	1
5(b)(iv)	1:2	1
	VCl_2	1

Q# 41/ IGCSE Chemistry/2017/s/Paper 41/

3(b)(i)	moles of water = 2.52 / 18 = 0.14 (mol)	1
3(b)(ii)	moles of anhydrous magnesium sulfate = 0.02 (mol)	1
3(b)(iii)	ratio = 0.02/0.02 : 0.14/0.02 = 1 : 7	1
3(b)(iv)	$MgSO_4.7H_2O$ **M1** $MgSO_4$ **M2** rest of the formula correct	2

Q# 42/ IGCSE Chemistry/2017/s/Paper 41/

5(c)	**M1** moles of carbon dioxide = 180 / 24 000 = 0.0075	1
	M2 molar mass of barium carbonate = 197	1
	M3 mass of barium carbonate = **M1** × **M2** = 1.48 (g)	1
5(f)	360 (cm^3)	1

Q# 43/ IGCSE Chemistry/2017/m/Paper 42/

7(c)(i)	**M1** 34.61/12 : 61.54/16 : 3.85/1 **OR** 2.885 : 3.846 : 3.85	1
	M2 2.885/2.885 : 3.846/2.885 : 3.85/2.885 **OR** 1 : 1.3(33) : 1.3(33) **OR** 3:4:4	1
	M3 $C_3O_4H_4$	1
7(c)(ii)	relative formula mass / relative molecular mass	1

Q# 44/ IGCSE Chemistry/2017/m/Paper 42/

2(b)(i)	2^-	1
2(b)(ii)	$2Ag^+ + Cr_2O_7^{2-} \rightarrow Ag_2Cr_2O_7$	1

Q# 45/ IGCSE Chemistry/2017/m/Paper 42/

Question	Answer	Marks
6(a)(i)	**M1** (relative formula mass $BaCO_3$ =) 197	1
	M2 (10.0/197 =) 0.0508 (0.0508 alone scores [2])	1
6(a)(ii)	1.22	1
6(b)	2.24	1
6(c)(i)	0.00219	1
6(c)(ii)	**M1** moles HCl = 2 × 0.00219 **OR** correct evaluation of this (= 0.00438)	1
	M2 (0.00438/0.01875) = 0.234 (0.234 alone scores [2])	1

Q# 46/ iGCSE Chemistry/2014/w/Paper 31/

7 (a) (i) $6Li + N_2 = 2Li_3N$
species (1) balancing (1)

Q# 47/ iGCSE Chemistry/2013/s/Paper 31/ Q6

(c) $2NH_3 + NaClO \rightarrow N_2H_4 + NaCl + H_2O$ [2]
not balanced only 1

Q# 48/ iGCSE Chemistry/2013/s/Paper 31/ Q3

(b) experiment 1 $Ca^{2+} + CO_2 + H_2O$ [1]

Q# 49/ iGCSE Chemistry/2014/s/Paper 31/ Q6

(d) number of moles of O_2 formed = 0.096 / 24 = 0.004 (1)
number of moles of H_2O_2 in 40 cm^3 of solution = 0.004 × 2 = 0.008 (1)

concentration of the hydrogen peroxide in mol / dm^3 = 0.008 / 0.04 = 0.2 (1) [3]

Q# 50/ iGCSE Chemistry/2013/w/Paper 31/ Q4

(d) number of moles of HCl in 40 cm^3 of hydrochloric acid,
concentration 2.0 mol / dm^3 = 0.04 × 2.0 = 0.08 [1]
maximum number of moles of CO_2 formed = 0.04 [1]
mass of one mole of CO_2 = 44 g [1]
maximum mass of CO_2 lost = 0.04 × 44 = 1.76 g [1]

Q# 51/ iGCSE Chemistry/2013/w/Paper 31/ Q6

(c) number of moles of CO_2 formed = 2.112 / 44 = 0.048 [1]
number of moles of H_2O formed = 0.432 / 18 = 0.024 [1]

$x = 2$ and $y = 1$ **NOT:** ecf from this line

formula is $2PbCO_3.Pb(OH)_2$ / $Pb(OH)_2.2PbCO_3$ [1]

Q# 52/ iGCSE Chemistry/2012/w/Paper 31/ Q7

(c) number of moles of HCl used = 0.05 × 2 = 0.1 [1]
number of moles of $SrCl_2.6H_2O$ which could be formed. = 0.05 [1]
mass of one mole of $SrCl_2.6H_2O$ is 267 g
theoretical yield of $SrCl_2.6H_2O$ = 0.05 × 267 = 13.35 g [1]
percentage yield = 6.4 / 13.35 × 100 = 47.9% [1]
accept: 48%
allow: ecf

Q# 53/ iGCSE Chemistry/2012/w/Paper 31/ Q2

(c) BrF_3 / F_3Br; [1]
BrF_5 / F_5Br; [1]

Q# 54/ iGCSE Chemistry/2012/s/Paper 31/

(b) moles of Fe = 51.85/56 = 0.926 (0.93); [1]
moles of O = 22.22/16 = 1.389 (1.39); [1]
moles of H_2O = 16.67/18 = 0.926 (0.93); [1]

if given as 0.9 1.4 0.9
three of the above correct = [2]
two of the above correct = [1]

simplest whole number mole ratio Fe : O : H_2O is 2: 3: 2 / $Fe_2O_3.2H_2O$; [1]
allow: ecf for a formula based on an incorrect whole number ratio

Q# 55/ iGCSE Chemistry/2012/s/Paper 31/

6 (a) 10 cm^3; [1]
65 cm^3; [1]

Q# 56/ iGCSE Chemistry/2011/w/Paper 31/ Q7

(c) calculation:
M_r for $NaHCO_3$ = 84 g; M_r for Na_2O = 62 g; M_r for NaOH = 40 g
M_r for Na_2CO_3 = 106 g

(i) number of moles of $NaHCO_3$ used = 3.36/84 = 0.04 [1]

(ii) if residue is Na_2O, number of moles of Na_2O = 2.12/62
=0.034 / 0.03

if residue is NaOH, number of moles of NaOH = 2.12/40
= 0.053 / 0.05

if reside is Na_2CO_3, number of moles of Na_2CO_3 = 2.12/106 =0.02 all three correct [2]
note: two correct = 1

(iii) equation 3 [1]
mole ratio 2:1 agrees with equation [1]

Q# 57/ iGCSE Chemistry/2011/s/Paper 31/ Q5 (d)

(iii) 1.33 / 1.3 / 1.3333 (mol/dm^3) scores both marks [2]
not 1.34
for a correct method – $M_1 V_1$ / moles of NaOH = 0.02
with an incorrect answer **only** [1]

Q# 58/ IGCSE Chemistry/2017/w/Paper 43/

4(b)(i)	oxidation	1
4(c)	$2H_2 + O_2 \rightarrow 2H_2O$	1
4(f)	electrolysis	1

Q# 59/ IGCSE Chemistry/2017/w/Paper 42/

4(a)	the breakdown (into elements)	1
	of an (ionic) compound by (the passage of) electricity	1
4(b)(i)	oxygen	1
4(b)(ii)	glowing splint	1
	relights	1
4(b)(iii)	$2H^+ + 2e^- \rightarrow H_2$ **M1** gain of electrons by H^+ **M2** rest of equation	2
4(c)	*the wires:* electrons	1
	the electrolyte: ions	1
4(d)	any 2 from: • green gas at positive electrode • bulb is brighter • rate of bubbles increases	2

Q# 60/ IGCSE Chemistry/2017/s/Paper 43/

Question	Answer	Marks
5(a)(i)	loss (of electrons)	1
5(a)(ii)	$Ni \rightarrow Ni^{2+} + 2e^-$	1
5(a)(iii)	goes down / gets less / decreases / lower / smaller	1

Q# 61/ iGCSE Chemistry/2014/w/Paper 31/ Q4 (d)

(ii) R to L in wire [1]

(iii) $2H^+ + 2e^- \rightarrow H_2$
species (1) balancing (1) [2]

Q# 62/ iGCSE Chemistry/2012/s/Paper 31/

8 **(a) (i)** device which changes chemical energy; [1]
into electrical energy; [1]
OR
produces a voltage / potential difference / electricity; [1]
due to difference in reactivity of two metals; [1]
OR
produces a voltage / potential difference / electricity; [1]
by redox reactions; [1]

(ii) negative / electrode B / right electrode; [1]
accept: anode because it is the electrode which supplies electrons to external circuit
loses ions / iron ions / Fe^{2+} or Fe^{3+}; [1]
electrons move from this electrode; [1]

(iii) change of mass of electrode / mass of rust formed; [1]
time / mention of stop watch / regular intervals; [1]

(iv) to make it a better conductor; [1]

Q# 63/ iGCSE Chemistry/2011/s/Paper 31/ Q2 (a)

(ii) cell [1]
accept battery
not generator

Q# 64/ IGCSE Chemistry/2017/w/Paper 42/

3(a)	*exothermic mark*: horizontal line representing the energy of the products below the energy of the reactants	1
	label of products mark: product line labelled with $2CO_2 + 3H_2O$	1
	correct direction of vertical heat of reaction arrow: arrow starts level with reactant energy and finishes level with product energy **AND** has (only) **one** arrow head	1
3(b)	activation energy / E_a	1

3(c)	–650 kJ / mol **M1** bonds broken 2 □ ((3 □ 410) + 360 + 460) + (3 □ 500) 2 □ (1230 + 360 + 460) + 1500 2 □ 2050 + 1500 4100 + 1500 = 5600 **M2** bonds formed (2 □ (2 □ 805)) + (4 □ (2 □ 460)) 2 □ 1610 + 4 □ 920 3220 + 3680 = 6900 **M3 = M1 – M2** energy change of reaction = 5600 – 6900 = –1300 **M4 = M3 / 2**	4

Q# 65/ IGCSE Chemistry/2017/s/Paper 43/

2(b)(i)	approximately horizontal line draw to right of and below the reagent line	1
	energy change shown starting level with the reactant energy **AND** finishing level with the product energy **AND** having only one (correct) arrow head **AND** labelled ΔH / energy change	1
2(b)(ii)	(energy required to break bonds =) 3624	1
	(energy given out when bonds made =) 3738	1
	–114 (kJ / mol)	1

Q# 66/ IGCSE Chemistry/2017/m/Paper 42/

Question	Answer	Marks
4(a)(i)	arrow labelled **A** on or near wire going in an anti-clockwise direction	1
4(a)(ii)	arrow labelled **B** in electrolyte pointing towards the cathode	1
4(c)	**M1** anode mass decreases	1
	M2 copper lost as ions **OR** copper (atoms) becomes ions **OR** $Cu \rightarrow Cu^{2+} + 2e^-$	1
	M3 cathode mass increases	1
	M4 copper deposited / layer of copper forms / copper collected at cathode **OR** $Cu^{2+} + 2e^- \rightarrow Cu$	1

Q# 67/ iGCSE Chemistry/2013/w/Paper 31/ Q7

(b) exothermic reaction gives out energy [1]
endothermic reaction absorbs
takes in energy [1]

(c)

bonds broken	energy
C-H	+412
Cl-Cl	+242
total energy	+654

[1]

bonds formed	energy
C-Cl	–338
H-Cl	–431
total energy	–769

[1]
energy change –115 [1]
negative sign indicates exothermic [1]

Q# 68/ iGCSE Chemistry/2011/s/Paper 31/ Q5

(d) (i) the reaction is exothermic / reaction produces heat/energy [1]
all the sodium hydroxide used up/neutralised / reaction has stopped [1]

(ii) adding colder acid / no more heat produced [1]
if not given in **(d)(i)** any comments such as "reaction has stopped" can gain mark

Q# 69/ IGCSE Chemistry/2017/w/Paper 43/

5(b)(i)	reversible reaction in which the rate of the forward reaction **equals** the rate of the backward reaction	1
	concentration of all reactants and products becomes constant / does not change	1
5(b)(ii)	forward reaction is endothermic	1
	(increased temperature) causes equilibrium to shift to the right / to shift in the endothermic direction / to form more nitrogen dioxide / to form more product(s)	1
5(b)(iii)	less brown / lighter / paler / colour fades	1
	more molecules / moles / volume on the right ORA OR equilibrium shifts in the direction of fewer molecules / moles / lower volume	1

Q# 70/ IGCSE Chemistry/2017/w/Paper 42/

5(a)	both colours referred to correctly as observations in both parts of the answer	1
	(if sulfuric acid is added to solution Y,) equilibrium moves to the right-hand side	1
	because the concentration of acid has increased	1
	(if sodium hydroxide is added to solution Y,) equilibrium moves to the left-hand side	1
	because sodium hydroxide reacts with / neutralises sulfuric acid	1
5(b)(ii)	fewer moles / molecules / particles (of gas) on the left-hand side	1
5(b)(iii)	endothermic	1
5(b)(iv)	increases rate (of reaction)	1

Q# 71/ IGCSE Chemistry/2017/w/Paper 41/Q5

5(c)(i)	becomes paler	1
	equilibrium moves right	1
	(because) fewer moles (of gas) on right	1
5(c)(ii)	equilibrium moved right / more N_2O_4 / less NO_2	1
	(forward) reaction exothermic	1

Q# 72/ IGCSE Chemistry/2017/w/Paper 41/

3(a)(i)	brown / orange solid (forms / is made) OR solution becomes paler / colourless	1
3(a)(ii)	magnesium is oxidised **AND** copper ions are reduced OR magnesium loses electrons **AND** copper ions gain electrons OR magnesium increases in oxidation number **AND** copper decreases in oxidation number	1
3(a)(iii)	Cu^{2+} OR copper(II) ions OR copper ions	1
	gains electrons	1

Q# 73/ IGCSE Chemistry/2017/w/Paper 41/

7(a)(i)	more particles (of acid) in a given volume / dm^3 / cm^3	1
	more collisions per second / unit time OR greater collision rate	1
7(a)(ii)	particles have more energy / particles move faster / more collisions per second / more collisions per unit time / greater collision rate	1
	more (of the) particles / collisions have energy greater than the activation energy / more particles have sufficient energy to react / more collisions have sufficient energy to react / a greater percentage of collisions are successful	1

Q# 74/ IGCSE Chemistry/2017/s/Paper 41/

5(a)	(stop-) watch **AND** syringe	1
5(b)	graph starts at **X** and is a curve with a decreasing gradient	1
	graph hits zero rate at 114±6 seconds	1
5(c)	**M1** moles of carbon dioxide = 180 / 24 000 = 0.0075	1
	M2 molar mass of barium carbonate = 197	1
	M3 mass of barium carbonate = **M1** × **M2** = 1.48 (g)	1
5(d)	curve starts from (0,0) and has a lower gradient than the original curve	1
	because lumps have a lower surface area	1

5(d)	curve starts from (0,0) and has a lower gradient than the original curve	1
	because lumps have a lower surface area	1

Q# 75/ IGCSE Chemistry/2017/m/Paper 42/

4(b)(i)	electrons are lost	1
4(b)(ii)	**M1** Cu^{2+} ions on left	1
	M2 rest of equation correct and correctly balanced ($Cu^{2+} + 2e^- \rightarrow Cu$ scores [2])	1

Q# 76/ IGCSE Chemistry/2017/m/Paper 42/

3(a)	any 2 from: • forward and backward reactions occur at equal rates • amounts / moles / concentrations (of substances) remain constant • closed system	2
3(b)	**M1** (particles) have more energy **OR** (particles) move faster	1
	M2 more collisions per second **OR** greater collision rate	1
	M3 more (of the) particles / collisions have energy greater than the activation energy **OR** more particles / collisions have sufficient energy to react **OR** a greater percentage / proportion / fraction of collisions are successful	1
3(c)	**M1** equilibrium moves left / yield decreases	1
	M2 because the forward reaction is exothermic **OR** because the reverse reaction is endothermic	1
3(d)	**M1** no change	1
	M2 numbers of moles of gas on each side is the same	1

Q# 77/ iGCSE Chemistry/2014/s/Paper 31/

6 (a) (i) rate at t_2 less than at t_1 **or** the rate decreases (1)

rate at t_3 zero / reaction stopped (1) [2]

(ii) rate at t_2 less than at t_1 because **concentration** of hydrogen peroxide is less at t_2 **or concentration** of hydrogen peroxide is decreasing. (1)

(rate at t_3 zero / reaction stopped because) hydrogen peroxide is used up (1) [2]

(b) (i) steeper and must come from the origin (1)
final volumes the same (1) [2]

(ii) Any **two** from: [2]
steeper curve because of a faster rate
faster rate because of increased surface area
same amount / volume / mass / no of mol of hydrogen peroxide
ecf for M1 for a shallower curve because of slower rate.

(c) filter (and rinse / wash) (1)

dry manganese (IV) oxide (1)

weigh / measure mass manganese(IV) oxide after reaction (1)

the mass should be 0.1 g **or** unchanged. (1) [4]

Q# 78/ iGCSE Chemistry/2013/w/Paper 31/

4 (a) (i) (mass at t =0) – (mass at t = 5) [1]
NOTE: must have mass at t = 5 not final mass

(ii) fastest at origin
slowing down between origin and flat section gradient = 0
where gradrient = 0
three of above in approximately the correct positions [2]

(iii) 3 correct comments about gradient = [2]
2 correct comments about gradient = [1]
1 correct comment about gradient = [0] [2]

(b) start at origin and smaller gradient [1]
same final mass just approximate rather than exact [1]

(c) (i) smaller surface area [1]
lower collision rate [1]

(ii) molecules have more energy [1]
collide more frequently / more molecules have enough energy to react [1]

Q# 79/ iGCSE Chemistry/2013/s/Paper 31/

3 (a) (i) pieces have (same) surface area [1]
same amount / mass / quantity / volume / number of moles of carbonate [1]

(ii) no more bubbles / carbon dioxide **or** piece disappears / dissolves [1]

(b) experiment 1 $Ca^{2+} + CO_2 + H_2O$ [1]

(c) (i) more concentrated **or** higher concentration (of acid) (in experiment 1) [1]
accept: arguments based on collision theory

(iii) lower temperature (particles) have less energy [1]
moving more slowly [1]
fewer collisions / lower collision rate [1]
or
lower temperature (particles) have less energy [1]
fewer particles collide [1]
with the necessary energy to react [1]
note: less energy fewer successful collisions gains all 3 marks

Q# 80/ iGCSE Chemistry/2012/w/Paper 31/

5 (a) (i) rate of reaction; [1]
influenced by light / only happens in light; [1]
or:
turns light into chemical energy = [2]
accept: light is catalyst = [1]

(ii) reduction of silver halides; [1]
they are reduced to silver / $2AgCl \rightarrow 2Ag + Cl_2$; [1]
appropriate importance given; [1]
or:
photosynthesis;
correct comment about chemistry carbon dioxide to carbohydrates / carbon dioxide to oxygen;
anything sensible e.g. its role in the food chain or decrease greenhouse effect or oxygen for respiration;
or:
chlorination;
making chloroalkanes;
appropriate importance given;

Q# 81/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(iii) keeps rate high / increase rate at lower temperatures; [1]

Q# 82/ iGCSE Chemistry/2012/w/Paper 31/

3 (a) (i) any three from:
particles have more energy;
move faster;
collide more frequently;
more successful collisions; [3]
accept: atoms or molecules for particles
not: electrons
not: vibrate more

(ii) reaction faster with temperature increase; [1]
enzymes denatured / destroyed;
not: killed [1]

(b) (i) bigger initial gradient; [1]
same final volume of nitrogen; [1]

(ii) decrease / slows down; [1]

(iii) concentration of organic compound decreases; [2]
compound used up = [1]
or: fewer particles;
collision rate decreases;

Q# 83/ iGCSE Chemistry/2011/w/Paper 31/

5 (a) (i) rate of reaction decreases / gradient decreases [1]
because concentration of bromine decreases [1]
reaction stops because all bromine is used up [1]

(ii) initial rate greater / gradient greater [1]
because bigger surface area / more particles of iron exposed [1]
or:
final mass the same [1]
because mass of bromine is the same so the same mass of iron is used [1]

(iii) increase / decrease / change rate of stirring / not stirred [1]
measure new rate / compare results [1]

Q# 84/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(b) (i) pressure would move position of equilibrium to right / increase yield of $COCl_2$; [1]
increase pressure favours side with less (gas) molecules / smaller volume; [1]

(ii) increase temperature favours endothermic reaction; [1]
so less products / reduce yield; [1]

Q# 85/ iGCSE Chemistry/2012/s/Paper 31/Q4

(c) catalyst would not affect yield / change position of equilibrium / affects both sides equally; [1]
(higher) temperature would reduce yield / increase in temperature would favour back reaction; [1]

Q# 86/ iGCSE Chemistry/2011/w/Paper 31/

4 (a) rate of forward reaction equals rate of back reaction [1]
concentrations do not change / macroscopic properties remain constant (with time) [1]
accept: amounts

(b) (i) increase [1]
reaction 2 [1]
Vr > Vp [1]

(ii) same [1]
reaction 1 [1]
Vr = Vp [1]

(iii) decrease [1]
reaction 3 [1]
Vp > Vr [1]
accept: moles of gas / molecules of gas as an alternative to volume

Q# 87/ iGCSE Chemistry/2012/s/Paper 31/Q4

(d) (i) V^{3+} is oxidant; [1]

(ii) V^{3+} to V^{4+}; [1]
increase in oxidation number / electron loss; [1]

Q# 88/ iGCSE Chemistry/2011/w/Paper 31/ Q5

(b) (i) Fe to Fe^{2+} [1]
because oxidation is electron loss / increase in oxidation number [1]

(ii) Fe [1]

Q# 89/ IGCSE Chemistry/2017/s/Paper 43/

1(a)(v)	**L**	**1**
1(a)(vi)	**D**	**1**

Q# 90/ IGCSE Chemistry/2017/s/Paper 42/

4(a)	any 3 from: • catalyst • more than one / variable oxidation state / oxidation number / valency • form coloured **compounds** / coloured **ions** • forms complex ions / complexes	3

Q# 91/ IGCSE Chemistry/2017/s/Paper 42/

5(a)(i) — 3

	aqueous potassium chloride	aqueous potassium bromide	aqueous potassium iodide
chlorine			✓
bromine	×		✓
iodine	×	×	

5 cells completed correctly = [3]
3 or 4 cells completed correctly = [2]
2 cells completed correctly = [1]

5(c)(i)	solid	1
5(c)(ii)	$2Na + At_2 \rightarrow 2NaAt$ **M1** formula of NaAt **M2** equation fully correct	2

Q# 92/ IGCSE Chemistry/2017/s/Paper 41/

2(a)(iii)	Cr_2O_3	1

Q# 93/ iGCSE Chemistry/2014/s/Paper 31/

4 (a) (i)

Group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons	1	2	3	4	5	6	7
valency	1	2	3	4	3	2	1

(1) for each line [2]

(ii) number of valency electrons = the group number (1) [1]

(iii) for Na to Al
the valency is the same as the number of valency (outer) electrons (1)

(because) this is the number of electrons **lost** (for full energy level) (1)

for P to Cl
the valency is 8 – [number of valency (outer) electrons]
or valency + valency electrons = 8 (1)

(because) this is number of electrons **needed** (or to be **gained**) (for full energy level) (1)

(b)

(ii) ionic (metal) chlorides on the left (1)
covalent (non-metal) chlorides on the right (1) [2]

Q# 94/ iGCSE Chemistry/2013/w/Paper 31/

1 (a) uranium / plutonium / thorium [1]

(b) graphite / carbon [1]

(c) platinum / titanium / mercury / gold [1]
NOT: carbon / graphite

(d) helium [1]

(e) nitrogen / phosphorus [1]

(f) argon [1]
ACCEPT: any ion 2 + 8 + 8 e.g. K^+ etc.

(g) tellurium [1]
ACCEPT: correct symbol

Q# 95/ iGCSE Chemistry/2013/s/Paper 31/

2 (a) 3 or III [1]

(b) good conductor and it is a metal/has delocalised (free) electrons [1]

(c) N **or** P **or** As **or** Sb [1]
accept Bi

(d) $M_2(SO_4)_3$ [1]
accept: $Ga_2(SO_4)_3$

(e) it would react with/dissolves in a named strong acid [1]
it would react with/dissolves in a named alkali [1]
it shows both basic and acid properties =1 [1]
it reacts with both acids and bases/alkalis =1 [1]
[max 2]

[Total: 6]

Q# 96/ iGCSE Chemistry/2012/w/Paper 31/

2 (a) (i) become darker; [1]

(ii) increase; [1]

(iii) black / dark grey; [1]
not: brown
solid; [1]

Q# 97/ iGCSE Chemistry/2012/s/Paper 31/

3 (a) (i) decrease down group; [1]

(ii) caesium / francium; [1]

(iii) $2Rb + 2H_2O \rightarrow 2RbOH + H_2$ [2]
not balanced = [1]

Q# 98/ iGCSE Chemistry/2012/s/Paper 31/

(b) hard;
strong / high tensile strength;
high mp / bp / high fixed points;
high density; [2]

three properties = [2]
two properties = [1]
not: properties of all metals e.g. good conductor, lustre etc. or form coloured compounds

Q# 99/ iGCSE Chemistry/2011/s/Paper 31/ Q5

(c) with hydriodic acid – iodine formed / goes dark brown / grey/black solid [1]

not purple vapour **not** purple/black solution

with hydrobromic acid – bromine formed / goes orange / yellow / brown / reddish brown / red / brown vapour [1]

note can accept brown for iodine provided bromine is different orange/brown etc.

Q# 100/ IGCSE Chemistry/2017/s/Paper 42/

Question	Answer	Marks
3(a)(i)	450 °C	1
	200 atmospheres	1
3(a)(ii)	iron	1
3(b)(i)	4(NO)	1
	5(O_2) **AND** 6(H_2O)	1
3(b)(ii)	lower yield of NO / lower yield of nitric acid / lower yield of product / equilibrium shifts to left (at higher temperatures) / backward reaction favoured(at higher temperatures) ORA	1
3(b)(iii)	too slow / rate decreases ORA	1

Q# 101/ iGCSE Chemistry/2013/w/Paper 31/

3 (a) (i) fractional distillation [1]
(liquid) air [1]

(ii) cracking / heat in presence of catalyst [1]
of alkane / petroleum [1]
to give an alkene and hydrogen [1]

OR: electrolysis (1)
named electrolyte (1)
hydrogen at cathode (1)

OR: from methane (1)
react water / steam (1)
heat catalyst (1)
only **ACCEPT:** water with methane **or** electrolysis

(b) (i) the pair with both graphs correct is C [1]
NOTE: mark **(b)(ii)** independent of **(b)(i)**

(ii) high pressure favours side with lower volume / fewer moles [1]
this is RHS / product / ammonia [1]
%NH_3 / yield increases as pressure increases [1]

the forward reaction is exothermic [1]
exothermic reactions favoured by low temperatures [1]
%NH_3 / yield decreases as temperature increases [1]
ACCEPT: reverse arguments

(iii) increases reaction rate [1]
ACCEPT: reduces activation energy [1]
OR: decreases the amount of energy particles need to react
OR: economic rate at lower temperature so higher yield

[Total: 14]

Q# 102/ iGCSE Chemistry/2013/s/Paper 31/ Q6

(b) any five from:

- high pressure favours lower volume side / movement to right / ammonia side, **or** high pressure increases the yield
- high pressure increases rate
- low temperature favours exothermic reaction / increases yield / favours the forward reaction
- low temperature gives low rate or vice versa
- catalyst increases rate or lowers activation energy
- 450 °C low enough to give an economic yield but with catalyst gives a fast enough rate
  note need whole concept to get this compromise temperature point [5]

Q# 103/ iGCSE Chemistry/2010/w/Paper 31/ Q4

(b) **(i)** expensive metal / iron cheaper / better catalyst [1]

(ii) high pressure favours side with smaller volume / fewer moles [1]
this is right hand side / product / ammonia side [1]

(iii) recycled / sent over catalyst again [1]
accept used again

(iv) advantage high yield [1]
disadvantage slow reaction rate etc [1]

Q# 104/ iGCSE Chemistry/2009/s/Paper 31/

6 **(a)** **(i)** air (liquid) [1]
petroleum **or** crude oil **or** alkanes **or** methane **or** water **or** steam **or** steam reforming **or** suitable aqueous solution e.g. brine or sea water [1]
NOTE: cannot crack methane

(ii) iron [1]

(iii) (as a) fertiliser **or** to make fertilisers **or** to make nitric acid [1]

(b) **(i)** concentrations/macroscopic properties do not change [1]
accept amounts stay the same
NOT no change

rate of forward and back reactions equal [1]

(ii) it decreases with increase temperature [1]
or it increases with decrease temperature

(c) **(i)** shows an increase either a line **or** curve [1]
(any decrease = 0)

(ii) increase pressure favours the side with lower volume or molecules or moles [1]
that is RHS **or** products side [1]
ignore any mention of rates

Q# 105/ iGCSE Chemistry/2008/w/Paper 31/ Q5

(ii) ammonia **or** methanol **or** hydrogen chloride **or** margarine [1]
NOT nylon

Q# 106/ iGCSE Chemistry/2008/s/Paper 31/

8 (a) burning wood produces carbon dioxide [1]
less photosynthesis **or** trees take up carbon dioxide [1]

Q# 107/ iGCSE Chemistry/2007/w/Paper 3/ Q6

(c) (i) cracking
heat (alkane) **or** (alkane) and catalyst
NOTE thermal cracking or catalytic cracking [2]
alkane = alkene + hydrogen
ANY TWO [2]

OR steam reforming
$CH_4 + H_2O = CO + 3H_2$ [2]
or water/steam [1]
catalyst **or** heat [1]

Q# 108/ iGCSE Chemistry/2006/w/Paper 3/

5 (a) (i) iron [1]

(ii) advantage higher yield [1]
explanation lower temperature favours the exothermic reaction
(that is the forward reaction) [1]

(b) (i) Sent over the catalyst again **or** used to make more ammonia [1]
NOT just reused

(ii) It has the highest boiling point [1]

(c) (i) $CO_2 + 2NH_3 = CO(NH_2)_2 + H_2O$ [2]
Not balanced [1]

(ii) Any comment based on deficiency of PK/or ONLY provides Nitrogen as a nutrient [1]
NOT soil pH

Q# 109/ iGCSE Chemistry/2005/w/Paper 3/

Question 7

(a) from methane **[1]**
and water **[1]**

OR electrolysis **[1]**
suitable electrolyte **[1]**

OR alkane **[1]**
cracking **[1]** **[2]**

(b)(i) iron **[1]**

(ii) lower temperature moves equilibrium to right **[1]**
because forward reaction is exothermic **[1]**

Q# 110/ iGCSE Chemistry/2004/s/Paper 3/ Q2

(b) (i) potassium [1]

(ii) ammonium sulphate [1]

Q# 111/ iGCSE Chemistry/2003/w/Paper 3/

1 (a) (i) different boiling points [1]

(ii) methane **or** water **or** petroleum **or** named petroleum fraction **or** alkane
Any TWO [2]

(b) (i) volume decrease for forward reaction **or** fewer moles of gas on products side [1]
favoured by increase in pressure [1]
or increase in pressure moves position of equilibrium to right

(ii) increase [1]
exothermic reaction favoured by lower temperature [1]

(iii) 300 to 600 ^{0}C
1:3 volume ratio
iron (catalyst)
150 to 300 atm
Any TWO [2]

Q# 112/ iGCSE Chemistry/2014/w/Paper 31/

3 **(a)** Any **two** from:
bleach/making wood pulp/making paper
food/fruit juice/wine preservative
fumigant/sterilising/insecticide [2]

(b) heating/roasting/burning (zinc sulfides) [1]
in air/oxygen COND on M1 [1]

(c) **(i)** V_2O_5 [1]

(ii) position of equilibrium shifts right/yield increases [1]
to save energy [1]

(iii) faster reaction/rate [1]

more collisions per second/higher collision frequency [1]

fewer moles/molecules (of gas) on right [1]

(so) position of equilibrium shifts right/yield increases [1]

(d) (the reaction is) too violent/too exothermic **or** produces mist/fumes (of acid) [1]

Q# 113/ iGCSE Chemistry/2013/w/Paper 31/ Q6

(b) **(i)** anhydrous cobalt chloride becomes hydrated [1]
ACCEPT: hydrous

(ii) carbon dioxide is acidic [1]
sodium hydroxide and calcium oxide are bases / alkalis [1]

(iii) Any two of:
water, calcium carbonate and sodium carbonate [2]
ACCEPT: sodium bicarbonate

Q# 114/ iGCSE Chemistry/2011/s/Paper 31/ Q4

(b) for a high yield need low temperature [1]
then rate would be too slow or uneconomic [1]
a discussion of optimum temperature could score mark 1 and 2

presence of catalyst would increase rate (at same temperature) [1]
does not alter the yield (at that temperature) [1]
/ economic rate at lower temperature, therefore higher yield

higher pressure which would increase yield / rate [1]
yield high enough / high pressure expensive [1]
max [4]

accept reverse arguments
note increase yield ≡ position of equilibrium to right

Q# 115/ iGCSE Chemistry/2009/w/Paper 3/ Q6

(ii) change from purple **or** pink [1]
to colourless **NOT** clear [1]

(iii) reacts with oxygen in air [1]

Q# 116/ iGCSE Chemistry/2009/w/Paper 3/

6 (a) (i) burn sulfur in air **or** oxygen [1]
or heat a metal sulfide in air

(ii) bleach for wood pulp/cloth/straw **or** preserve food **or** sterilising
or making wine **or** fumigant **or** refrigerant [1]
Accept making paper

(iii) vanadium(V) oxide **accept** vanadium oxide **or** V_2O_5
or vanadium pentoxide [1]
oxidation state not essential but if given it has to be (V)

(iv) rate too slow **or** rate not economic [1]

(v) reaction too violent **or** forms a mist [1]

Q# 117/ iGCSE Chemistry/2008/s/Paper 31/ QiGCSE Chemistry/201

(g) vanadium [1]

ACCEPT name or symbol

Q# 118/ iGCSE Chemistry/2007/w/Paper 3/

4 (a) (i) bleach for wood pulp **or** preserving food **or** sterilising
or in wine making **or** as a refrigerant **or** in metallurgy **or**
(liquid) sulphur dioxide is used in the petroleum industry
or kill microbes(etc) **or** insecticide [1]

(ii) (react with) oxygen **or** air [1]
NOT burnt/burn in air/oxygen
450°C [1]
vanadium oxide catalyst (if oxidation state given has to be correct) **or** platinum [1]
If four conditions are given which include high pressure then **MAX** [2]
High pressure is incorrect **MAX** 10 atm.

(iii) ammonium sulphate **or** superphosphate [1]
or potassium sulphate **or** magnesium sulphate

Q# 119/ iGCSE Chemistry/2006/s/Paper 3/Q5 (b)

(iii) Low enough for good yield [1]
High enough for (economic) rate [1]
Any similar explanation will be awarded the mark
NOT just that it is the optimum temperature

(iv) bubble into (conc) sulphuric acid [1]
add water [1]
NOT consequential

Q# 120/ iGCSE Chemistry/2006/s/Paper 3/

5 (a) (i) Burn sulphur in air (or oxygen) [1]

(ii) as a bleach [1]

(iii) kill bacteria/micro-organisms [1]
NOT prevents food going bad or rotten or decaying

(b) (i) decrease [1]

(ii) exothermic [1]
COND increase temperature favours back reaction so it is endothermic, so forward reaction must be exothermic [1]
OR any similar explanation will be awarded the mark, for example
The forward reaction is not favoured by an increase in temperature so it is exothermic (rather than endothermic)

(iii) Low enough for good yield [1]
High enough for (economic) rate [1]
Any similar explanation will be awarded the mark
NOT just that it is the optimum temperature

Q# 121/ iGCSE Chemistry/2005/s/Paper 3/

(c) (i) vanadium oxide **or** vanadium(V) oxide **or** vanadium pentoxide or V_2O_5
Must be correct oxidation state if one given [1]

(ii) 400 to 500° C [1]

(iii) add to (concentrated) sulphuric acid **NOT** dilute [1]
COND (upon sulphuric acid) above then add water [1]

Q# 122/ iGCSE Chemistry/2005/s/Paper 3/

4 (a) (i) correct word equation (carbon dioxide and water) [1]
Accept correct symbol equation

(ii) Must have a correct reagent otherwise wc = 0
add (acidified) barium chloride(aq) **or** nitrate **or** add barium ions [1]
COND white precipitate [1]
NOT lead(II) compounds

(iii) low pH **or** universal indicator turns red(aq) [1]
pH 3 **or** less

(b) (i) $H_2S + 2O_2 = H_2SO_4$ **[2]**
unbalanced [1]

(ii) unpleasant smell **or** it is poisonous **or** when burnt forms acid rain **or** forms sulphur dioxide **or** forms sulphuric acid **[1]**
NOT it is a pollutant

(iii) 2H to 1S
COND 8e around sulphur atom
2e per hydrogen atom
THREE correct **[2]**
TWO from above [1]
Ionic structure = [0]

Q# 123/ iGCSE Chemistry/2004/s/Paper 3/

2. (a) (i) USA **or** Texas **or** Poland **or** Mexico **or** Japan **or** Ethiopia
Australia **or** Sicily **[1]**
accept other sources of sulphur eg petroleum
or natural gas **or** metal sulphides **or** volcanoes
NOT coal, **NOT** underground

(ii) Preserving food **or** bleaching **or** sterilising **or** disinfecting **or** making paper **or** bleaching wood pulp
or wine **or** jam **or** fumigation **or** making paper **[1]**
NOT making wood pulp

(iii) burnt/roast in oxygen **or** air **[1]**

(iv) vanadium(V) oxide **or** vanadium oxide **or** platinum **[1]**
ignore oxidation state of vanadium

(v) Increase temperature (increases rate) but reduces yield **[1]**
catalyst only increases rate **or** a catalyst does not influence position of equilibrium **[1]**
NOT a definition of a catalyst

(vi) sulphur trioxide + sulphuric acid = oleum **[1]**
correct symbol equation acceptable

(vii) $H_2S_2O_7 + H_2O = 2H_2SO_4$ **[1]**

Q# 124/ iGCSE Chemistry/2003/w/Paper 3/

5 (a) (i) preserve food **or** sterilising [1]
(ii) making paper [1]

(b) (i) making sulphuric acid **or** Contact Process [1]
(ii) oxygen [1]
(iii) vanadium oxide as catalyst (ignore oxidation state)
400 to 500 °C
pressure less than 10 atm
Any TWO [2]

Q# 125/ iGCSE Chemistry/2002/w/Paper 3/

1 (a) (i) vanadium(V) oxide as catalyst - ignore oxidation state
and accept no oxidation state
temperature 300 to 600 ^{0}C
pressure up to 10 atmos, accept atmospheric pressure
volume ratio of gases either 2:1 **or** slight excess of oxygen
ANY three [3]

(ii) decrease [1]
COND back reaction is endothermic or same argument based on forward reaction is exothermic [1]
or increase in temp favours back reaction

(iii) dissolve in (conc) sulphuric acid **NOT** dilute [1]
add water **or** dilute [1]

Q# 126/ iGCSE Chemistry/2001/w/Paper 3/Q4

5 (a) (i) bleach [1]

(ii) kills bacteria or germs or micro organisms [1]

iGCSE Chemistry Paper 2 Multiple Choice 231marks

Topics 1 and 2 have been merged into Topic 1

Topic Chem 1 **Q# 1/** iGCSE Chemistry/2017/w/Paper 23/

1 Which statement describes sublimation?

A Particles moving slowly past each other speed up and move further apart.

B Particles vibrating next to each other become mobile and move slowly past each other.

C Particles vibrating next to each other start to move rapidly and move further apart.

D Rapidly moving particles slow down and move closer together.

2 25 cm^3 of an alkali are added to 20 cm^3 of an acid. The temperature change is measured.

Which apparatus is **not** needed in the experiment?

A 25 cm^3 measuring cylinder

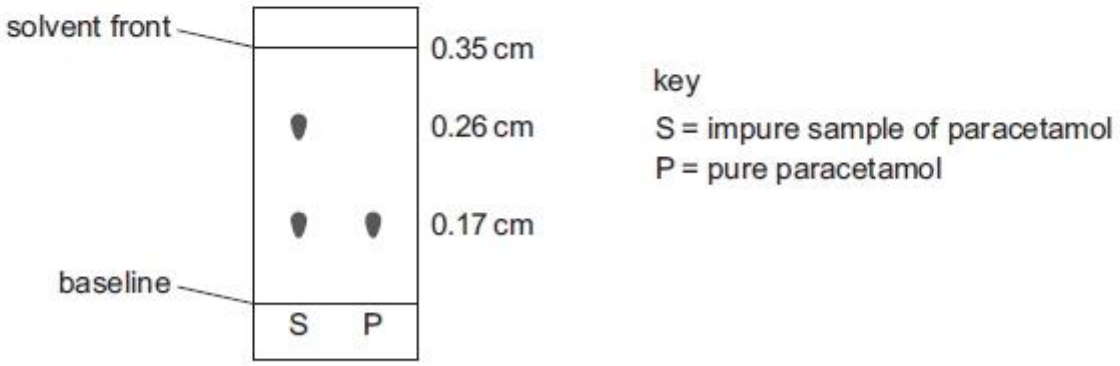
B 100 cm^3 beaker

C balance

D thermometer

3 The painkiller paracetamol is synthesised from 4-aminophenol.

Chromatography was carried out on an impure sample of paracetamol. The results are shown (not drawn to scale).

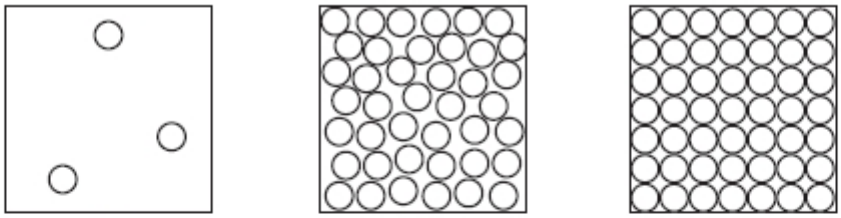


The sample of paracetamol was contaminated with 4-aminophenol only.

What is the R_f value of 4-aminophenol?

A 0.49 **B** 0.65 **C** 0.74 **D** 1.35

1 The diagram shows the arrangement of particles in the three states of matter.



P Q R

Solid carbon dioxide (dry ice) sublimes to gaseous carbon dioxide.

Which row describes the initial and final states?

	initial state	final state
A	P	R
B	Q	P
C	R	P
D	R	Q

2 During an experiment a measurement is recorded in cm^3.

Which apparatus is used?

A balance

B measuring cylinder

C stopclock

D thermometer

3 A student carried out paper chromatography on a mixture of amino acids.

The student sprayed the dried chromatogram with a locating agent.

What is the function of the locating agent?

A to dissolve the amino acids

B to form coloured spots with the amino acids

C to preserve the amino acids

D to stop the amino acids reacting

1 Which process causes the greatest increase in the distance between particles?

A condensation

B freezing

C melting

D sublimation

2 A student put 25.0 cm^3 of dilute hydrochloric acid into a conical flask.

The student added 2.5 g of solid sodium carbonate and measured the change in temperature of the mixture.

Which apparatus does the student need to use to obtain the most accurate results?

A balance, measuring cylinder, thermometer

B balance, pipette, stopwatch

C balance, pipette, thermometer

D burette, pipette, thermometer

3 The results obtained from a chromatogram are shown.

	distance travelled / cm
solvent	5.0
substance X	3.0
substance Y	2.5

Which row gives the R_f values of substance X and substance Y?

	R_f (X)	R_f (Y)
A	0.5	0.6
B	0.6	0.5
C	1.6	2.0
D	2.0	1.6

Topic Chem 1 **Q# 4/** iGCSE Chemistry/2017/s/Paper 23/

2 A compound, X, has a melting point of 71 °C and a boiling point of 375 °C.

Which statement about X is correct?

A It is a liquid at 52 °C and a gas at 175 °C.

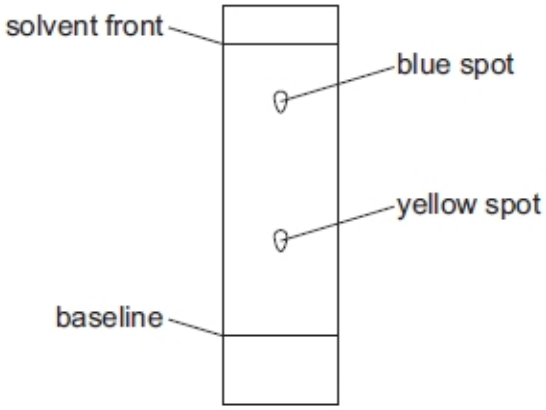
B It is a liquid at 69 °C and a gas at 380 °C.

C It is a liquid at 75 °C and a gas at 350 °C.

D It is a liquid at 80 °C and a gas at 400 °C.

3 A student used chromatography to analyse a green food colouring.

The chromatogram obtained is shown.



The table lists some yellow food dyes and their R_f values.

Which yellow food dye does the green food colouring contain?

	yellow food dye	R_f value
A	Quinolene Yellow	0.48
B	Sunset Yellow	0.32
C	tartrazine	0.69
D	Yellow 2G	0.82

Topic Chem 1 **Q# 5/** iGCSE Chemistry/2017/s/Paper 22/

2 Impurities change the melting and boiling points of substances.

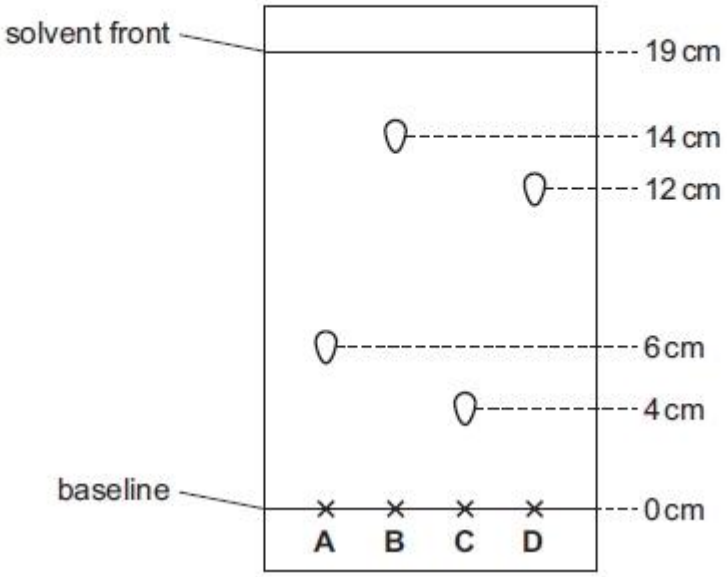
Sodium chloride is added to a sample of pure water.

How does the addition of sodium chloride affect the melting point and boiling point of the water?

	melting point	boiling point
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

3 The diagram shows a chromatogram of four substances.

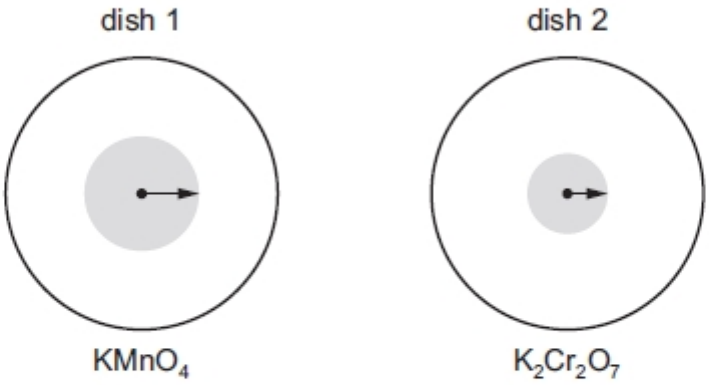
Which substance has an R_f value of approximately 0.32?



Topic Chem 1 **Q# 6/** iGCSE Chemistry/2017/s/Paper 21/

1 Small crystals of purple $KMnO_4$ (M_r = 158) and orange $K_2Cr_2O_7$ (M_r = 294) were placed at the centres of separate petri dishes filled with agar jelly. They were left to stand under the same physical conditions.

After some time, the colour of each substance had spread out as shown.



The lengths of the arrows indicate the relative distances travelled by particles of each substance.

Which statement is correct?

A Diffusion is faster in dish 1 because the mass of the particles is greater.

B Diffusion is faster in dish 2 because the mass of the particles is greater.

C Diffusion is slower in dish 1 because the mass of the particles is smaller.

D Diffusion is slower in dish 2 because the mass of the particles is greater.

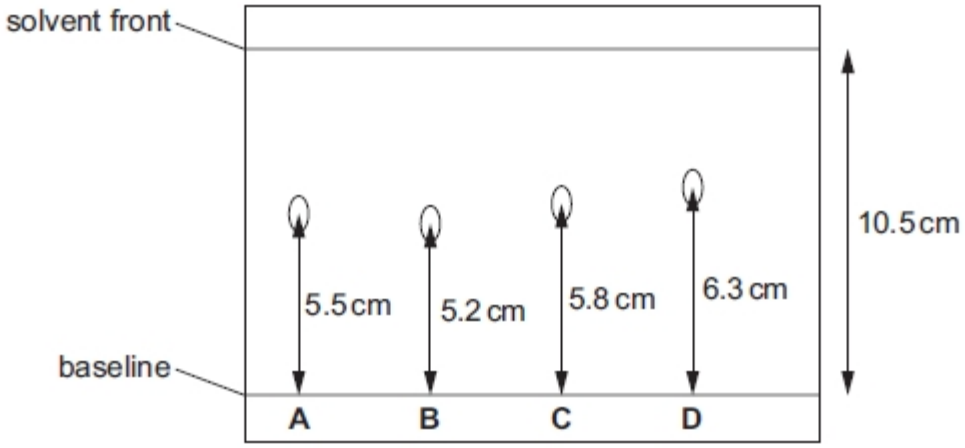
2 Pure water has a boiling point of 100 °C and a freezing point of 0 °C.

What is the boiling point and freezing point of a sample of aqueous sodium chloride?

	boiling point / °C	freezing point / °C
A	98	–2
B	98	2
C	102	–2
D	102	2

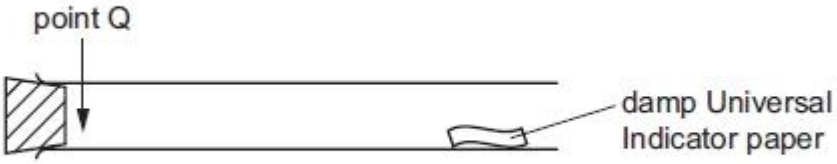
3 A chromatogram obtained from the chromatography of four substances is shown.

Which substance has an R_f value of 0.6?



Topic Chem 1 **Q# 7/** iGCSE Chemistry/2017/m/Paper 22/

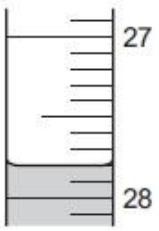
1 A gas is released at point Q in the apparatus shown.



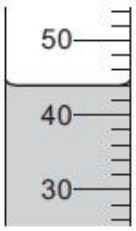
Which gas changes the colour of the damp Universal Indicator paper most quickly?

	gas	relative molecular mass
A	ammonia	17
B	carbon dioxide	44
C	chlorine	71
D	hydrogen	2

2 The diagrams show liquids in a burette and a measuring cylinder.



burette

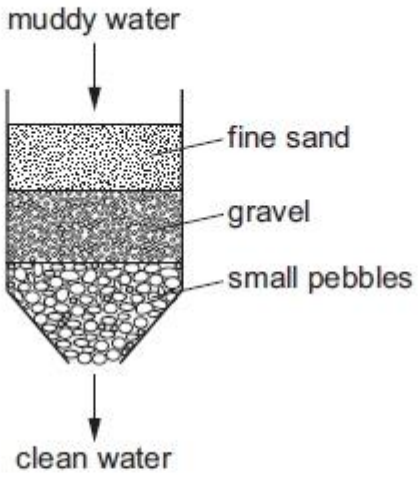


measuring cylinder

Which row shows the correct readings for the burette and the measuring cylinder?

	burette	measuring cylinder
A	27.8	42
B	27.8	44
C	28.2	42
D	28.2	44

3 The diagram shows how muddy water can be purified.



Which process for purifying the muddy water is shown?

A crystallisation

B distillation

C filtration

D solvent extraction

4 Which compound is silicon(IV) oxide?

	melting point /°C	good electrical conductor when solid	good electrical conductor when molten
A	–73	no	no
B	801	no	yes
C	1495	yes	yes
D	1710	no	no

5 Carbon has three naturally occurring isotopes, ^{12}C, ^{13}C and ^{14}C.

Which statement explains why the isotopes have the same chemical properties?

A They have the same number of electrons in the first shell.

B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

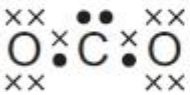
D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A

B

C



D

7 The equation represents the reaction between solid magnesium oxide and dilute hydrochloric acid to form magnesium chloride and water.

$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$

Which row shows the state symbols for hydrochloric acid, magnesium chloride and water?

	HCl	$MgCl_2$	H_2O
A	(aq)	(aq)	(l)
B	(aq)	(l)	(l)
C	(l)	(aq)	(aq)
D	(l)	(l)	(aq)

4 Which row describes silicon(IV) oxide?

	has a giant structure	is an acidic oxide	conducts electricity
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✓	✓

5 Why do isotopes of the same element have the same chemical properties?

A They have the same nucleon number.

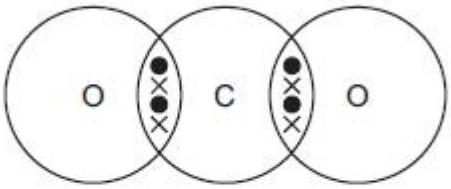
B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

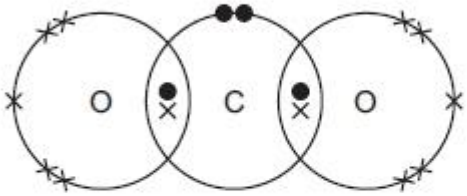
D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

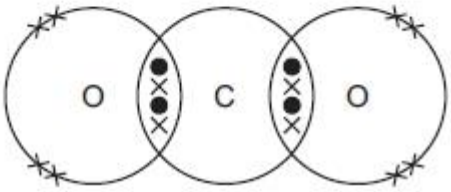
A



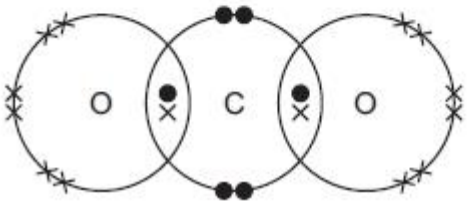
B



C



D



4 Two statements about silicon(IV) oxide are given.

1 It is a hard substance.

2 It has a macromolecular structure with strong covalent bonds.

Which is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is not correct.

D Statement 2 is correct but statement 1 is not correct.

5 Which statement explains why isotopes of the same element have the same chemical properties?

A They have a different number of neutrons in the nucleus.

B They have the same number of neutrons in the nucleus.

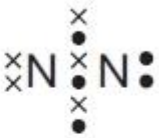
C They have the same number of outer shell electrons.

D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?

A

B



C

D

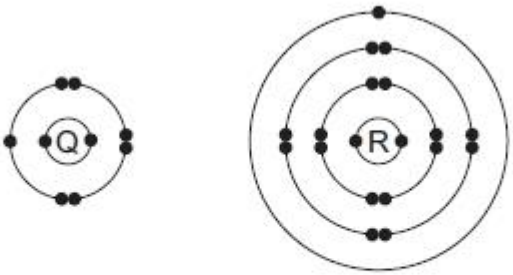
7 The equation for the reaction between barium chloride solution and dilute sulfuric acid is shown.

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

Which row shows the state symbols for this equation?

	$BaCl_2$	H_2SO_4	$BaSO_4$	$2HCl$
A	(aq)	(aq)	(s)	(aq)
B	(aq)	(l)	(s)	(aq)
C	(l)	(aq)	(s)	(l)
D	(aq)	(l)	(aq)	(l)

4 The electronic structures of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

A QR_7 **B** Q_2R_4 **C** QR **D** Q_7R

5 Which substance is a macromolecule?

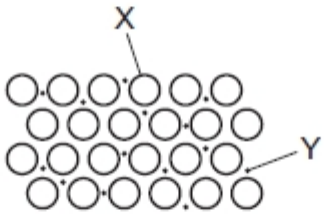
A ammonia

B carbon dioxide

C diamond

D water

6 The diagram shows metallic bonding.



Which labels are correct?

	X	Y
A	atomic nucleus	outer electron
B	metal atom	mobile electron
C	metal ion	mobile electron
D	positive ion	negative ion

Topic Chem 3 **Q# 12/** iGCSE Chemistry/2017/s/Paper 22/

4 Which element does **not** form a stable ion with the same electronic structure as argon?

A aluminium

B chlorine

C phosphorus

D potassium

5 Graphite and diamond are both forms of the element carbon.

Which row shows the number of other carbon atoms that each carbon atom is covalently bonded to in graphite and diamond?

	graphite	diamond
A	3	3
B	3	4
C	4	3
D	4	4

6 Which statement describes metallic bonding?

A The attraction between a lattice of negative ions and delocalised protons.

B The attraction between a lattice of positive ions and delocalised electrons.

C The attraction between delocalised protons and electrons.

D The attraction between oppositely charged ions.

Topic Chem 3 **Q# 13/** iGCSE Chemistry/2017/s/Paper 21/

4 Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

1 Sodium atoms form positive ions.

2 Sodium atoms form negative ions.

3 Sodium atoms gain electrons.

4 Sodium atoms lose electrons.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

5 Diamond is extremely hard and does not conduct electricity.

Which statement explains these properties?

A It has a lattice of positive carbon ions in a 'sea of electrons'.

B It has delocalised electrons and each carbon atom forms three covalent bonds with other carbon atoms.

C It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms.

D It has strong ionic bonds between each carbon atom.

6 Which statement about metals is **not** correct?

A Metals are malleable because the metal ions can slide over one another.

B Metals conduct electricity because electrons can move through the lattice.

C Metals consist of a giant lattice of metal ions in a 'sea of electrons'.

D Metals have high melting points because of the strong attraction between the metal ions.

Topic Chem 3 **Q# 14/** iGCSE Chemistry/2017/m/Paper 22/

4 Which statement explains why isotopes of an element have the same chemical properties?

A They have different numbers of neutrons.

B They have the same number of electrons as protons.

C They have the same number of electrons in the outer shell.

D They have the same number of protons in the nucleus.

5 The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Br^-
Ca^{2+}	CO_3^{2-}
Cu^{2+}	NO_3^-
Fe^{3+}	S^{2-}
K^+	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium sulfate	$Al_2(SO_4)_3$
B	calcium nitrate	$Ca(NO_3)_2$
C	iron(III) bromide	Fe_3Br
D	potassium sulfide	K_2S

6 Diamond and silicon(IV) oxide both have giant structures.

Which statements are correct?

1 Both substances are compounds.

2 There are strong covalent bonds in diamond.

3 Silicon(IV) oxide is bonded ionically.

4 Both substances have very high melting points.

A 1 and 2 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

7 Which statement about metals is correct?

A Layers of positive ions can slide over each other making metals malleable.

B Metallic bonding consists of a lattice of negative ions in a sea of delocalised electrons.

C Metallic bonding consists of a lattice of positive ions in a sea of delocalised negative ions.

D Metals conduct electricity because positive ions are free to move.

Topic Chem 4 **Q# 15/** iGCSE Chemistry/2017/w/Paper 23/

8 A compound contains 34.5% calcium, 24.1% silicon and 41.4% oxygen by mass.

What is its empirical formula?

A Ca_2SiO_3 **B** $CaSiO_3$ **C** $CaSi_2O_3$ **D** $CaSiO_6$

Topic Chem 4 **Q# 16/** iGCSE Chemistry/2017/w/Paper 22/

7 The equation for the reaction between phosphorus and oxygen is shown.

$$xP_4 + yO_2 \rightarrow zP_2O_5$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	5	2
B	1	10	2
C	2	5	2
D	2	10	1

8 The relative molecular mass of an alcohol is 88.

Its percentage composition by mass is: C, 54.5%; H, 9.1%; O, 36.4%.

Which row shows the empirical formula and molecular formula for this alcohol?

	empirical formula	molecular formula
A	C_2H_4O	C_2H_4O
B	C_2H_4O	$C_4H_8O_2$
C	$C_4H_8O_2$	$C_4H_8O_2$
D	$C_4H_8O_2$	C_2H_4O

Topic Chem 4 **Q# 17/** iGCSE Chemistry/2017/w/Paper 21/

8 A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen.

What is its empirical formula?

A CH **B** CH_2 **C** C_2H_4 **D** C_6H

Topic Chem 4 **Q# 18/** iGCSE Chemistry/2017/s/Paper 23/

7 Aqueous iron(III) sulfate and aqueous sodium hydroxide react to give a precipitate of iron(III) hydroxide and a solution of sodium sulfate.

What is the balanced equation for this reaction?

A $Fe_2(SO_4)_3(aq) + 2NaOH(aq) \rightarrow Fe(OH)_3(s) + Na_2SO_4(aq)$

B $Fe_2(SO_4)_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3Na_2SO_4(aq)$

C $Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(aq)$

D $2Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 4Fe(OH)_3(s) + 6Na_2SO_4(aq)$

8 The equation for the reaction between sodium carbonate and dilute hydrochloric acid is shown.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

What is the maximum volume of carbon dioxide produced when 26.5 g of sodium carbonate react with dilute hydrochloric acid?

A 6 dm^3 **B** 12 dm^3 **C** 18 dm^3 **D** 24 dm^3

Topic Chem 4 **Q# 19/** iGCSE Chemistry/2017/s/Paper 22/

7 Which equations are balanced?

1 $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

2 $ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + 2H_2O$

3 $Mg(NO_3)_2 + NaOH \rightarrow Mg(OH)_2 + 2NaNO_3$

4 $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

8 Calcium carbide, CaC_2, reacts with water to form ethyne, C_2H_2, and calcium hydroxide.

The equation for the reaction is shown.

$$CaC_2(s) + 2H_2O(l) \rightarrow C_2H_2(g) + Ca(OH)_2(s)$$

Which volume of ethyne is produced when 6 g of water react completely with calcium carbide?

A 4 dm^3 **B** 8 dm^3 **C** 36 dm^3 **D** 72 dm^3

Topic Chem 4 **Q# 20/** iGCSE Chemistry/2017/s/Paper 21/

7 Aluminium reacts with fluorine.

$$xAl(s) + yF_2(g) \rightarrow zAlF_3(s)$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	2	1
B	2	3	2
C	3	2	3
D	4	3	4

8 Carbon monoxide burns in oxygen to produce carbon dioxide.

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

Which mass of carbon dioxide is produced from 14 g of carbon monoxide?

A 22 g **B** 28 g **C** 44 g **D** 88 g

Topic Chem 4 **Q# 21/** iGCSE Chemistry/2017/m/Paper 22/

8 The gas hydrazine has the molecular formula N_2H_4.

Hydrazine burns in air to form nitrogen gas and steam.

$$N_2H_4(g) + O_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

Which statements are correct?

1 1 mole of hydrazine gives 72 dm^3 of gaseous products when it reacts with oxygen at room temperature and pressure.

2 The empirical formula of hydrazine is NH_2.

3 The total number of atoms in 1 mole of hydrazine is 6 × the Avogadro constant.

4 The volume of 1 mole of hydrazine at room temperature and pressure is 6 × 24 dm^3.

A 1, 2 and 3 **B** 1 and 2 only **C** 2, 3 and 4 **D** 3 and 4 only

9 Copper(II) carbonate is broken down by heating to form copper(II) oxide and carbon dioxide gas.

The equation for the reaction is shown.

$$CuCO_3 \rightarrow CuO + CO_2$$

31.0 g of copper(II) carbonate are heated until all of the contents of the test-tube have turned from green to black.

The yield of copper(II) oxide formed is 17.5 g.

What is the percentage yield?

A 19.02% **B** 21.88% **C** 56.50% **D** 87.50%

Topic Chem 5 **Q# 22/** iGCSE Chemistry/2017/w/Paper 21/

9 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

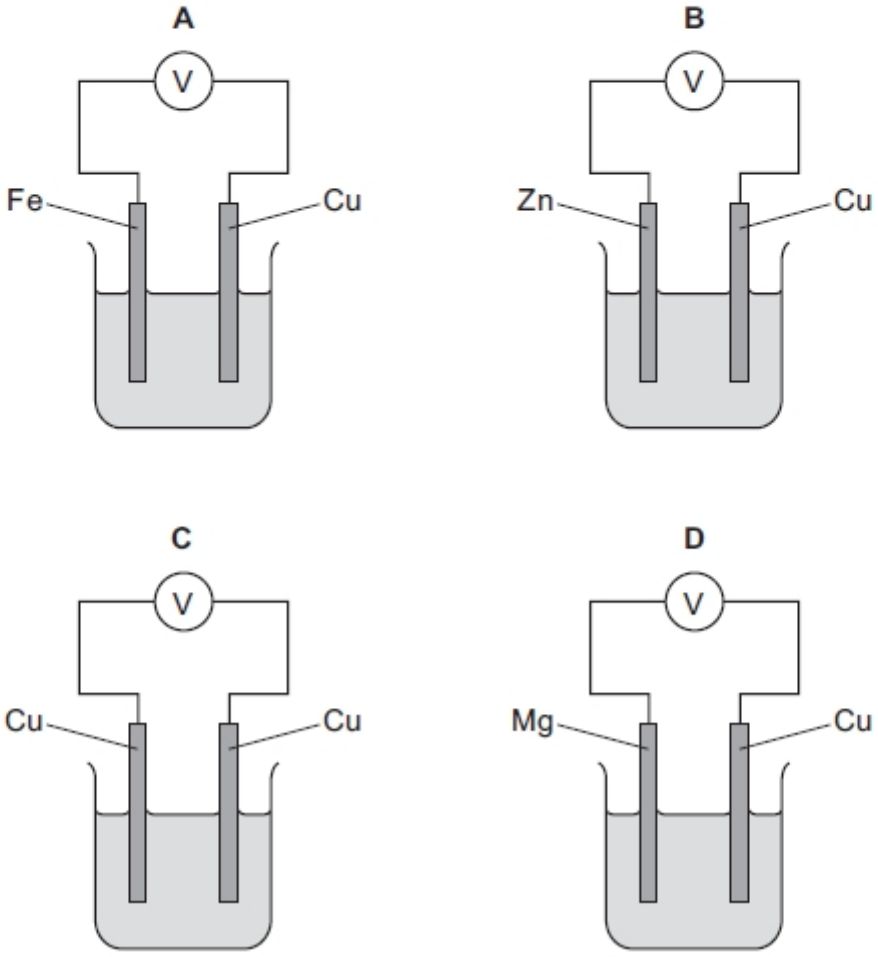
2 Electrons move round the external circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

10 Which metal combination produces the highest voltage reading in the cells shown?



Topic Chem 5 **Q# 23/** iGCSE Chemistry/2017/s/Paper 22/

9 Which statement about electrolysis is correct?

A Electrons move through the electrolyte from the cathode to the anode.

B Electrons move towards the cathode in the external circuit.

C Negative ions move towards the anode in the external circuit.

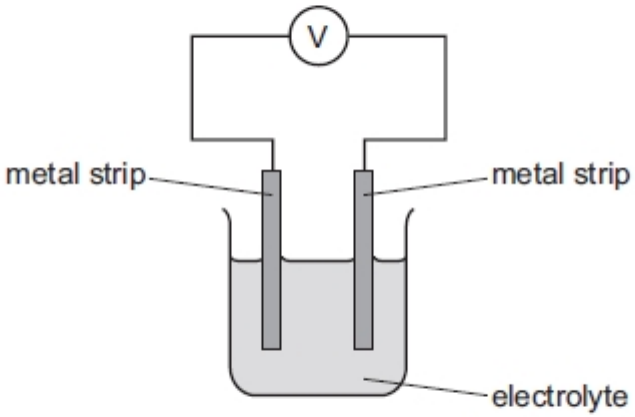
D Positive ions move through the electrolyte towards the anode during electrolysis.

Topic Chem 5 **Q# 24/** iGCSE Chemistry/2017/s/Paper 21/

10 The reactivity series for a number of different metals is shown.

most reactive →					least reactive
magnesium	zinc	iron	copper	silver	platinum

The diagram shows different metal strips dipped into an electrolyte.



Which pair of metals produces the highest voltage?

A copper and magnesium

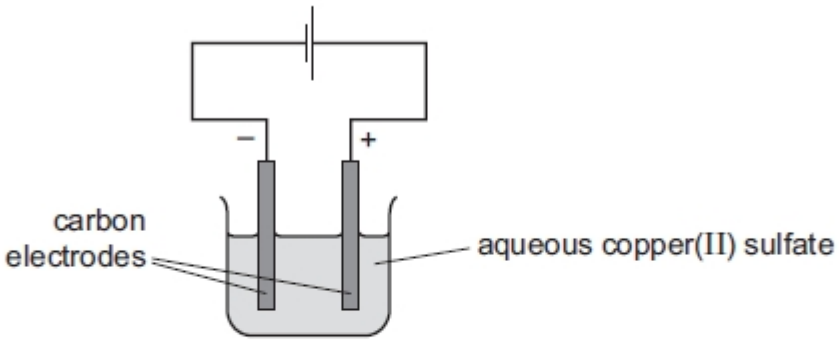
B magnesium and platinum

C magnesium and zinc

D silver and platinum

Topic Chem 5 **Q# 25/** iGCSE Chemistry/2017/m/Paper 22/

10 The diagram shows the electrolysis of aqueous copper(II) sulfate.



Which statement is correct?

A Copper metal is deposited at the positive electrode.

B In the external circuit the electrons move from positive to negative.

C In the solution the electrons move from negative to positive.

D Oxygen gas is produced at the positive electrode.

11 Four solutions are separately electrolysed.

experiment	solution	electrodes
1	dilute aqueous sodium chloride	carbon
2	aqueous copper(II) sulfate	copper
3	concentrated hydrochloric acid	carbon
4	dilute sulfuric acid	carbon

In which two experiments is a colourless gas evolved at the anode?

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

Topic Chem 6 **Q# 26/** iGCSE Chemistry/2017/w/Paper 23/

11 Some bond energies are shown in the table.

bond	bond energy in kJ/mol
H–H	+436
O=O	+496
H–O	+460

Hydrogen reacts with oxygen. The reaction is exothermic.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

What is the energy change for the reaction?

A –3208 kJ/mol

B –908 kJ/mol

C –472 kJ/mol

D –448 kJ/mol

Topic Chem 6 **Q# 27/** iGCSE Chemistry/2017/w/Paper 22/

11 The equation for the combustion of methane is shown.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The energy change for the combustion of methane is –890 kJ/mol.

The bond energies are shown in the table.

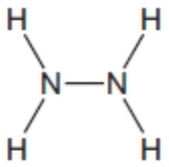
bond	bond energy in kJ/mol
C–H	+410
O=O	+496
H–O	+460

What is the bond energy of the C=O bond?

A +49 kJ/mol **B** +841 kJ/mol **C** +1301 kJ/mol **D** +1335 kJ/mol

Topic Chem 6 **Q# 28/** iGCSE Chemistry/2017/w/Paper 21/

11 The compound hydrazine is used as a rocket fuel. It has the structural formula shown.



One of the reactions of hydrazine is shown. This reaction is exothermic.

$$N_2H_4 \rightarrow N_2 + 2H_2$$

The bond energies are shown in the table.

	bond energy in kJ/mol
H–H	+436
N–H	+390
N–N	+160
N≡N	+945

What is the energy change for this reaction?

A –339 kJ/mol **B** –97 kJ/mol **C** +97 kJ/mol **D** +339 kJ/mol

12 Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

Topic Chem 6 **Q# 29/** iGCSE Chemistry/2017/s/Paper 23/

11 Heat energy is produced when hydrocarbons burn in air.

Which equations represent this statement?

1 $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

2 $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

3 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

13 Hydrogen and chlorine react to form hydrogen chloride.

The reaction is exothermic.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The overall energy change for this reaction is –184 kJ / mol.

The table gives some of the bond energies involved.

bond	bond energy in kJ / mol
H–Cl	+430
H–H	+436

What is the energy of the Cl–Cl bond?

A –240 kJ / mol

B –190 kJ / mol

C +190 kJ / mol

D +240 kJ / mol

Topic Chem 6 **Q# 30/** iGCSE Chemistry/2017/s/Paper 22/

11 Which statement about fuels is correct?

A Heat energy can only be produced by burning fuels.

B Hydrogen is used as a fuel although it is difficult to store.

C Methane is a good fuel because it produces only water when burned.

D Uranium is burned in air to produce energy.

13 The equation for the reaction between hydrogen and chlorine is shown.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
Cl–Cl	+240
H–Cl	+430
H–H	+436

What is the energy change for the reaction?

A –1536 kJ / mol

B –184 kJ / mol

C +184 kJ / mol

D +246 kJ / mol

Topic Chem 6 **Q# 31/** iGCSE Chemistry/2017/s/Paper 21/

11 Some properties of four fuels are shown in the table.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

12 Which statements about exothermic and endothermic reactions are correct?

1 During an exothermic reaction, heat is given out.

2 The temperature of an endothermic reaction goes up because heat is taken in.

3 Burning methane in the air is an exothermic reaction.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

13 Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.

The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–Cl	+340
C–C	+350
C–H	+410
Cl–Cl	+240
H–Cl	+430

What is the energy change for the reaction?

A –1420 kJ / mol

B –120 kJ / mol

C +120 kJ / mol

D +1420 kJ / mol

12 Ammonia is made by reacting nitrogen with hydrogen in the presence of an iron catalyst.

The reaction is exothermic.

The equation for the reaction is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

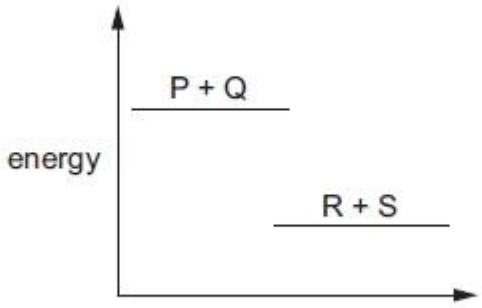
The bond energies are shown in the table.

bond	bond energy in kJ/mol
H–H	436
N–H	390
N≡N	945

What is the energy given out during this reaction?

A –4593 kJ/mol **B** –1083 kJ/mol **C** –959 kJ/mol **D** –87 kJ/mol

13 The energy level diagram for the reaction between P and Q to form R and S is shown.



Which row describes the energy changes involved and the type of reaction?

	energy changes involved	type of reaction
A	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	endothermic
B	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	exothermic
C	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	endothermic
D	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	exothermic

14 Silver chloride reacts when it is exposed to light.

Which row shows what happens to the silver in this process?

	half-equation	type of reaction
A	$Ag \rightarrow Ag^+ + e^-$	oxidation
B	$Ag \rightarrow Ag^+ + e^-$	reduction
C	$Ag^+ + e^- \rightarrow Ag$	oxidation
D	$Ag^+ + e^- \rightarrow Ag$	reduction

15 Which statement about the effect of concentration and temperature on the rate of a reaction is **not** correct?

A If the concentration of a reactant is increased, the rate of reaction increases because more particles have sufficient energy to react.

B If the concentration of a reactant is increased, the rate of reaction increases because there are more collisions between particles per second.

C If the temperature is increased, the rate of reaction increases because there are more collisions between particles per second.

D If the temperature is increased, the rate of reaction increases because more particles have sufficient energy to react.

16 The following reaction has reached equilibrium in a closed system.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which row shows the effect of increasing the pressure on the equilibrium mixture?

	reaction rate	amount of SO_2	amount of SO_3
A	increases	decreases	increases
B	increases	increases	decreases
C	unchanged	decreases	increases
D	unchanged	increases	decreases

Topic Chem 7 **Q# 34/** iGCSE Chemistry/2017/w/Paper 22/

14 Copper metal donates electrons to silver ions.

Zinc metal donates electrons to copper ions.

What is the strongest reducing agent?

A copper ions

B copper metal

C silver ions

D zinc metal

15 Four statements about the effect of increasing temperature on a reaction are shown.

1 The activation energy becomes lower.

2 The particles move faster.

3 There are more collisions between reacting particles.

4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

A 1, 2 and 3 **B** 1, 3 and 4 **C** 2, 3 and 4 **D** 2 and 3 only

16 The formation of sulfur trioxide from sulfur dioxide is a reversible reaction.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which changes would increase the equilibrium yield of SO_3?

1 increasing the pressure

2 lowering the temperature

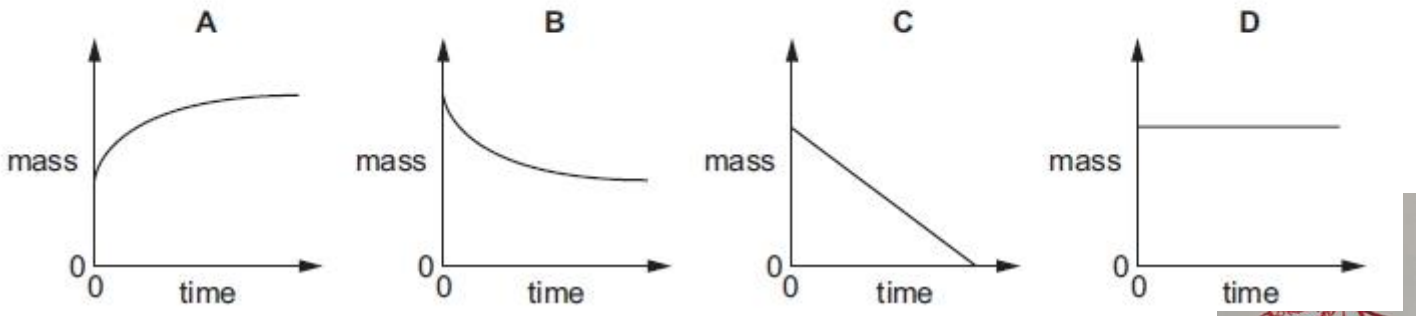
3 decreasing the concentration of oxygen

A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only

Topic Chem 7 **Q# 35/** iGCSE Chemistry/2017/w/Paper 21/

13 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



14 Copper(II) oxide reacts with hydrogen.

$$CuO + H_2 \rightarrow Cu + H_2O$$

Which row is correct?

	oxidising agent	reducing agent
A	H_2	CuO
B	CuO	H_2
C	H_2O	Cu
D	Cu	H_2O

15 Ethanoic acid reacts slowly with calcium carbonate.

Which statements explain why an increase in temperature increases the rate of the reaction?

1 The activation energy of the reaction is decreased.

2 There is an increase in collision rate.

3 The particles have more energy.

4 There will be fewer successful collisions.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

16 Methane reacts with steam to produce hydrogen and carbon monoxide.

The equation for the reaction is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons 3H_2(g) + CO(g)$$

The reaction is reversible. The forward reaction is endothermic.

Which changes in temperature and pressure increase the equilibrium yield of carbon monoxide?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

Topic Chem 7 **Q# 36/** iGCSE Chemistry/2017/s/Paper 23/

14 Which changes are physical changes?

1 melting ice to form water

2 burning hydrogen to form water

3 adding sodium to water

4 boiling water to form steam

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

16 Hydrogen is produced when methane reacts with steam.

The equation for the reaction is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

The forward reaction is endothermic.

Which conditions produce the highest yield of hydrogen?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

Topic Chem 7 **Q# 37/** iGCSE Chemistry/2017/s/Paper 22/

14 A gas is produced when calcium carbonate is heated.

Which type of change is this?

A chemical

B exothermic

C physical

D separation

16 The reaction used to manufacture ammonia from nitrogen and hydrogen is reversible.

An equilibrium can be established between ammonia, nitrogen and hydrogen.

Which statement describes the equilibrium?

A Both the forward reaction and the backward reaction have the same rate.

B The rate of the backward reaction is greater than the rate of the forward reaction.

C The rate of the forward reaction is greater than the rate of the backward reaction.

D The forward and backward reactions have both stopped.

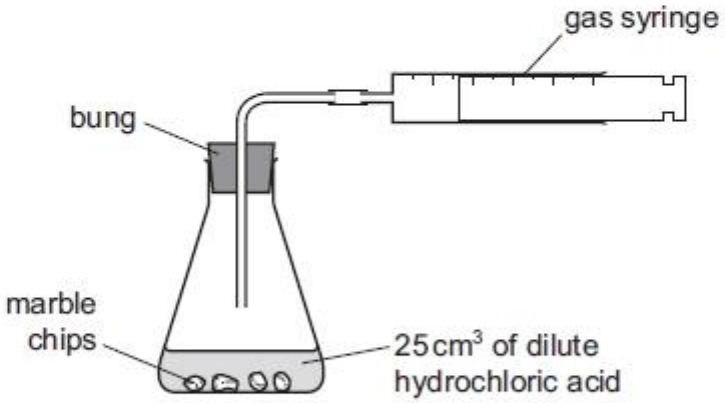
14 When sulfur is heated it undergoes a .....1..... change as it melts.

Further heating causes the sulfur to undergo a .....2..... change and form sulfur dioxide.

Which words complete gaps 1 and 2?

	1	2
A	chemical	chemical
B	chemical	physical
C	physical	chemical
D	physical	physical

15 A student was investigating the reaction between marble chips and dilute hydrochloric acid.



Which changes slow down the rate of reaction?

	temperature of acid	concentration of acid	surface area of marble chips
A	decrease	decrease	decrease
B	decrease	decrease	increase
C	increase	decrease	decrease
D	increase	increase	increase

16 Nitrogen, hydrogen and ammonia gases are placed inside a container. The container is then sealed. After some time, an equilibrium forms.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which statement describes the equilibrium in this container?

A The amount of ammonia remains constant from the moment the container is sealed.

B The amounts of ammonia, nitrogen and hydrogen in the container are always equal.

C The rate of formation of ammonia is equal to the rate of decomposition of ammonia.

D The rate of formation of ammonia is faster than the rate of decomposition of ammonia.

17 An example of a redox reaction is shown.

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

Which statement about the reaction is correct?

A Zn is the oxidising agent and it oxidises Cu^{2+}.

B Zn is the oxidising agent and it reduces Cu^{2+}.

C Zn is the reducing agent and it oxidises Cu^{2+}.

D Zn is the reducing agent and it reduces Cu^{2+}.

Topic Chem 7 **Q# 39/** iGCSE Chemistry/2017/m/Paper 22/

14 Copper(II) carbonate reacts with dilute sulfuric acid.

$$CuCO_3(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + CO_2(g) + H_2O(l)$$

The rate of the reaction can be changed by varying the conditions.

Which changes always increase the rate of this chemical reaction?

1 increasing the concentration of sulfuric acid

2 increasing the size of the pieces of copper(II) carbonate

3 increasing the temperature

4 increasing the volume of sulfuric acid

A 1, 3 and 4 **B** 1 and 3 only **C** 2 and 3 **D** 3 and 4 only

15 Which reaction is **not** affected by the presence of light?

A a candle burning

B methane reacting with chlorine

C photosynthesis

D silver bromide decomposing to form silver

16 The equation for the reversible reaction between hydrogen and iodine to form hydrogen iodide is shown.

The colours of the reactants and products are shown.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

colourless purple colourless

The forward reaction is exothermic.

Which statement is correct?

A An increase in pressure has no effect on the equilibrium position.

B The purple colour fades when the reaction mixture is heated.

C When equilibrium is reached, both forward and reverse reactions stop.

D When more hydrogen gas is added, the purple colour increases.

17 Chlorine displaces bromine from a solution of potassium bromide.

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

What is the oxidising agent in this reaction?

A bromide ions

B bromine

C chloride ions

D chlorine

Topic Chem 8 **Q# 40/** iGCSE Chemistry/2017/w/Paper 23/

19 Three solids, P, Q and R, all react with dilute sulfuric acid to produce zinc sulfate.

P and R produce gases during the reaction.

The gas produced when P reacts will not burn. The gas produced when R reacts will burn.

What are P, Q and R?

	P	Q	R
A	zinc	zinc hydroxide	zinc carbonate
B	zinc carbonate	zinc	zinc oxide
C	zinc carbonate	zinc hydroxide	zinc
D	zinc oxide	zinc carbonate	zinc

20 Which ion forms a green precipitate with aqueous sodium hydroxide that dissolves in an excess of aqueous sodium hydroxide?

A Ca^{2+} **B** Cr^{3+} **C** Cu^{2+} **D** Fe^{2+}

Topic Chem 8 **Q# 41/** iGCSE Chemistry/2017/w/Paper 22/

19 Copper(II) sulfate can be prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the yield of copper(II) sulfate

20 Compound P reacts with hydrochloric acid to produce a gas that turns limewater milky.

What is P?

A sodium carbonate

B sodium chloride

C sodium hydroxide

D sodium sulfate

17 Some properties of four oxides are listed.

Oxide 1 reacts with both acids and alkalis to form salts.

Oxide 2 reacts with acids to form salts but does not react with alkalis.

Oxide 3 reacts with alkalis to form salts but does not react with acids.

Oxide 4 does not react with acids or alkalis.

Which row describes the oxides?

	oxide 1	oxide 2	oxide 3	oxide 4
A	amphoteric	acidic	basic	neutral
B	amphoteric	basic	acidic	neutral
C	neutral	acidic	basic	amphoteric
D	neutral	basic	acidic	amphoteric

18 What is **not** a typical characteristic of acids?

A They react with alkalis producing water.

B They react with **all** metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn blue litmus paper red.

19 Zinc sulfate is made by reacting an excess of zinc oxide with dilute sulfuric acid.

The excess zinc oxide is then removed from the solution.

Which process is used to obtain solid zinc sulfate from the solution?

A crystallisation

B dissolving

C filtration

D fractional distillation

20 What is used to test for chlorine?

A a glowing splint

B damp litmus paper

C limewater

D potassium manganate(VII) solution

18 Which oxide is amphoteric?

A Al_2O_3 **B** CaO **C** Na_2O **D** SO_2

19 Chloric(I) acid, HClO, is formed when chlorine dissolves in water. It is a weak acid.

What is meant by the term *weak acid*?

A It contains fewer hydrogen atoms than a strong acid.

B It is easily neutralised by a strong alkali.

C It is less concentrated than a strong acid.

D It is only partially ionised in solution.

20 Silver nitrate reacts with sodium chloride to produce silver chloride and sodium nitrate. The equation for the reaction is shown.

$$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$$

How is silver chloride separated from the reaction mixture?

A crystallisation

B distillation

C evaporation

D filtration

21 Aqueous sodium hydroxide reacts with an aqueous solution of compound Y to give a green precipitate.

Aqueous ammonia also reacts with an aqueous solution of compound Y to give a green precipitate.

In each case the precipitate is insoluble when an excess of reagent is added.

Which ion is present in Y?

A chromium(III)

B copper(II)

C iron(II)

D iron(III)

18 Which type of oxide is aluminium oxide?

A acidic

B amphoteric

C basic

D neutral

19 Which statements about a weak acid, such as ethanoic acid, are correct?

1 It reacts with a carbonate.

2 It does not neutralise aqueous sodium hydroxide solution.

3 It turns red litmus blue.

4 It is only partially ionised in aqueous solution.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

20 Silver chloride is a white solid which is insoluble in water.

Which statement describes how a sample of pure silver chloride can be made?

A Add aqueous silver nitrate to aqueous sodium chloride and then filter.

B Add aqueous silver nitrate to dilute hydrochloric acid, evaporate and then crystallise.

C Add silver carbonate to dilute hydrochloric acid, evaporate and then crystallise.

D Add silver to dilute hydrochloric acid, filter and then wash the residue.

21 Dilute sulfuric acid is added to two separate aqueous solutions, X and Y. The observations are shown.

solution X	white precipitate
solution Y	bubbles of a colourless gas

Which row shows the ions present in the solutions?

	solution X	solution Y
A	Ba^{2+}	CO_3^{2-}
B	Ca^{2+}	Cl^-
C	Cu^{2+}	CO_3^{2-}
D	Fe^{2+}	NO_3^-

18 Zinc oxide is amphoteric.

Which row describes the reactions of zinc oxide?

	reaction with hydrochloric acid	reaction with aqueous sodium hydroxide
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = reaction occurs

✗ = reaction does not occur

19 Which row shows how the hydrogen ion concentration and pH of ethanoic acid compare to those of hydrochloric acid of the same concentration?

	ethanoic acid compared to hydrochloric acid	
	hydrogen ion concentration	pH
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

20 A pure sample of the insoluble salt barium carbonate can be made using the method given.

step 1 Dissolve barium chloride in water.

step 2 Separately dissolve sodium carbonate in water.

step 3 Mix the two solutions together.

step 4 Filter the mixture.

step 5

step 6 Dry the residue between two sheets of filter paper.

Which instruction is missing from step 5?

A Heat the residue to dryness.

B Heat the residue to the point of crystallisation.

C Place the filtrate in an evaporating basin.

D Wash the residue with water.

21 Substance X reacts with warm dilute hydrochloric acid to produce a gas which decolourises acidified aqueous potassium manganate(VII).

Substance X gives a yellow flame in a flame test.

What is X?

A potassium chloride

B potassium sulfite

C sodium chloride

D sodium sulfite

Topic Chem 8 **Q# 46/** iGCSE Chemistry/2017/m/Paper 22/

18 Beryllium oxide reacts with both sulfuric acid and aqueous sodium hydroxide.

Which type of oxide is beryllium oxide?

A acidic

B amphoteric

C basic

D neutral

19 A student investigates two acids W and X.

The same volumes of W and X are reacted separately with excess magnesium.

The student makes the following observations.

1 Hydrogen gas is produced at a faster rate with W than with X.

2 The total volume of hydrogen gas produced is the same for both acids.

Which statement explains these observations?

A The pH of W is higher than the pH of X.

B W is an organic acid.

C W is a stronger acid than X.

D W is more concentrated than X.

20 A student is given an unknown solution.

Which two tests provide evidence that the solution is copper(II) sulfate?

1 adding dilute hydrochloric acid

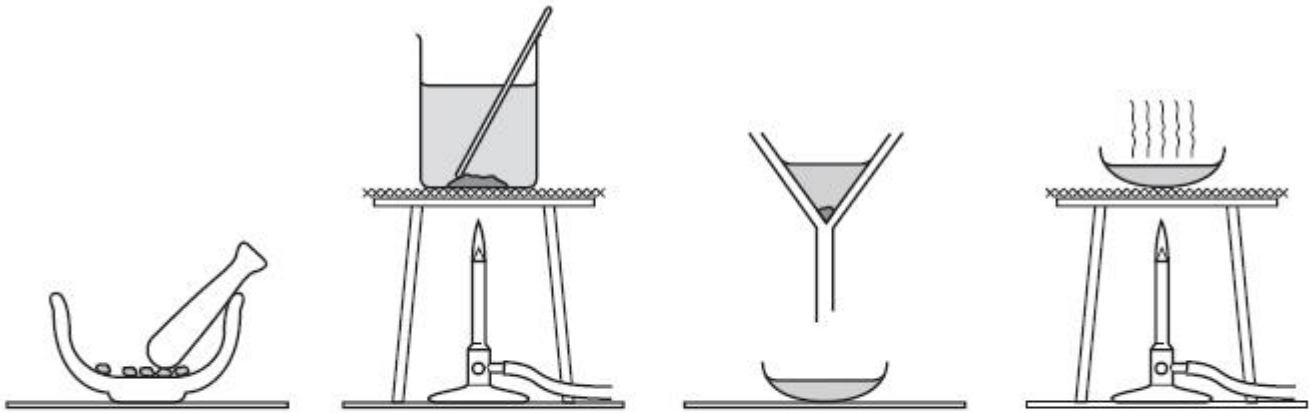
2 adding aqueous sodium hydroxide

3 adding dilute nitric acid, then silver nitrate solution

4 adding dilute nitric acid, then barium nitrate solution

A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

21 The diagram shows the steps in the preparation of a salt.



Which salt is prepared by this method?

A barium sulfate

B copper(II) sulfate

C potassium sulfate

D sodium sulfate

Topic Chem 9 **Q# 47/** iGCSE Chemistry/2017/w/Paper 23/

21 A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

A Element R does not conduct electricity.

B Elements R and Y react together to form an ionic compound.

C Element Z exists as a diatomic molecule.

D Element Z reacts with element T.

22 Some properties of element X are shown.

melting point in °C	98
boiling point in °C	883
reaction with cold water	gives off H_2 gas
reaction when heated with oxygen	burns to give a white solid

In which part of the Periodic Table is X found?

A Group I

B Group VII

C Group VIII

D transition elements

23 The table gives some properties of an element.

melting point in °C	3422
appearance of the element	grey
appearance of the chloride of the element	dark blue
density in g / cm^3	19.2
electrical conductivity when solid	good

Which other property would you expect this element to have?

A acts as a catalyst

B brittle

C forms an acidic oxide

D highly reactive with water

Topic Chem 9 **Q# 48/** iGCSE Chemistry/2017/w/Paper 22/

21 Which statement about nitrogen and phosphorus is **not** correct?

A Both are in the same group of the Periodic Table.

B Both are in the same period of the Periodic Table.

C Both are non-metals.

D Both have the same number of electrons in their outer shell.

22 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement is correct?

A Sodium atoms have more electrons than rubidium atoms.

B Sodium has a lower density than rubidium.

C Sodium has a lower melting point than rubidium.

D Sodium is more reactive than rubidium.

23 Which properties do the elements chromium, iron and vanadium have in common?

1 They all conduct electricity.

2 They, or their compounds, can act as catalysts.

3 They all form coloured compounds.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Topic Chem 9 **Q# 49/** iGCSE Chemistry/2017/w/Paper 21/

21 Which statements about the trends across a period of the Periodic Table are correct?

1 Aluminium is more metallic than sodium.

2 Beryllium is more metallic than carbon.

3 Boron is more metallic than lithium.

4 Magnesium is more metallic than silicon.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

22 Astatine is an element in Group VII of the Periodic Table.

Astatine is .....1..... reactive than iodine.

The melting point of astatine is .....2..... than the melting point of iodine.

Astatine is .....3..... in colour than bromine.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	less	higher	darker
B	less	lower	lighter
C	more	higher	darker
D	more	lower	lighter

23 Which row describes the properties of a typical transition element?

	melting point	forms coloured compounds	can act as a catalyst
A	high	no	no
B	high	yes	yes
C	low	no	yes
D	low	yes	no

24 Why is argon gas used to fill electric lamps?

A It conducts electricity.

B It glows when heated.

C It is less dense than air.

D It is not reactive.

Topic Chem 9 **Q# 50/** iGCSE Chemistry/2017/s/Paper 23/

23 Ununseptium (atomic number 117) is a man-made element that is below astatine in Group VII of the Periodic Table.

What is the expected state of ununseptium at room temperature?

A a diatomic gas

B a liquid

C a monatomic gas

D a solid

Topic Chem 9 **Q# 51/** iGCSE Chemistry/2017/s/Paper 22/

23 The elements oxygen and sulfur are in the same group of the Periodic Table.

Which statement about oxygen and sulfur is **not** correct?

A They are non-metals.

B They have giant covalent structures.

C They have six electrons in their outer shells.

D They react together to form an acidic oxide.

Topic Chem 9 **Q# 52/** iGCSE Chemistry/2017/s/Paper 21/

22 Which element is less reactive than the other members of its group in the Periodic Table?

A astatine

B caesium

C fluorine

D rubidium

23 The elements in Group IV of the Periodic Table are shown.

carbon

silicon

germanium

tin

lead

flerovium

What does **not** occur in Group IV as it is descended?

A The proton number of the elements increases.

B The elements become more metallic.

C The elements have more electrons in their outer shells.

D The elements have more electron shells.

24 Why are weather balloons sometimes filled with helium rather than hydrogen?

A Helium is found in air.

B Helium is less dense than hydrogen.

C Helium is more dense than hydrogen.

D Helium is unreactive.

Topic Chem 9 **Q# 53/** iGCSE Chemistry/2017/m/Paper 22/

22 Which property of elements increases across a period of the Periodic Table?

A metallic character

B number of electron shells

C number of outer shell electrons

D tendency to form positive ions

23 Magnesium, calcium, strontium and barium are Group II elements.

Group II elements follow the same trends as Group I elements.

Which statements about Group II elements are correct?

1 Calcium reacts faster than magnesium with water.

2 Barium reacts less vigorously than magnesium with dilute acid.

3 Strontium oxidises in air more slowly than barium.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

24 The noble gases are in Group VIII of the Periodic Table.

Which statement explains why noble gases are unreactive?

A They all have eight electrons in their outer shells.

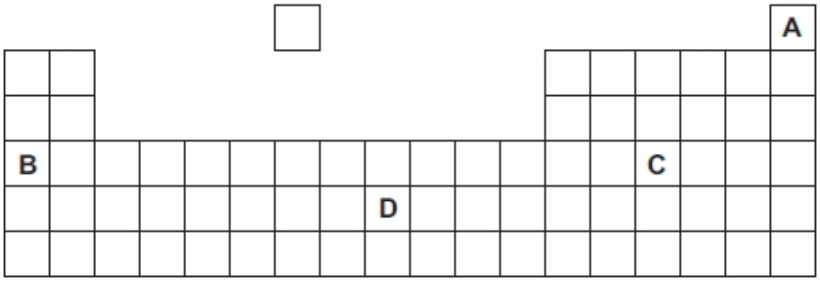
B They all have full outer shells.

C They are all gases.

D They are all monoatomic.

25 Part of the Periodic Table is shown.

Which element is used as a catalyst?



Topic Chem 10 **Q# 54/** iGCSE Chemistry/2017/w/Paper 23/

26 Aluminium is obtained by the electrolysis of a mixture of aluminium oxide and cryolite.

Why is cryolite used?

A as a catalyst to speed up the process

B as a coolant to prevent the process getting too hot

C as a solvent for aluminium oxide

D as the main source of aluminium ions

27 Metal M is mixed with copper to produce brass.

What is M?

A chromium

B nickel

C vanadium

D zinc

28 Some metal nitrates and carbonates decompose when heated strongly.

Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.

The carbonate of metal Q does not decompose when heated with a Bunsen burner.

What is metal Q?

A calcium

B copper

C sodium

D zinc

Topic Chem 10 **Q# 55/** iGCSE Chemistry/2017/w/Paper 22/

26 Aluminium is extracted from bauxite by electrolysis.

Which row shows the anode material and the anode reaction?

	anode material	anode reaction
A	carbon	$Al^{3+} + 3e^- \rightarrow Al$
B	carbon	$2O^{2-} \rightarrow O_2 + 4e^-$
C	steel	$Al^{3+} + 3e^- \rightarrow Al$
D	steel	$2O^{2-} \rightarrow O_2 + 4e^-$

27 Which statement about the metal zinc is **not** correct?

A It forms an oxide more readily than iron.

B It is manufactured by the electrolysis of zinc blende.

C It is used to make brass.

D It is used to prevent iron from rusting.

28 Calcium nitrate decomposes when it is heated.

What is the equation for the thermal decomposition of calcium nitrate?

A $2Ca(NO_3)_2 \rightarrow 2CaO + O_2 + 4NO_2$

B $Ca(NO_3)_2 \rightarrow Ca(NO_2)_2 + O_2$

C $Ca(NO_3)_2 \rightarrow Ca + O_2 + 2NO_2$

D $Ca(NO_3)_2 \rightarrow Ca + 3O_2 + N_2$

Topic Chem 10 **Q# 56/** iGCSE Chemistry/2017/w/Paper 21/

25 What is a property of **all** metals?

A conduct electricity

B hard

C low melting points

D react with water

26 Aluminium is extracted by the electrolysis of aluminium oxide.

Which statement is **not** correct?

A Aluminium ions are oxidised at the cathode.

B Carbon dioxide is made at the anode.

C Cryolite is added to lower the melting point of the aluminium oxide.

D The electrodes are made from graphite.

27 Which row describes how the metals are used?

	mixed with zinc to form brass	used to galvanise iron
A	aluminium	tin
B	aluminium	zinc
C	copper	tin
D	copper	zinc

28 Information about the nitrates and carbonates of two metals, Q and R, is shown.

	appearance	solubility in water	effect of heat
nitrate of Q	white solid	soluble	colourless gas evolved which relights a glowing splint
carbonate of Q	white solid	soluble	no reaction
nitrate of R	white solid	soluble	brown gas evolved
carbonate of R	white solid	insoluble	colourless gas evolved which turns limewater milky

Which statement is correct?

A Q is calcium and R is magnesium.

B Q is magnesium and R is sodium.

C Q is potassium and R is copper.

D Q is sodium and R is calcium.

Topic Chem 10 **Q# 57/** iGCSE Chemistry/2017/s/Paper 23/

25 Which equation from the zinc extraction process shows the metal being produced by reduction?

A $ZnO + C \rightarrow Zn + CO$

B $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

C $Zn(g) \rightarrow Zn(l)$

D $Zn(l) \rightarrow Zn(s)$

27 The section of the reactivity series shown includes a newly discovered element, symbol X.

The only oxide of X has the formula XO.

Ca

Mg

Fe

X

H

Cu

Which equation shows a reaction which occurs?

A $Cu(s) + X^{2+}(aq) \rightarrow Cu^{2+}(aq) + X(s)$

B $2X(s) + Cu^{2+}(aq) \rightarrow 2X^{+}(aq) + Cu(s)$

C $X(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3XO(s)$

D $X(s) + 2HCl(aq) \rightarrow XCl_2(aq) + H_2(g)$

Topic Chem 10 **Q# 58/** iGCSE Chemistry/2017/s/Paper 22/

25 Which process is involved in the extraction of zinc from zinc blende?

A Cryolite is added to lower the melting point of zinc blende.

B Molten zinc blende is electrolysed.

C Zinc blende is heated with carbon.

D Zinc blende is roasted in air.

26 Element E:

- forms an alloy
- has a basic oxide
- is below hydrogen in the reactivity series.

What is E?

A carbon

B copper

C sulfur

D zinc

27 A list of metals is shown.

aluminium

copper

iron

magnesium

silver

zinc

Which metal will displace all of the other metals from aqueous solutions of their salts?

A aluminium

B iron

C magnesium

D zinc

25 Metal X is added to a colourless aqueous solution of the sulfate of metal Y.

A coloured solution is formed and metal Y is deposited at the bottom of the beaker.

Which row describes elements X and Y and their relative reactivity?

	type of element	relative reactivity
A	X is a transition element	X is more reactive than Y
B	X is a transition element	Y is more reactive than X
C	Y is a transition element	X is more reactive than Y
D	Y is a transition element	Y is more reactive than X

26 Element E:

- forms an alloy
- has a basic oxide
- is below hydrogen in the reactivity series.

What is E?

A carbon

B copper

C sulfur

D zinc

27 Zinc metal is extracted from its ore zinc blende in a similar method to that used to extract iron from hematite.

In which way is zinc extraction different from iron extraction?

A Carbon and carbon monoxide are the main reducing agents.

B Hot air at the base of the furnace reacts with coke to keep the furnace hot.

C The metal is removed as a vapour at the top of the furnace.

D The metal oxide is added into the top of the furnace.

28 Stainless steel is an alloy of iron and other metals. It is strong and does not rust but it costs much more than normal steel.

What is **not** made from stainless steel?

A cutlery

B pipes in a chemical factory

C railway lines

D saucepans

26 Which statement about **all** metals is correct?

A They are attracted to a magnet.

B They are weak and brittle.

C They may be used to form alloys.

D They react with water.

27 Which substance produces sulfur dioxide when roasted in air?

A bauxite

B cryolite

C hematite

D zinc blende

28 Which metal carbonate does **not** produce carbon dioxide when it is heated with a Bunsen burner?

A copper(II) carbonate

B magnesium carbonate

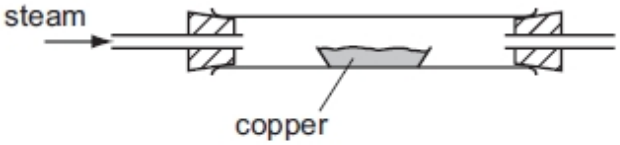
C sodium carbonate

D zinc carbonate

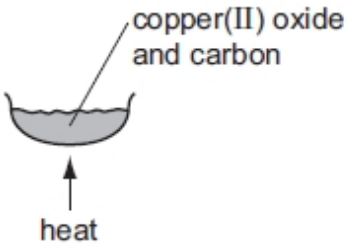
29 Two experiments are carried out.

In experiment 1, copper is heated with steam.

In experiment 2, copper(II) oxide is heated with carbon.



experiment 1



experiment 2

Which row describes what happens in experiments 1 and 2?

	experiment 1	experiment 2
A	no reaction	no reaction
B	no reaction	reaction
C	reaction	no reaction
D	reaction	reaction

Topic Chem 11 **Q# 61/** iGCSE Chemistry/2017/w/Paper 23/

30 A piece of zinc is attached to the hull of a steel boat. Steel is an alloy of iron.

Which statement explains why the zinc prevents the iron from rusting?

A Zinc is less reactive than iron, and iron is less likely to lose electrons than zinc.

B Zinc is less reactive than iron, and iron is more likely to lose electrons than zinc.

C Zinc is more reactive than iron, and iron is less likely to lose electrons than zinc.

D Zinc is more reactive than iron, and iron is more likely to lose electrons than zinc.

31 The Haber process for making ammonia is carried out at a temperature of 450 °C and a pressure of 200 atmospheres in the presence of a catalyst.

Which statement is **not** correct?

A Lowering the pressure increases the rate at which ammonia is produced.

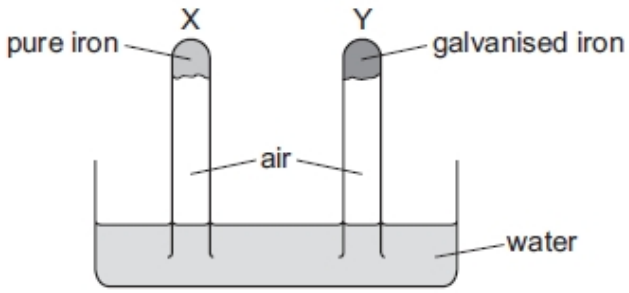
B Lowering the temperature slows down the rate at which ammonia is produced.

C Maintaining a very high pressure is very difficult and needs expensive equipment.

D The reaction is a reversible reaction which can proceed forwards and backwards.

Topic Chem 11 **Q# 62/** iGCSE Chemistry/2017/w/Paper 22/

30 An experiment to investigate the effect of galvanising iron is shown.



The experiment is left for seven days.

What happens to the water level in tubes X and Y?

	tube X	tube Y
A	falls	rises
B	no change	no change
C	rises	falls
D	rises	no change

31 Which metal is used as a catalyst in the Haber process for the manufacture of ammonia?

A iron

B nickel

C platinum

D vanadium

32 Which process removes carbon dioxide from the atmosphere?

A combustion of fossil fuels

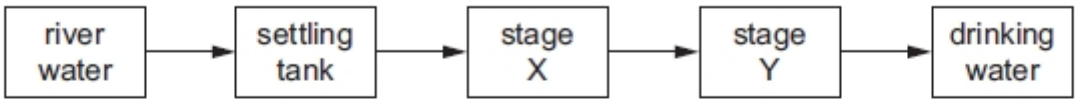
B decomposition of carbonates

C photosynthesis

D respiration

Topic Chem 11 **Q# 63/** iGCSE Chemistry/2017/w/Paper 21/

29 The flow chart shows stages in the treatment of river water to produce drinking water.



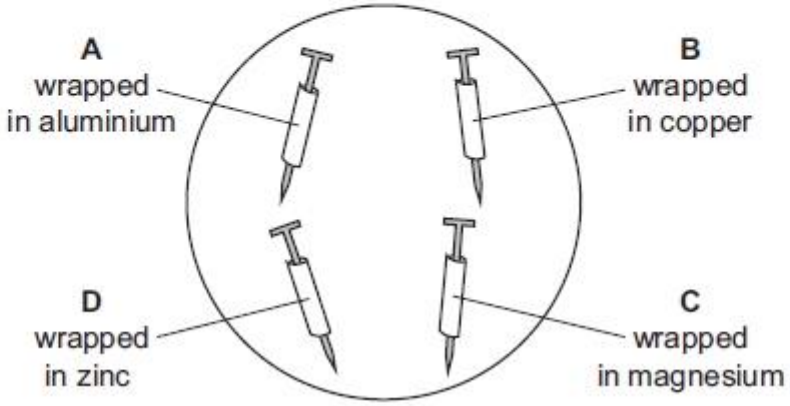
What occurs at stages X and Y?

	X	Y
A	distillation	chlorination
B	distillation	filtration
C	filtration	chlorination
D	filtration	distillation

30 Four iron nails had different metals wrapped around them.

The nails were placed in an open dish filled with water and left for a week.

Which iron nail has no protection against rusting?



31 Ammonia is made by the Haber process.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

What are the sources of the nitrogen and hydrogen used in the Haber process?

	nitrogen	hydrogen
A	fertilisers	reacting methane with steam
B	fertilisers	the air
C	the air	reacting methane with steam
D	the air	the air

32 Which process does **not** produce carbon dioxide?

A combustion of alkanes

B photosynthesis

C respiration

D thermal decomposition of limestone

Topic Chem 11 **Q# 64/** iGCSE Chemistry/2017/s/Paper 23/

30 The carbon cycle describes how carbon dioxide gas is added to or removed from the atmosphere.

Which row describes the movement of carbon dioxide during each process?

	photosynthesis	combustion	respiration
A	added to the atmosphere	added to the atmosphere	removed from the atmosphere
B	added to the atmosphere	removed from the atmosphere	added to the atmosphere
C	removed from the atmosphere	added to the atmosphere	added to the atmosphere
D	removed from the atmosphere	added to the atmosphere	removed from the atmosphere

31 Which row gives the catalyst for the Haber process and the sources of the raw materials?

	catalyst	source of hydrogen	source of nitrogen
A	iron	electrolysis	fertiliser
B	iron	methane	air
C	vanadium pentoxide	methane	air
D	vanadium pentoxide	methane	fertiliser

32 Petrol burns in a car engine to produce waste gases which leave through the car exhaust.

One of these waste gases is an oxide of nitrogen.

Which statement describes how this oxide of nitrogen is formed?

A Carbon dioxide reacts with nitrogen in the catalytic converter.

B Nitrogen reacts with oxygen in the car engine.

C Nitrogen reacts with oxygen in the catalytic converter.

D Petrol combines with nitrogen in the car engine.

Topic Chem 11 **Q# 65/** iGCSE Chemistry/2017/s/Paper 22/

30 The carbon cycle includes the processes combustion, photosynthesis and respiration.

Which row shows how each process changes the amount of carbon dioxide in the atmosphere?

	combustion	photosynthesis	respiration
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	increases
D	increases	increases	decreases

31 Which statement about the conditions used in the Haber process is **not** correct?

A A high temperature is used because the forward reaction is exothermic.

B A high pressure is used because there are fewer moles of gas in the products than in the reactants.

C An iron catalyst is used to increase the rate of the forward reaction.

D The unreacted hydrogen and nitrogen are recycled to increase the amount of ammonia produced.

32 Which chemical reaction decreases pollution in the air?

A $S + O_2 \rightarrow SO_2$

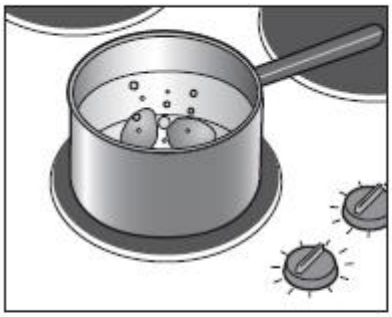
B $N_2 + O_2 \rightarrow 2NO$

C $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

D $2NO + 2CO \rightarrow 2CO_2 + N_2$

Topic Chem 11 **Q# 66/** iGCSE Chemistry/2017/s/Paper 21/

29 The diagram shows some uses of water in the home.



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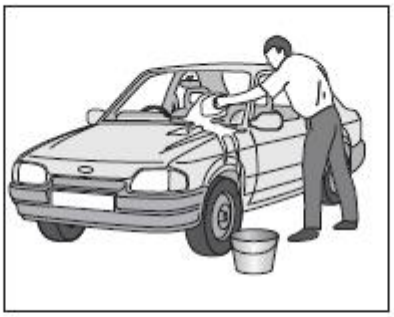

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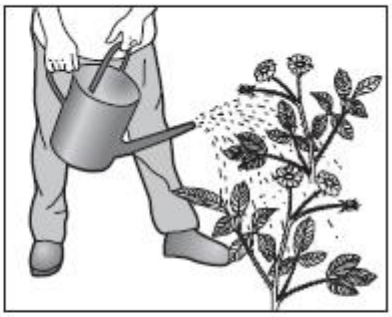


3

For which uses is it important for the water to have been treated?

A 1 only **B** 2 only **C** 3 only **D** 1, 2 and 3

30 Oxides of nitrogen are found in polluted air.

Which statement about oxides of nitrogen is correct?

A Oxides of nitrogen are formed by the reaction of nitrogen with oxygen during the fractional distillation of liquid air.

B Oxides of nitrogen are formed in a car engine by the reaction of petrol with nitrogen from the air.

C Oxides of nitrogen are removed from exhaust gases by reaction with carbon dioxide in a catalytic converter.

D Oxides of nitrogen are removed from exhaust gases by reduction in a catalytic converter.

31 Photosynthesis and respiration are important natural processes.

Which statement is correct?

A Carbon dioxide is formed by the reaction of glucose with water during photosynthesis.

B Carbon dioxide is removed from the air by respiration.

C Glucose reacts with water to form oxygen during respiration.

D Photosynthesis produces glucose and oxygen.

32 Which row gives the conditions for the Haber process?

	temperature / °C	pressure / atm	catalyst
A	200	2	V_2O_5
B	200	450	Fe
C	450	200	Fe
D	500	250	V_2O_5

Topic Chem 11 **Q# 67/** iGCSE Chemistry/2017/m/Paper 22/

30 Which two gases are obtained from liquid air by fractional distillation?

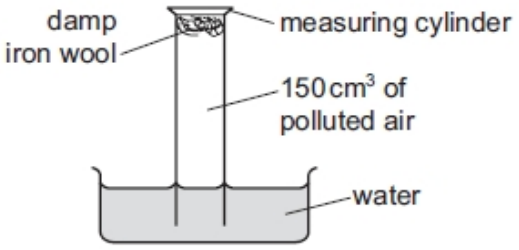
A carbon dioxide and oxygen

B carbon dioxide and water vapour

C nitrogen and oxygen

D nitrogen and water vapour

31 An experiment to find the percentage of oxygen in 150 cm^3 of polluted air is shown.



The apparatus is left for one week.

After this time, the volume of gas in the measuring cylinder is 122 cm^3.

What is the percentage of oxygen, to the nearest whole number, in the polluted air?

A 19% **B** 21% **C** 28% **D** 81%

Topic Chem 12 **Q# 68/** iGCSE Chemistry/2017/w/Paper 21/

33 Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

	temperature /°C	pressure /atm	catalyst
A	40	200	Fe
B	40	200	V_2O_5
C	400	2	Fe
D	400	2	V_2O_5

Topic Chem 12 **Q# 69/** iGCSE Chemistry/2017/s/Paper 21/

33 Which statement about sulfuric acid is correct?

A It is made by the Haber process.

B It is made in the atmosphere by the action of lightning.

C It reacts with ammonia to produce a fertiliser.

D It reacts with copper metal to produce hydrogen gas.

Topic Chem 12 **Q# 70/** iGCSE Chemistry/2017/m/Paper 22/

33 The ions present in ammonium sulfate are formed from the products of the Contact and Haber processes.

Both of these processes involve the use of a catalyst.

Which row is correct?

	ion	formed from	process	catalyst
A	ammonium	ammonia	Contact	iron
B	ammonium	ammonia	Haber	vanadium(V) oxide
C	sulfate	sulfuric acid	Contact	vanadium(V) oxide
D	sulfate	sulfuric acid	Haber	iron

Topic Chem 13 **Q# 71/** iGCSE Chemistry/2017/w/Paper 21/

34 Some marble chips (calcium carbonate) are heated strongly and substances X and Y are formed.

Substance X is a white solid that reacts with water, giving out heat. Substance Y is a colourless gas.

What are substances X and Y?

	X	Y
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

Topic Chem 13 **Q# 72/** iGCSE Chemistry/2017/s/Paper 23/

34 Two equations are shown.

reaction 1 $CaCO_3 \rightarrow CaO + CO_2$

reaction 2 $CaO + H_2O \rightarrow Ca(OH)_2$

Which terms describe reactions 1 and 2?

	reaction 1	reaction 2
A	reduction	hydration
B	reduction	hydrolysis
C	thermal decomposition	hydration
D	thermal decomposition	hydrolysis

Topic Chem 13 **Q# 73/** iGCSE Chemistry/2017/s/Paper 22/

34 Statements about methods of manufacture and uses of calcium oxide are shown.

1 It is manufactured by reacting acids with calcium carbonate.

2 It is manufactured by heating calcium carbonate.

3 It is used to desulfurise flue gases.

4 It is used to treat alkaline soil.

Which statements are correct?

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

Topic Chem 13 **Q# 74/** iGCSE Chemistry/2017/s/Paper 21/

34 Which statement is **not** correct?

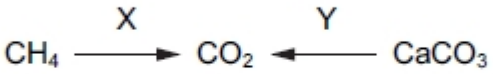
A Converting limestone into lime is a thermal decomposition reaction.

B Flue gas desulfurisation is a neutralisation reaction.

C In the extraction of iron, calcium carbonate is converted into calcium oxide.

D Slaked lime is added to soil as a fertiliser.

32 Two reactions, X and Y, produce carbon dioxide.



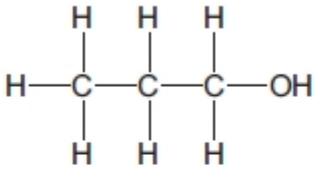
Which types of reaction are X and Y?

	X	Y
A	combustion	combustion
B	combustion	thermal decomposition
C	thermal decomposition	combustion
D	thermal decomposition	thermal decomposition

Topic Chem 14

Q# 76/ iGCSE Chemistry/2017/w/Paper 23/

35 The structure of compound R is shown.



What is R?

A propane

B propanoic acid

C propanol

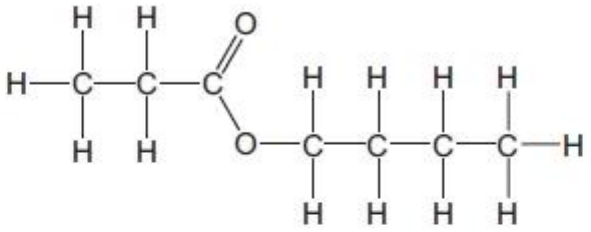
D propene

36 Fuel oil and naphtha are two fractions obtained from petroleum.

What are the major uses of these fractions?

	fuel oil	naphtha
A	jet fuel	making chemicals
B	jet fuel	making roads
C	ship fuel	making chemicals
D	ship fuel	making roads

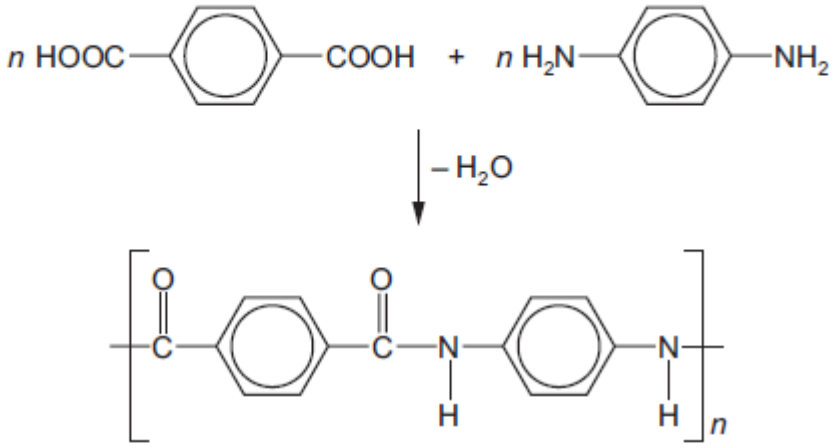
39 The structure of an ester is shown.



Which combination of carboxylic acid and alcohol produces this ester?

	carboxylic acid	alcohol
A	butanoic acid	ethanol
B	butanoic acid	propanol
C	ethanoic acid	butanol
D	propanoic acid	butanol

40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

	how the polymer is formed	type of polymer
A	addition polymerisation	polyamide
B	addition polymerisation	polyester
C	condensation polymerisation	polyamide
D	condensation polymerisation	polyester

35 The structures of four organic compounds are shown.

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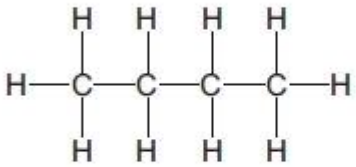

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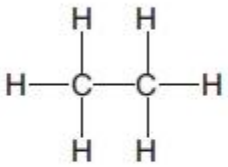

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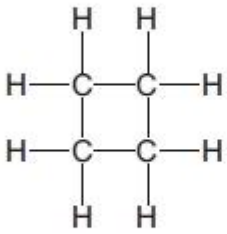

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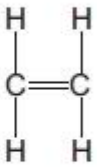


Which compounds are unsaturated?

A S only **B** T and U **C** U only **D** V only

36 Which statement is **not** correct?

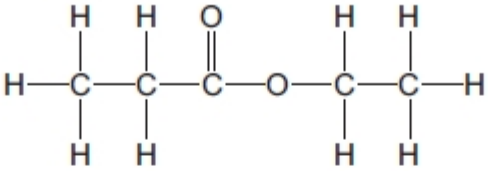
A Petroleum is a mixture of hydrocarbons.

B The main constituent of natural gas is ethane.

C The naphtha fraction of petroleum is used for making chemicals.

D When natural gas burns in air, carbon dioxide and water are formed.

39 The structure of an ester is shown.



Which substances react to form this ester?

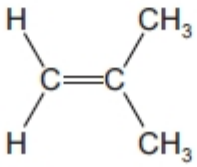
A ethanol and ethanoic acid

B ethanol and propanoic acid

C propanol and ethanoic acid

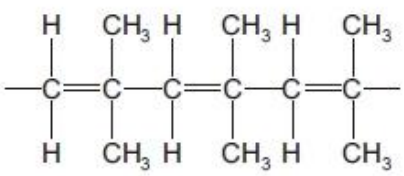
D propanol and propanoic acid

40 A polymer can be made from methyl propene.

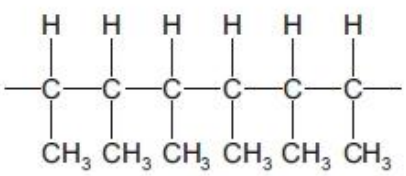


Which diagram shows the structure of the polymer?

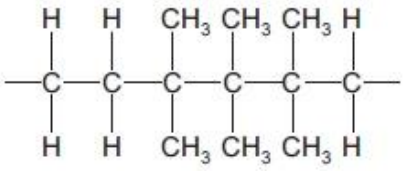
A



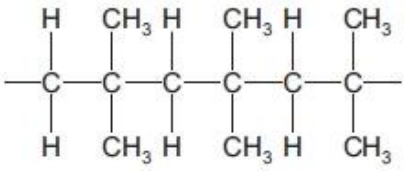
B



C



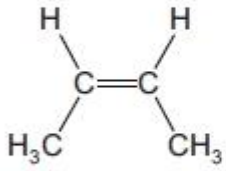
D



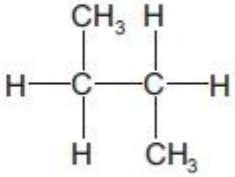
Topic Chem 14 **Q# 78/** iGCSE Chemistry/2017/w/Paper 21/

35 The structures of some organic molecules are shown.

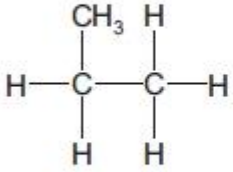
1



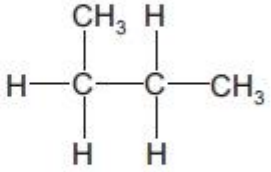
2



3



4



Which structures represent an alkane with four carbon atoms?

A 1 only **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

36 Some of the fractions obtained from the fractional distillation of petroleum are used as fuels for vehicles.

Which two fractions are used as fuels for vehicles?

A bitumen fraction and gasoline fraction

B bitumen fraction and naphtha fraction

C gasoline fraction and kerosene fraction

D kerosene fraction and lubricating fraction

37 X, Y and Z are three hydrocarbons.

X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do compounds X, Y and Z have in common?

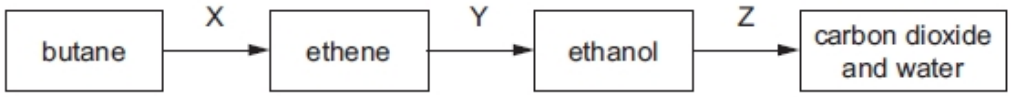
1 They are all alkenes.

2 They are all part of the same homologous series.

3 They all have the same boiling point.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

38 The diagram shows a reaction sequence.



Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

39 Which pair of compounds can be used to prepare $CH_3CH_2COOCH_2CH_3$?

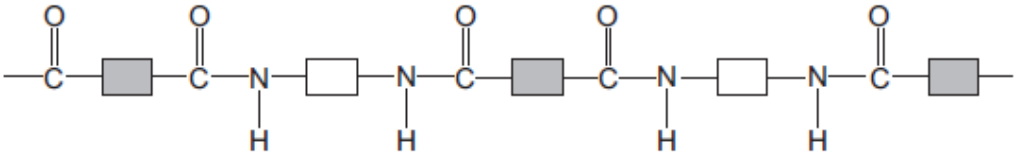
A ethanoic acid and ethanol

B ethanoic acid and propanol

C propanoic acid and ethanol

D propanoic acid and propanol

40 The structure of a synthetic polymer is shown.



The structure shows that it is a .....1..... . It is formed by .....2..... polymerisation.

Which words complete gaps 1 and 2?

	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

Topic Chem 14 **Q# 79/** iGCSE Chemistry/2017/s/Paper 23/

35 Fuel oil, gasoline, kerosene and naphtha are four fractions obtained from the fractional distillation of petroleum.

What is the order of the boiling points of these fractions?

	highest boiling point → lowest boiling point
A	fuel oil → kerosene → gasoline → naphtha
B	fuel oil → kerosene → naphtha → gasoline
C	gasoline → naphtha → kerosene → fuel oil
D	naphtha → gasoline → kerosene → fuel oil

35 Fuel oil, gasoline, kerosene and naphtha are four fractions obtained from the fractional distillation of petroleum.

What is the order of the boiling points of these fractions?

	highest boiling point → lowest boiling point
A	fuel oil → kerosene → gasoline → naphtha
B	fuel oil → kerosene → naphtha → gasoline
C	gasoline → naphtha → kerosene → fuel oil
D	naphtha → gasoline → kerosene → fuel oil

36 Butane and methylpropane are isomers with molecular formula C_4H_{10}.

Which statements are correct?

1 They have similar chemical properties.

2 They have the same general formula.

3 They have the same structural formula.

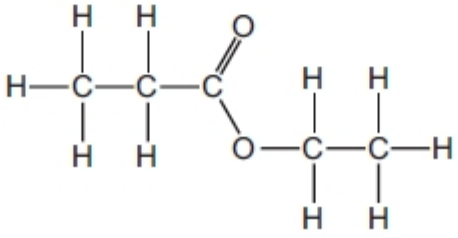
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

38 Ethanol can be produced by fermentation or by the catalytic addition of steam to ethene.

Which row shows an advantage and a disadvantage for each process?

	fermentation		catalytic addition of steam to ethene	
	advantage	disadvantage	advantage	disadvantage
A	batch process	slow reaction	continuous process	fast reaction
B	fast reaction	continuous process	pure ethanol formed	renewable raw material
C	renewable raw material	batch process	pure ethanol formed	slow reaction
D	renewable raw material	impure ethanol formed	fast reaction	finite raw material

39 The structure of an ester is shown.



Which alcohol and carboxylic acid produce this ester?

	alcohol	carboxylic acid
A	ethanol	ethanoic acid
B	ethanol	propanoic acid
C	propanol	ethanoic acid
D	propanol	propanoic acid

40 How can the amino acids in a protein be separated and identified?

A Add a locating agent to the protein.

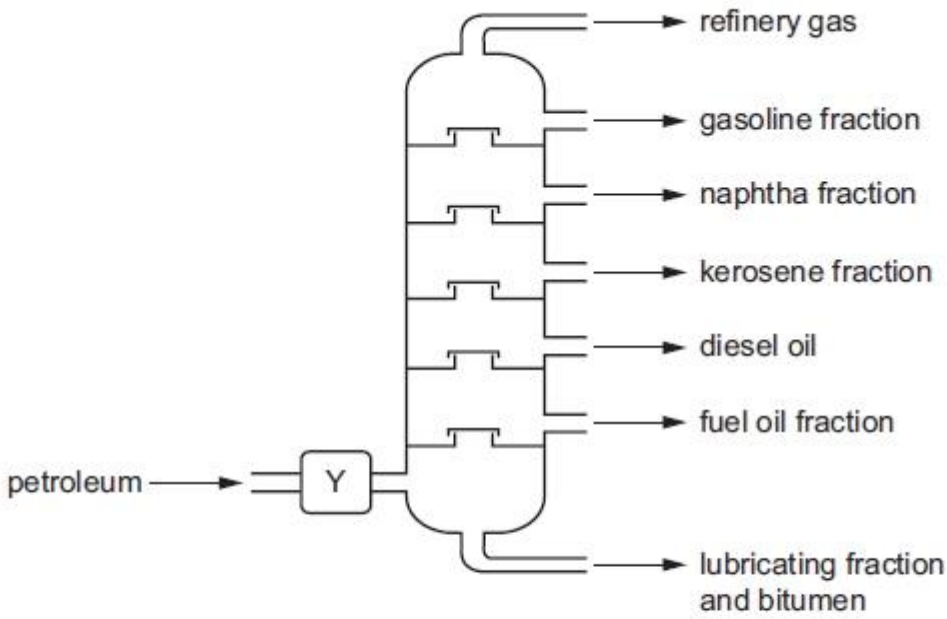
B Hydrolyse the protein and then use chromatography.

C Polymerise the protein and then add a locating agent.

D Use chromatography on a solution of the protein.

Topic Chem 14 **Q# 80/** iGCSE Chemistry/2017/s/Paper 22/

35 The industrial fractional distillation of petroleum is shown.



Which process happens at Y?

A burning

B condensation

C cracking

D evaporation

36 Which statement about homologous series is **not** correct?

A Alkenes have the same general formula, C_nH_{2n+2}.

B Each member of the homologous series of alkanes differs from the next by CH_2.

C The members of a homologous series all have similar chemical properties.

D The members of a homologous series all have the same functional group.

38 Ethanol is manufactured by fermentation or by the catalytic addition of steam to ethene.

What is an advantage of ethanol manufacture by fermentation instead of by the catalytic addition of steam to ethene?

A Ethanol manufactured by fermentation is purified by distillation.

B Ethanol manufacture by fermentation produces purer ethanol.

C Ethanol manufacture by fermentation uses large areas of land.

D Ethanol manufacture by fermentation uses renewable resources.

39 The formula of an ester is $CH_3CH_2CH_2COOCH_2CH_2CH_3$.

Which acid and alcohol react together to make the ester?

	acid	alcohol
A	butanoic acid	butanol
B	butanoic acid	propanol
C	propanoic acid	butanol
D	propanoic acid	propanol

40 Polyesters and polyamides are types of synthetic polymer.

Which statements are correct?

1 They are made by addition polymerisation.

2 They are made by condensation polymerisation.

3 The monomers from which they are made are unsaturated hydrocarbons.

4 The monomers from which they are made contain reactive functional groups at their ends.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

35 Which fraction of petroleum is **not** matched to its correct use?

	fraction	use
A	bitumen	making roads
B	gasoline	fuel for cars
C	kerosene	fuel for ships
D	naphtha	chemical industry

36 The diagram shows the structures of two organic molecules.

Which statement about these molecules is **not** correct?

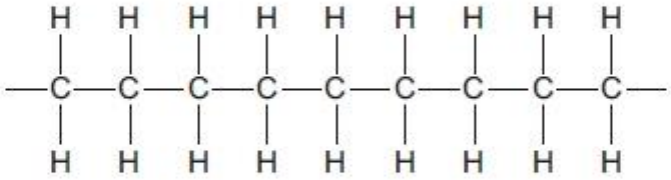
A They are both alcohols.

B They both produce carbon dioxide and water when they burn in oxygen.

C They contain different functional groups.

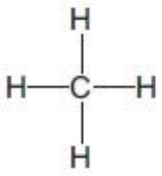
D They have the same general formula.

37 The diagram shows part of the molecule of a polymer.

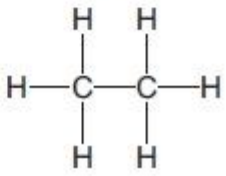


Which diagram shows the monomer from which this polymer could be manufactured?

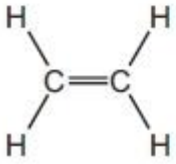
A



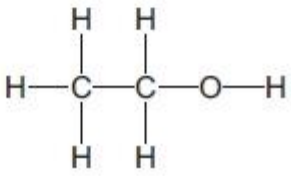
B



C



D



38 Ethanol is manufactured by fermentation or by the catalytic addition of steam to ethene.

Which statement is correct?

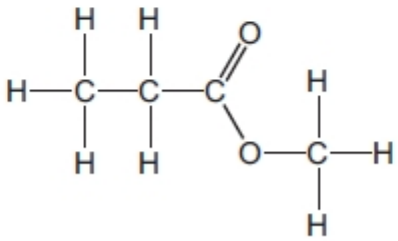
A Fermentation uses a higher temperature than the catalytic addition of steam to ethene.

B Fermentation uses a non-renewable resource.

C The catalytic addition of steam to ethene produces purer ethanol than fermentation.

D The catalytic addition of steam to ethene uses a biological catalyst.

39 The structure of an ester is shown.



Which row is correct?

	name of ester	names of the carboxylic acid and the alcohol used to form the ester
A	methyl propanoate	methanoic acid and propanol
B	methyl propanoate	methanol and propanoic acid
C	propyl methanoate	methanoic acid and propanol
D	propyl methanoate	methanol and propanoic acid

40 Keratin is a protein that is found in human hair.

Keratin is chemically broken down to produce amino acids.

What is the name of this chemical process?

A catalysis

B hydration

C hydrolysis

D polymerisation

34 The table shows the composition of four different types of petroleum.

fraction	Arabian Heavy /%	Arabian Light /%	Iranian Heavy /%	North Sea /%
gasoline	18	21	21	23
kerosene	11	15	13	15
diesel oil	18	21	20	24
fuel oil	53	43	46	38

Which type of petroleum is best for the motor vehicle industry?

A Arabian Heavy

B Arabian Light

C Iranian Heavy

D North Sea

35 Which reaction of ethene is **not** an addition reaction?

A reaction with bromine

B reaction with hydrogen

C reaction with oxygen

D reaction with steam

36 Ethanol is a fuel used in cars. It can be made from petroleum.

$C_4H_{10} \rightarrow C_2H_4 + C_2H_6$ cracking

$C_2H_4 + H_2O \rightarrow C_2H_5OH$ producing ethanol

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ burning

Compounds of how many homologous series appear in these equations?

A 1 **B** 2 **C** 3 **D** 4

37 Ethanol is produced from either ethene or sugar.

Which type of chemical reaction is used in each case?

	ethene → ethanol	sugar → ethanol
A	addition	fermentation
B	addition	fractional distillation
C	distillation	fermentation
D	distillation	fractional distillation

38 The structural formula of an organic compound is shown.

$$CH_3CH_2COOCH_3$$

What is the name of this compound?

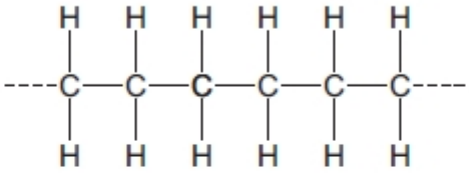
A butanoic acid

B ethyl ethanoate

C methyl propanoate

D propyl methanoate

39 The diagram shows the structure of an important product.



This product is formed by ..... 1 ..... of an ..... 2 ..... .

Which words complete gaps 1 and 2?

	1	2
A	addition polymerisation	alkane
B	addition polymerisation	alkene
C	cracking	alkane
D	cracking	alkene

40 Which pair of compounds reacts to form a condensation polymer?

A CH_3COOH and $C_2H_5NH_2$

B $HCOOH$ and HOC_2H_4OH

C $HOC_6H_{12}OH$ and $HOOCC_3H_6COOH$

D $H_2NC_2H_4NH_2$ and HOC_3H_6OH

Mark Scheme for Multiple Choice Questions

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/

1	C
2	C
3	C

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/

1	C
2	B
3	B

Q# 3/ iGCSE Chemistry/2017/w/Paper 21/

1	D
2	C
3	B

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/

2	D
3	B

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/

2	C
3	A

Q# 6/ iGCSE Chemistry/2017/s/Paper 21/

1	D
2	C
3	D

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/

1	A
2	B
3	C

Q# 8/ iGCSE Chemistry/2017/w/Paper 23/

4	D
5	B
6	A
7	A

Q# 9/ iGCSE Chemistry/2017/w/Paper 22/

4	B
5	B
6	C

Q# 10/ iGCSE Chemistry/2017/w/Paper 21/

4	A
5	C
6	B
7	A

Q# 11/ iGCSE Chemistry/2017/s/Paper 23/

4	C
5	C
6	C

Q# 12/ iGCSE Chemistry/2017/s/Paper 22/

4	A
5	B
6	B

Q# 13/ iGCSE Chemistry/2017/s/Paper 21/

4	B
5	C
6	D

Q# 14/ iGCSE Chemistry/2017/m/Paper 22/

4	C
5	C
6	C
7	A

Q# 15/ iGCSE Chemistry/2017/w/Paper 23/

8	B

Q# 16/ iGCSE Chemistry/2017/w/Paper 22/

7	A
8	B

Q# 17/ iGCSE Chemistry/2017/w/Paper 21/

8	B

Q# 18/ iGCSE Chemistry/2017/s/Paper 23/

7	C
8	A

Q# 19/ iGCSE Chemistry/2017/s/Paper 22/

7	B
8	A

Q# 20/ iGCSE Chemistry/2017/s/Paper 21/

7	B
8	A

Q# 21/ iGCSE Chemistry/2017/m/Paper 22/

8	A
9	D

Q# 22/ iGCSE Chemistry/2017/w/Paper 21/

9	A
10	D

Q# 23/ iGCSE Chemistry/2017/s/Paper 22/

9	B

Q# 24/ iGCSE Chemistry/2017/s/Paper 21/

10	B

Q# 25/ iGCSE Chemistry/2017/m/Paper 22/

10	D
11	B

Q# 26/ iGCSE Chemistry/2017/w/Paper 23/

11	C
12	B

Q# 27/ iGCSE Chemistry/2017/w/Paper 22/

11	B
12	B

Q# 28/ iGCSE Chemistry/2017/w/Paper 21/

11	B
12	B

Q# 29/ iGCSE Chemistry/2017/s/Paper 23/

11	D
13	D

Q# 30/ iGCSE Chemistry/2017/s/Paper 22/

11	B
12	C
13	B

Q# 31/ iGCSE Chemistry/2017/s/Paper 21/

11	B
12	C
13	B

Q# 32/ iGCSE Chemistry/2017/m/Paper 22/

12	D
13	B

Q# 33/ iGCSE Chemistry/2017/w/Paper 23/

13	B
14	D
15	A
16	A

Q# 34/ iGCSE Chemistry/2017/w/Paper 22/

13	B
14	D
15	C
16	B

Q# 35/ iGCSE Chemistry/2017/w/Paper 21/

13	B
14	B
15	C
16	C

Q# 36/ iGCSE Chemistry/2017/s/Paper 23/

14	B
16	C

Q# 37/ iGCSE Chemistry/2017/s/Paper 22/

14	A
16	A

Q# 38/ iGCSE Chemistry/2017/s/Paper 21/

14	C
15	A
16	C
17	D

Q# 39/ iGCSE Chemistry/2017/m/Paper 22/

14	B
15	A
16	A
17	D

Q# 40/ iGCSE Chemistry/2017/w/Paper 23/

17	B
18	B
19	C
20	B
21	B
22	A
23	A

Q# 41/ iGCSE Chemistry/2017/w/Paper 22/

17	B
18	B
19	B
20	A

Q# 42/ iGCSE Chemistry/2017/w/Paper 21/

17	B
18	B
19	A
20	B

Q# 43/ iGCSE Chemistry/2017/s/Paper 23/

18	A
19	D
20	D
21	C

Q# 44/ iGCSE Chemistry/2017/s/Paper 22/

18	B
19	B
20	A
21	A

Q# 45/ iGCSE Chemistry/2017/s/Paper 21/

18	A
19	C
20	D
21	D

Q# 46/ iGCSE Chemistry/2017/m/Paper 22/

18	B
19	C
20	D
21	B

Q# 47/ iGCSE Chemistry/2017/w/Paper 23/

21	B
22	A
23	A
23	A
24	D

Q# 48/ iGCSE Chemistry/2017/w/Paper 22/

21	B
22	B
23	A
24	D

Q# 49/ iGCSE Chemistry/2017/w/Paper 21/

21	C
22	A
23	B
23	B
24	D

Q# 50/ iGCSE Chemistry/2017/s/Paper 23/

22	A
23	D
24	D

Q# 51/ iGCSE Chemistry/2017/s/Paper 22/

23	B

Q# 52/ iGCSE Chemistry/2017/s/Paper 21/

22	A
23	C
24	D

Q# 53/ iGCSE Chemistry/2017/m/Paper 22/

22	C
23	C
24	B
25	D

Q# 54/ iGCSE Chemistry/2017/w/Paper 23/

25	A
26	C
27	D
28	C

Q# 55/ iGCSE Chemistry/2017/w/Paper 22/

25	A
26	B
27	B
28	A

Q# 56/ iGCSE Chemistry/2017/w/Paper 21/

25	A
26	A
27	D
28	D

Q# 57/ iGCSE Chemistry/2017/s/Paper 23/

25	A
27	D

Q# 58/ iGCSE Chemistry/2017/s/Paper 22/

25	D
26	B
27	C
28	C

Q# 59/ iGCSE Chemistry/2017/s/Paper 21/

25	A
26	B
27	C
28	C

Q# 60/ iGCSE Chemistry/2017/m/Paper 22/

26	C
27	D
28	C
29	B

Q# 61/ iGCSE Chemistry/2017/w/Paper 23/

29	C
30	C
31	A
32	B

Q# 62/ iGCSE Chemistry/2017/w/Paper 22/

29	C
30	D
31	A
32	C

Q# 63/ iGCSE Chemistry/2017/w/Paper 21/

29	C
30	B
31	C
32	B

Q# 64/ iGCSE Chemistry/2017/s/Paper 23/

30	C
31	B
32	B

Q# 65/ iGCSE Chemistry/2017/s/Paper 22/

29	A
30	C
31	A
32	D

Q# 66/ iGCSE Chemistry/2017/s/Paper 21/

29	A
30	D
31	D
32	C

Q# 67/ iGCSE Chemistry/2017/m/Paper 22/

30	C
31	A

Q# 68/ iGCSE Chemistry/2017/w/Paper 21/

33	D

Q# 69/ iGCSE Chemistry/2017/s/Paper 21/

33	C

Q# 70/ iGCSE Chemistry/2017/m/Paper 22/

33	C

Q# 71/ iGCSE Chemistry/2017/w/Paper 21/

34	C

Q# 72/ iGCSE Chemistry/2017/s/Paper 23/

34	C

Q# 73/ iGCSE Chemistry/2017/s/Paper 22/

34	C

Q# 74/ iGCSE Chemistry/2017/s/Paper 21/

34	D

Q# 75/ iGCSE Chemistry/2017/m/Paper 22/

32	B

Q# 76/ iGCSE Chemistry/2017/w/Paper 23/

35	C
36	C
37	B
38	B
39	D
40	C

Q# 77/ iGCSE Chemistry/2017/w/Paper 22/

35	D
36	B
37	B
38	B
39	B
40	D

Q# 78/ iGCSE Chemistry/2017/w/Paper 21/

35	C
36	C
37	B
38	B
39	C
40	B

Q# 79/ iGCSE Chemistry/2017/s/Paper 23/

35	B
36	B
38	D
39	B
40	B

Q# 80/ iGCSE Chemistry/2017/s/Paper 22/

35	D
36	A
38	D
39	B
40	D

Q# 81/ iGCSE Chemistry/2017/s/Paper 21/

35	C
36	C
37	C
38	C
39	B
40	C

Q# 82/ iGCSE Chemistry/2017/m/Paper 22/

34	D
35	C
36	C
37	A
38	C
39	B
40	C