CAMBRIDGE International Examinations

Excellence in education

Cambridge IGCSE

Cambridge IGCSE® Chemistry (0620)
Past and specimen paper questions and answers

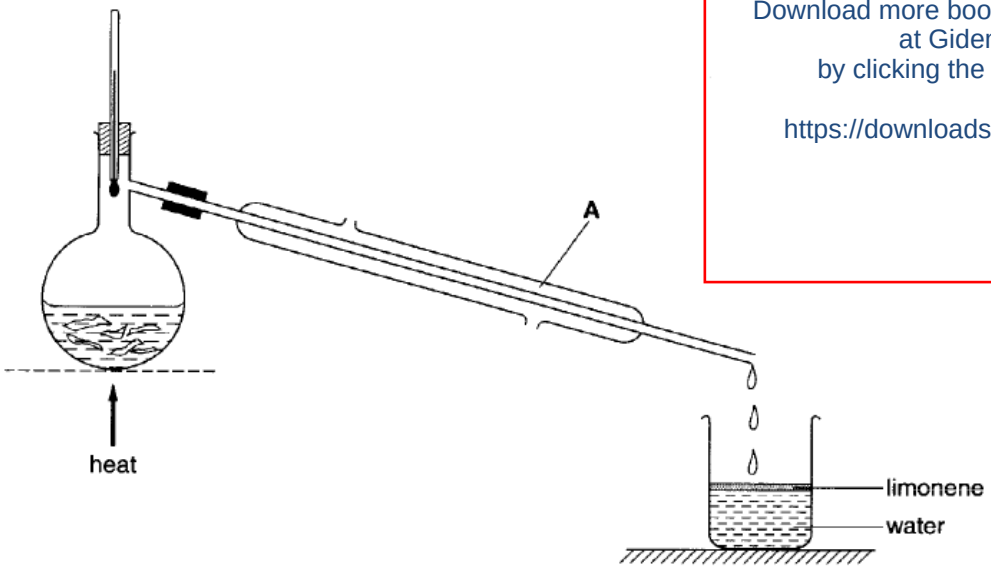
Contents

Experimental techniques

CORE question

Core 1

Limonene is a liquid hydrocarbon found in orange peel. It can be extracted by boiling the orange peel with water, using the apparatus shown below. The mixture of limonene and water distils at a temperature which is 1 °C below the boiling point of water.



(a) (i) State the name of the piece of apparatus labelled **A**.

.....[1]

(ii) Suggest what the reading on the thermometer will be when the limonene-water mixture is being distilled.

..... °C [1]

(iii) Limonene is less dense than water. What information in the diagram shows this?

.....[1]

0620 Cambridge IGCSE Chemistry Specimen Paper (2016)

Paper 1 Question 2

2 What is always true for a pure substance?

A It always boils at 100 °C.

B It contains only one type of atom.

C It has a sharp melting point.

D It is solid at room temperature.

EXTENSION question

Extension 1

(d) Chromatography is used to identify simple carbohydrates, such as sugars, in plant material.

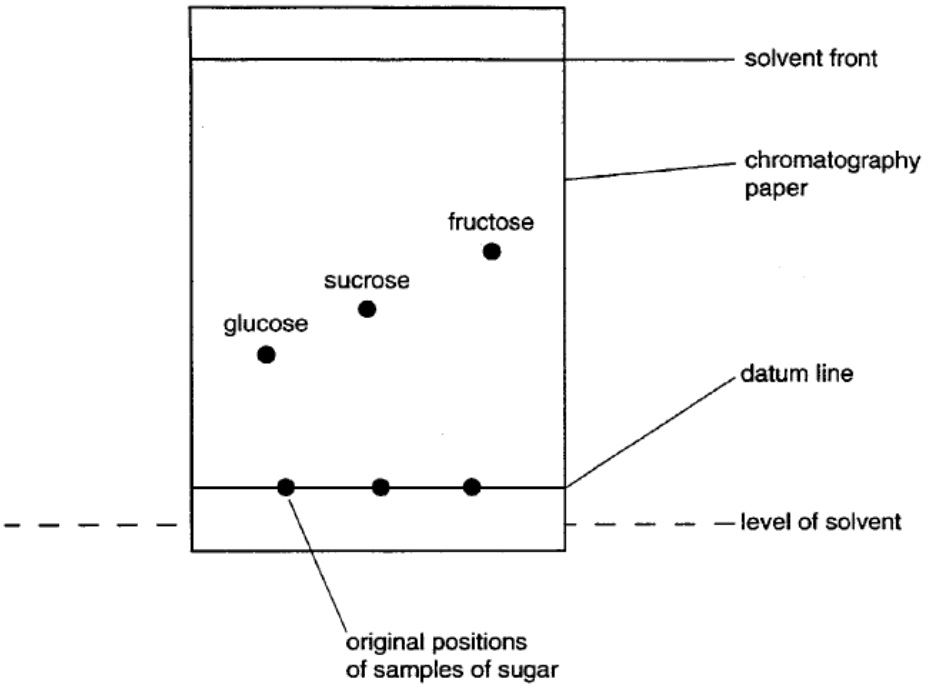


Fig. 5.2

A leaf is ground with 50% aqueous alcohol to give a colourless solution of the sugars. This solution is concentrated and a chromatogram is obtained. The paper is sprayed with resorcinol solution.

(i) A common use of ethanol is in alcoholic drinks. In this experiment it is used as a solvent. Give one other use.

.....[1]

(ii) Why is the datum line drawn in pencil?

.....[1]

(iii) Suggest a reason why it is necessary to spray the chromatogram with resorcinol.

.....

.....[2]

(iv) Describe how chromatography could be used to show that the hydrolysis of starch produces only one sugar, glucose.

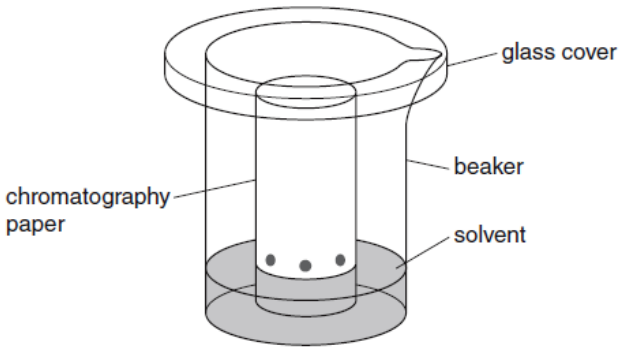
.....

.....[2]

0620 Cambridge IGCSE Chemistry Specimen Paper (2016)

Paper 2 Question 1

1 Amino acids are colourless and can be separated and identified by chromatography.



What additional apparatus is required to identify the amino acids present in a mixture?

A a locating agent

B a ruler

C a ruler and a locating agent

D neither a ruler or a locating agent

Experimental techniques – answers

Core 1

(a) (i) (Liebig) condenser

(ii) 99

(iii) limonene floats on water / on top of the water

Specimen Paper 1

2 C

Extension 1

(d) (i) fuel or making esters or antiseptic or ethanoic acid or vinegar or thermometers

(ii) does not dissolve or does not contain dyes

(iii) two of these
to develop it or locating agent
samples are colourless
to make them visible

(iv) any two of these
only one spot
same position or Rf value
compare with glucose

Specimen Paper 2

1 C

Particles, atomic structure, ionic bonding, the Periodic Table

CORE questions

Core 1

(b) Describe three things you would **see** when a small piece of sodium is added to a beaker of water.

1. .....

2. .....

3. .....

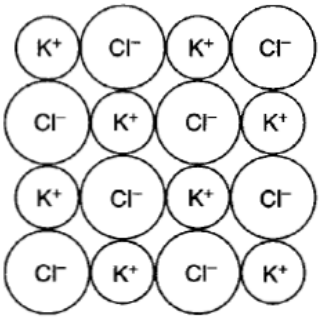
[3]

(c) Lithium (Li), sodium (Na), and potassium (K) are in the same group of the Periodic Table. The following table compares the properties and electronic structure of these elements. Suggest a value for the boiling point of sodium and complete the rest of the table.

element	*boiling point / °C*	*reaction with water*	*electronic structure*
lithium	1342	steady reaction	2.1
sodium		rapid reaction	
potassium	760		2.8.8.1

[3]

(d) When potassium burns in chlorine, potassium chloride is formed. Part of the structure of potassium chloride is shown below.



(i) Describe the type of bonding in potassium chloride.

.....[1]

(ii) State the simplest formula for potassium chloride.

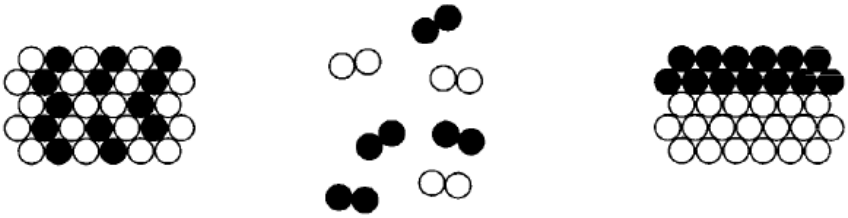
.....[1]

(iii) Explain why solid potassium chloride does not conduct electricity.

.....[1]

Core 2

(iii) Which one of the following, **A**, **B** or **C**, is a correct representation of an alloy?
Put a ring around the correct answer.



A **B** **C** [1]

(b) Zinc is a metal. State three physical properties that **all** metals have in common.

1. .....

2. .....

3. .....

[3]

Core 3

6 Carbon-14 is a radioactive isotope which is formed in the upper atmosphere.

(a) Explain the meaning of the terms

(i) *radioactive,* .....

.....[1]

(ii) *isotope.* .....

.....[2]

(b) State one medical use of radioactive isotopes.

.....[1]

(c) Carbon-14 has a nucleon (mass) number of 14.
Complete the table below to show the type of charge and number of particles present in one atom of carbon-14.

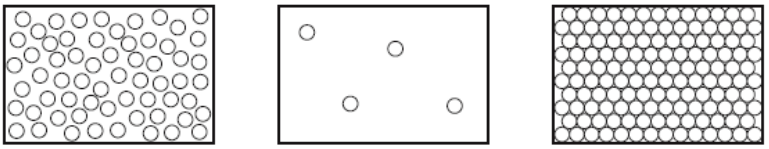
type of particle	*type of charge on the particle*	*number of particles present*
proton		
neutron		
electron		

[6]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 1

1 The diagrams show the arrangement of particles in three different physical states of substance X.



state 1 state 2 state 3

Which statement about the physical states of substance X is correct?

A Particles in state 1 vibrate about fixed positions.

B State 1 changes to state 2 by diffusion.

C State 2 changes directly to state 3 by condensation.

D The substance in state 3 has a fixed volume.

Paper 1 Question 3

3 Element Y has a nucleon number of 19 and a proton number of 9.

Which group in the Periodic Table does it belong to?

A I **B** III **C** VII **D** VIII

Paper 1 Question 4

4 The nucleon number and proton number of the lithium atom are shown by the symbol $^{7}_{3}Li$.

What is the correct symbol for the lithium ion in lithium chloride?

A $^{6}_{2}Li^{-}$ **B** $^{6}_{3}Li^{+}$ **C** $^{7}_{3}Li^{+}$ **D** $^{7}_{3}Li^{-}$

Paper 1 Question 6

6 The table shows the structure of different atoms and ions.

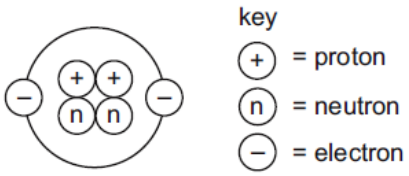
particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Mg	12	24	12	W	12
Mg^{2+}	X	24	12	12	10
F	9	19	9	Y	9
F^-	9	19	9	10	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	10	10	9	9
B	10	12	10	9
C	12	10	9	10
D	12	12	10	10

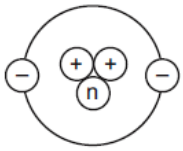
Paper 1 Question 7

7 The diagram shows the structure of an atom.

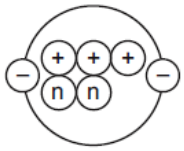


Which diagram shows the structure of an isotope of this atom?

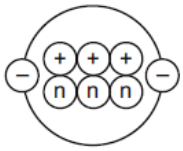
A



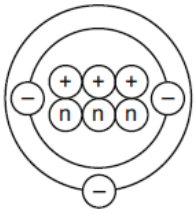
B



C



D



Paper 1 Question 8

8 Which two elements react together to form an ionic compound?

element	electronic structure
R	2,4
T	2,8
X	2,8,1
Z	2,8,7

A R and T **B** T and X **C** X and Z **D** Z and R

Paper 1 Question 11

11 The chemical formulae of two substances, W and X, are given.

W $NaAlSi_3O_8$

X $CaAl_2Si_2O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

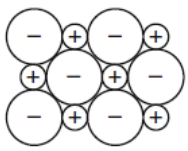
3 X contains twice as much aluminium as W.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 1, 2 and 3

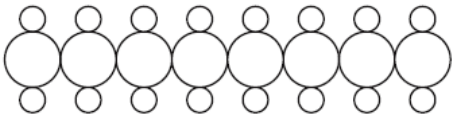
Paper 1 Question 28

28 Which diagram could represent the structure of an alloy?

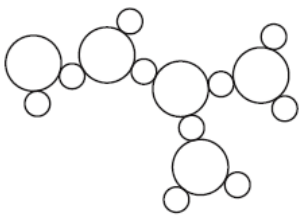
A



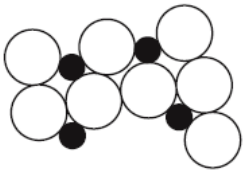
B



C

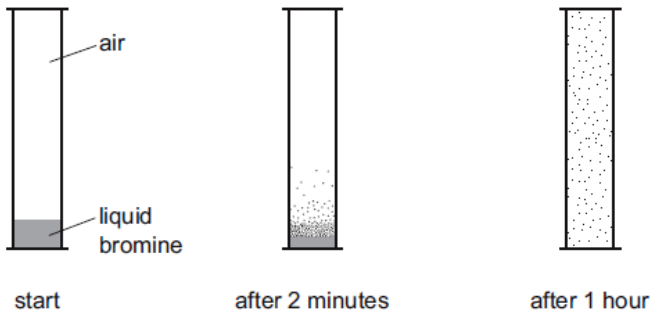


D



Paper 3 Question 2

(b) A teacher placed a small amount of liquid bromine in the bottom of a sealed gas jar of air. After two minutes red-brown fumes were seen just above the liquid surface. After one hour the red-brown colour had spread completely throughout the gas jar.



Use the kinetic particle model of matter to explain these observations.

.....

.....

..... [3]

EXTENSION question

Extension 1

The element scandium, proton (atomic) number, $Z = 21$, was discovered by L Nilson in Sweden in 1879.

(a) It forms only one ion which has the formula $^{45}_{21}Sc^{3+}$.

(i) How many electrons, protons and neutrons are there in this ion?

number of electrons .....

number of protons .....

number of neutrons .....

(ii) Predict the electron distribution of this ion.

.....

[4]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

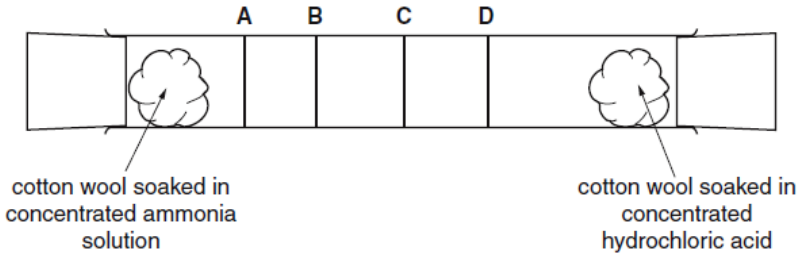
Paper 2 Question 2

2 The diagram shows the diffusion of hydrogen chloride and ammonia in a glass tube.

The gases are given off by the solutions at each end of the tube.

When hydrogen chloride and ammonia mix they produce a white solid, ammonium chloride.

Which line shows where the white solid is formed?



Paper 3 Question 5

(b) The symbols for two isotopes of iron are shown below.

$^{54}_{26}Fe$ $^{57}_{26}Fe$

(i) How do these two isotopes differ in their atomic structure?

..... [1]

(ii) Determine the number of neutrons present in one atom of the isotope $^{57}_{26}Fe$.

..... [1]

(iii) Determine the number of electrons in one Fe^{3+} ion?

..... [1]

Paper 4 Question 2

2 The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	18	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....

..... [1]

(ii) **A**, **B** and **C** are all particles of the same element.

.....

..... [1]

(iii) Particles **A** and **C** are isotopes of the same element.

.....

..... [2]

(b) **(i)** What is the electronic structure of particle **A**?

..... [1]

(ii) Is element **A**, a metal or a non-metal? Give a reason for your choice.

.....

..... [1]

[Total: 6]

Paper 4 Question 3

(ii) Compare the movement and arrangement of the molecules in solid nitrogen to those in nitrogen gas.

.....

.....

.....

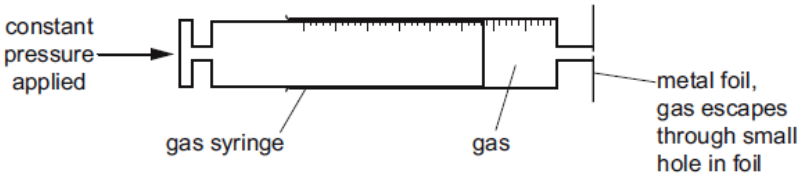
..... [3]

(b) A sealed container contains nitrogen gas. The pressure of the gas is due to the molecules of the gas hitting the walls of the container.
Use the kinetic theory to explain why the pressure inside the container increases when the temperature is increased.

.....

..... [2]

The following apparatus can be used to measure the rate of diffusion of a gas.



The following results were obtained.

gas	temperature / °C	rate of diffusion in cm^3 / min
nitrogen	25	1.00
chlorine	25	0.63
nitrogen	50	1.05

(c) (i) Explain why nitrogen gas diffuses faster than chlorine gas.

.....

..... [2]

(ii) Explain why the nitrogen gas diffuses faster at the higher temperature.

..... [1]

Particles, atomic structure, ionic bonding, the Periodic Table – answers

Core 1

(b) any three observations such as:
floats on water
moves about
bursts into flame
fizzes
bubbles
dissolves
disappears
goes into a ball

(c)

boiling point	reaction with water	electronic structure
900 – 1100	very vigorous	

(d) **(i)** ionic / electrovalent

(ii) KC*l*

(iii) ions are not free to move

Core 2

(iii) A

(b) any three from:
conduct heat
conduct electricity
malleable
ductile
sonorous
shiny

Core 3

(a) **(i)** ionising particles given off or named radiation, α, β and γ

(ii) atoms with the same number of protons / same element / same atomic number different numbers of neutrons / different mass numbers

(b) any suitable such as:
finding out how well an organ is carrying out its function treating cancers
sterilising surgical instruments

(c) + 6

none 8
6

Specimen Paper 1

1 D

3 C

4 C

6 D

7 A

8 C

11 B

28 D

Specimen Paper 3

2 **(b)** Any three of:
bromine evaporates / liquid evaporates;
more energetic particles change from liquid to vapour or gas;
diffusion;
random movement of particles / particles move everywhere / air and bromine particles are moving;
(bromine and air) particles get mixed up / collision of bromine and air particles;

Extension 1

(a) **(i)** 18e
21p
24n

(ii) 2.8.8

Specimen Paper 2

2 D

Specimen Paper 3 Question 5

5 (b) (i) number of neutrons / different nucleon number

(ii) 31

(iii) 23

Specimen Paper 4 Question 2

2 (a) (i) same number of protons and electrons

(ii) all have the same number of protons / same proton number / same atomic number

(iii) same number of protons / same proton number / same atomic number;
different number of neutrons / different nucleon number / different mass number;

(b) (i) 2, 8, 5

(ii) non-metal because it accepts electrons / needs 3e to complete outer energy level / because it is in Group V or 5e in outer shell
note: need both non-metal and reason for one mark

Specimen Paper 4 Question 3

3 (ii)

	solid	gas
pattern:	regular / lattice	random / irregular / no pattern;
distance:	close	far apart / spread out;
movement:	vibrate / fixed position	moving;

note: comparison must be made

(b) particles have more energy / move faster;
collide harder / collide more frequently / more collisions / collide with more force;
allow: molecules instead of particles

(c) (i) nitrogen has smaller M_r;
nitrogen (molecules) move faster (than chlorine molecules) / ora;
note: comparison must be made

(ii) (at higher temperature) molecules move faster / have more energy

Air and water

CORE questions

Core 1

Use

(a) State **two** uses of water in the home.

1. .....

2. .....[2]

(b) State the boiling point of pure water.

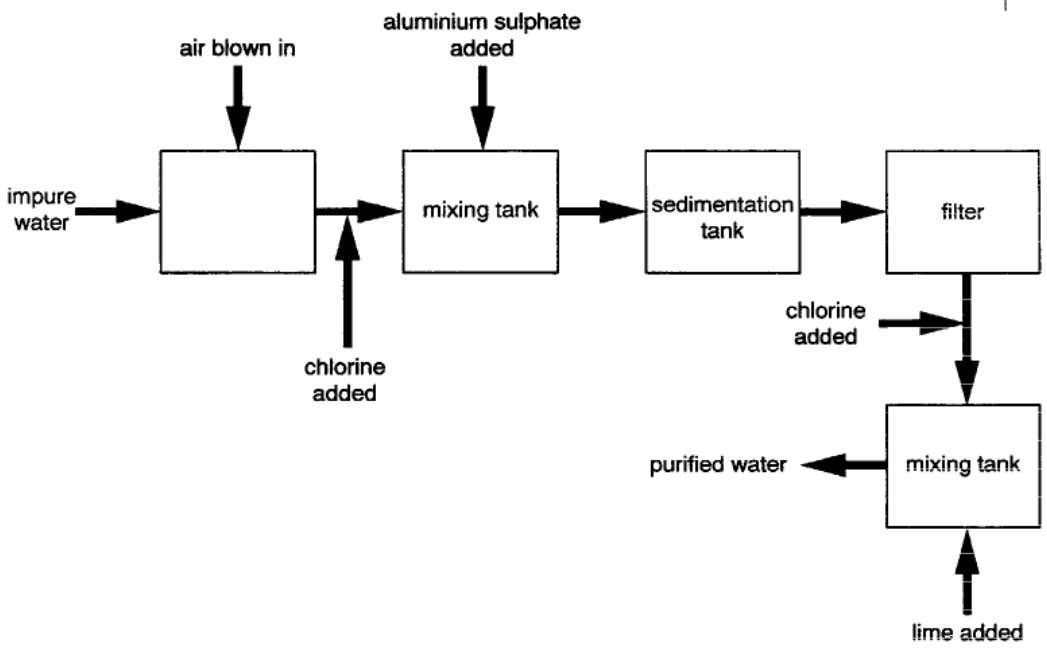
.....[2]

(c) Describe a **chemical** test for water.

Test .....

Result .....[2]

The flow chart shows the stages in water purification.



(d) Air is blown into impure water to help remove dissolved iron compounds.

(i) How could you test for iron(III) ions in the water?

Test .....

Result .....[2]

(ii) Which **two** gases make up most of the air?

..... and .....[2]

Core 1

(e) When chlorine is added during the water purification process, the water becomes acidic.

(i) Why is chlorine added during the water purification process?

.....[1]

(ii) Suggest why lime is added after chlorination.

.....

.....[2]

(f) The filter consists of a mixture of sand and stones.

Suggest how the filter helps purify the water.

.....

.....

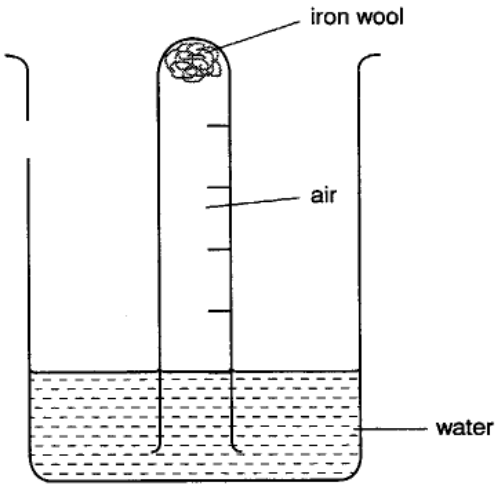
.....

.....[3]

ALTERNATIVE TO PRACTICAL question

Alternative to practical 1

A student set up the experiment below to investigate the effect of water and air on iron wool.



(a) Describe the appearance of the iron after 1 week.

.....[1]

(b) Predict the level of the water in the tube after 1 week. Explain your prediction.

level of water .....

explanation .....

.....[2]

(c) Suggest what would happen if the air in the tube after 1 week was tested with a lighted splint. Explain your suggestion.

result of test .....

explanation .....

.....[2]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 17

17 When pink cobalt(II) chloride crystals are heated they form steam and a blue solid.

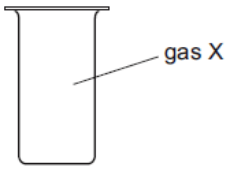
When water is added to the blue solid, it turns pink and becomes hot.

Which terms describe the pink cobalt(II) chloride crystals and the reactions?

	pink cobalt(II) chloride	reactions
A	aqueous	irreversible
B	anhydrous	reversible
C	hydrated	irreversible
D	hydrated	reversible

Paper 1 Question 26

26 X is a monatomic gas.



Which statement about gas X is correct?

A X burns in air.

B X is coloured.

C X is unreactive.

D X will displace iodine from potassium iodide.

Paper 1 Question 30

30 The table gives the composition of the atmosphere of four newly discovered planets.

planet	composition of atmosphere
W	argon, carbon dioxide and oxygen
X	argon, nitrogen and oxygen
Y	argon, carbon dioxide and methane
Z	methane, nitrogen and oxygen

On which planets is the greenhouse effect likely to occur?

A W only

B W, X and Z

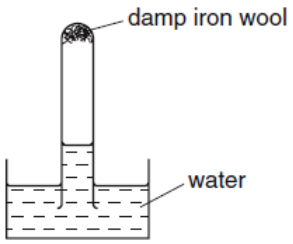
C W and Y only

D W, Y and Z

Paper 1 Question 33

33 A test-tube containing damp iron wool is inverted in water.

After three days, the water level inside the test-tube has risen.



Which statement explains this rise?

A Iron oxide has been formed.

B Iron wool has been reduced.

C Oxygen has been formed.

D The temperature of the water has risen.

Paper 1 Question 34

34 Greenhouse gases may contribute to climate change.

Two of these gases are emitted into the atmosphere as a result of processes within animals.

Gas .....1..... is produced by process .....3..... .

Gas .....2..... is produced by process .....4..... .

Which row correctly complete gaps 1, 2, 3 and 4?

	1	2	3	4
A	CO	C_2H_6	digestion	respiration
B	CO	C_2H_6	respiration	digestion
C	CO_2	CH_4	digestion	respiration
D	CO_2	CH_4	respiration	digestion

Paper 3 Question 5

(c) Pure iron rusts very easily.

Describe and explain **one** method of preventing rusting.

method .....

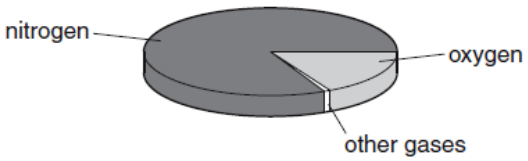
explain why this method works .....

..... [2]

Paper 3 Question 7

12

7 The pie chart shows the composition of air.



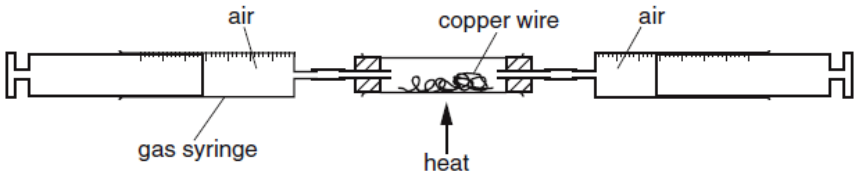
(a) (i) What is the percentage of nitrogen in the air?

..... [1]

(ii) Apart from nitrogen and oxygen, state the names of **two** gases present in unpolluted air.

..... and ..... [2]

(b) The percentage of oxygen in air can be found using the apparatus shown below.



Air is passed backwards and forwards over the heated copper using the syringes. The copper reacts with oxygen in the air.

copper + oxygen → copper(II) oxide

As the experiment proceeds, suggest what happens to

(i) the total volume of air in the gas syringes,

..... [1]

(ii) the mass of the wire in the tube.

..... [1]

EXTENSION question

Extension 1

Suggest an explanation why exposure to atmospheric pollution changes basic lead(II) carbonate into lead(II) sulphate.

.....

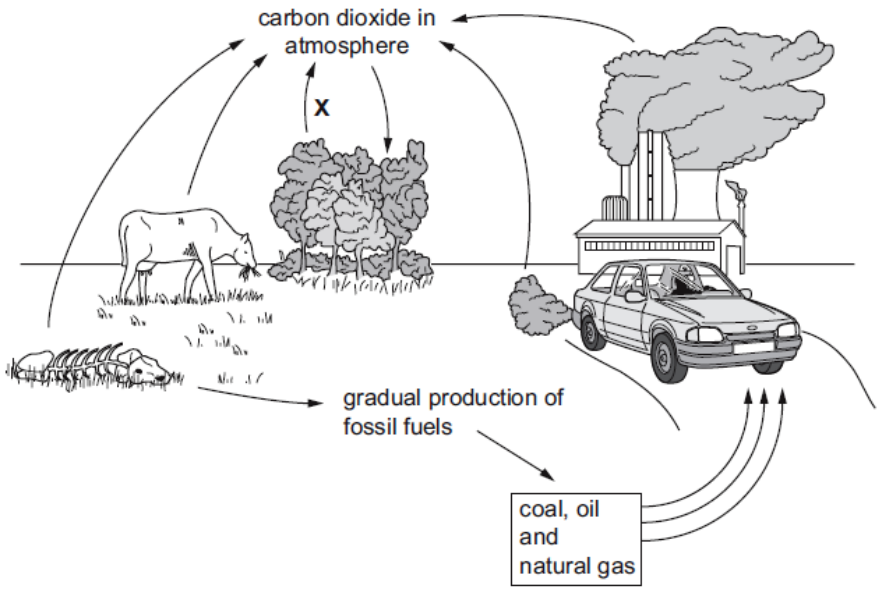
.....

.....[3]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 31

31 The diagram shows the carbon cycle.



Which process is shown by the arrow marked X?

A combustion

B photosynthesis

C respiration

D transpiration

Paper 2 Question 32

32 A catalytic converter removes harmful gases from motor car exhausts.

Which reaction does **not** take place in a catalytic converter?

A $2CO + O_2 \rightarrow 2CO_2$

B $N_2 + 2CO_2 \rightarrow 2NO + 2CO$

C $2NO_2 \rightarrow N_2 + 2O_2$

D $2NO_2 + 4CO \rightarrow N_2 + 4CO_2$

Air and water – answers

Core 1

(a) any two uses
e.g. washing, drinking, sanitation, growing plants, etc.

(b) 100 °C

(c) test add anhydrous / white copper sulphate or anhydrous / blue cobalt chloride
result copper sulphate goes blue / cobalt chloride goes pink

(d) **(i)** test add (sodium / potassium / other suitable) hydroxide or add ammonia
result brown / red-brown precipitate

(ii) nitrogen, oxygen

(e) **(i)** to kill bacteria / germs / to disinfect the water

(ii) lime is alkaline
to neutralise the acid / chlorine / to increase the pH

(f) impure water contains some solids trapped on stones / sand water drains through

Alternative to Practical 1

(a) rusty / brown

(b)

level of water	level rises / goes up tube
explanation	oxygen used up / $\frac{1}{5}$ of way up tube / 20% oxygen

(c)

result	would go out / pops
explanation	oxygen absent / hydrogen present

Specimen Paper 1

17 D

26 C

30 D

33 A

34 D

Specimen Paper 3

5 **(c)** suitable method, e.g. coating with paint / zinc / unreactive metal / plastic / oil / grease / galvanising / sacrificial protection;

suitable reason, e.g. stops air / water reaching surface;
note: reason must be consequential to the method chosen

7 **(a)** **(i)** 78 (%)
allow: 78–80

(ii) Any two of:
carbon dioxide; argon; neon; xenon; helium; radon; water;
not: hydrogen

(b) **(i)** decreases / gets less / gets lower / gets used up

(ii) increases / gets more / greater

Extension 1

Any three from:
acid rain
sulfur dioxide
burning of fossil fuels containing sulfur
sulfuric acid

Specimen Paper 2

31 C
32 B

Acids, bases and salts

CORE questions

Core 1

(d) The equations **A**, **B**, **C** and **D** show some reactions of acids.

A $Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$

B $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

C $CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$

D $CaO + 2HCl \rightarrow CaCl_2 + H_2O$

Answer the following questions by choosing from equations **A**, **B**, **C** or **D**.
You may use each letter once, more than once or not at all.

(i) Which reaction produces an explosive gas? ☐

(ii) Which reaction forms a sulphate? ☐

(iii) Which reaction gives off a gas which turns lime water cloudy? ☐

(iv) Which is a reaction between a hydroxide and an acid? ☐

(v) Which reaction involves a transition element? ☐

[5]

(e) Describe how crystals of sodium chloride can be made in the laboratory from hydrochloric acid and aqueous sodium hydroxide.

.....

.....

.....[3]

Core 2

Many buildings are made of concrete. Concrete is a mixture of cement, sand, water and small stones.

(a) Explain what is meant by the term *mixture*.

.....

.....[2]

(b) Sand is largely silicon(IV) oxide. Pure silicon(IV) oxide is a compound. Explain what is meant by the term *compound*.

.....

.....[2]

(c) Cement is made by roasting clay with crushed chalk. Chalk is largely calcium carbonate. When cement is made, some of the calcium carbonate breaks down to calcium oxide.

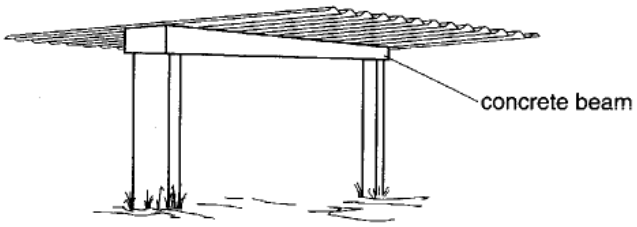
$CaCO_3(s)$	$\rightarrow$	$CaO(s)$	+	$CO_2(g)$
calcium carbonate		calcium oxide		carbon dioxide

(i) What type of chemical reaction is this?

.....[1]

Core 2

(d) The diagram shows a concrete beam supporting the roof of a shelter.



Concrete is quite porous. When rainwater soaks through it, some of the calcium oxide slowly dissolves to form aqueous calcium hydroxide. This solution is strongly alkaline.

(i) What is another name for calcium hydroxide?
Put a ring around the correct answer.

limestone

quicklime

slaked lime

soda [1]

(ii) Suggest a value for the pH of aqueous calcium hydroxide.

.....[1]

(iii) How would you use litmus paper to show that aqueous calcium hydroxide is alkaline?

.....

.....[2]

ALTERNATIVE TO PRACTICAL question

Alternative to practical 1

Indigestion tablets contain calcium carbonate.The tablets work by neutralising the excess of acid in the stomach.

calcium carbonate + hydrochloric acid ----> carbon dioxide + calcium chloride + water

You are provided with 2 different brands of indigestion tablet, **F** and **G**, dilute hydrochloric acid and common laboratory apparatus.

Plan an investigation to find which brand of indigestion tablet is best at neutralising acid. Your answer should include details of the apparatus to be used and the main practical steps in the investigation.

apparatus .....

.....

plan of investigation .....

.....

.....

.....

.....[5]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 11

11 The chemical formulae of two substances, W and X, are given.

W $NaAlSi_3O_8$

X $CaAl_2Si_2O_8$

Which statements are correct?

1 W and X contain the same amount of oxygen.

2 W contains three times as much silicon as X.

3 X contains twice as much aluminium as W.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 1, 2 and 3

Paper 1 Question 14

14 Which process is **not** exothermic?

A burning a fossil fuel

B obtaining lime from limestone

C radioactive decay of ^{235}U

D reacting hydrogen with oxygen

Paper 1 Question 19

19 Carbon dioxide gas reacts with aqueous sodium hydroxide.

Which type of reaction takes place?

A decomposition

B fermentation

C neutralisation

D oxidation

Paper 1 Question 20

20 An aqueous solution of the organic compound methylamine has a pH greater than 7.

Which statement about methylamine is correct?

A It neutralises an aqueous solution of sodium hydroxide.

B It reacts with copper(II) carbonate to give carbon dioxide.

C It reacts with hydrochloric acid to form a salt.

D It turns blue litmus red.

Paper 1 Question 21

21 A solution contains barium ions and silver ions and one type of anion.

What could the anion be?

A chloride only

B nitrate only

C sulfate only

D chloride or nitrate or sulfate

Paper 1 Question 22

22 A mixture containing two anions was tested and the results are shown below.

test	result
dilute nitric acid added	effervescence of a gas which turned limewater milky
dilute nitric acid added, followed by aqueous silver nitrate	yellow precipitate formed

Which anions were present?

A carbonate and chloride

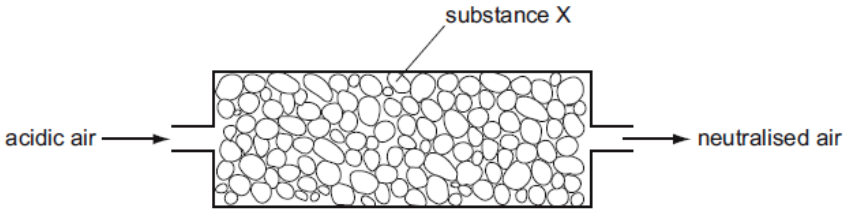
B carbonate and iodide

C sulfate and chloride

D sulfate and iodide

Paper 1 Question 36

36 Air containing an acidic impurity was neutralised by passing it through a column containing substance X.



What is substance X?

A calcium oxide

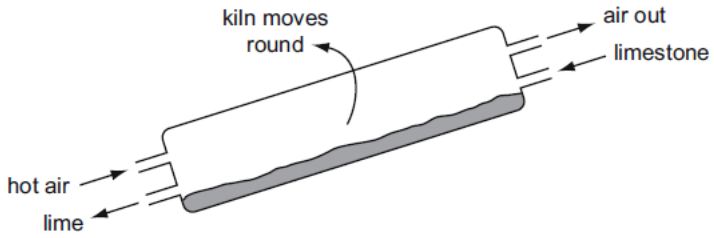
B sand

C sodium chloride

D concentrated sulfuric acid

Paper 3 Question 4

4 The diagram shows a rotary lime kiln used to make lime from limestone.
Limestone is fed in at the top of the kiln and lime comes out at the bottom.



(a) State the chemical name for lime?

.....[1]

(b) State the name of the type of chemical reaction that takes place in the kiln.

.....[1]

(c) Suggest why the air coming out of the kiln has a greater percentage of carbon dioxide than the air entering the kiln.

.....[1]

(d) State **one** use for lime.

.....[1]

(g) Describe how hydrochloric acid and limewater can be used to show that carbonate ions are present in calcium carbonate.

.....

.....

.....[3]

Paper 3 Question 6

(iii) Describe a test for chlorine.

test .....

result ..... [2]

(f) Hydrochloric acid reacts with the base calcium hydroxide.

(i) Complete the word equation for this reaction.

hydrochloric acid + calcium hydroxide → ..... + ...

..... [2]

(ii) Hydrochloric acid also reacts with zinc.
Complete the symbol equation for this reaction.

$$Zn + ...HCl \rightarrow ZnCl_2 + ...$$

[2]

Paper 5 (Practical Test) Question 2

- Tests for anions
- Tests for aqueous cations
- Tests for gases
- Flame tests for metal ions.

These tests include the expected results.

2 You are provided with a mixture of two solids, **C** and **D**. Solid **C** is water-soluble and **D** is insoluble in water. Carry out the following tests on **C** and **D**, recording all of your observations at each stage.

Add 15 cm^3 of distilled water to the mixture in the boiling tube. Stopper and shake the boiling tube for two minutes. Filter the contents of the tube, keeping the filtrate and residue for the following tests.

tests on the filtrate

(a) (i) To about 1 cm^3 of the solution, add a few drops of aqueous sodium hydroxide.

observation ..... [1]

(ii) Now add excess aqueous sodium hydroxide to the mixture.

observation ..... [1]

(b) To about 1 cm^3 of the solution add an equal volume of aqueous ammonia.

observation ..... [1]

(c) To about 1 cm^3 of the solution add excess aqueous sodium hydroxide.

Now add a small piece of aluminium foil and warm the mixture **carefully**. Test any gases given off.

observation .....

..... [2]

(d) Identify solid **C**.

..... [2]

tests on the residue

Wash the residue in the filter paper with a little distilled water.

Using a spatula, transfer some of the solid residue from the filter paper into two test-tubes.

(e) Heat the solid in the first test-tube gently and then strongly. Leave the test-tube to cool.

observation .....

..... [2]

(f) **(i)** Add about 2 cm^3 of dilute hydrochloric acid to the second test-tube. Test any gases given off. Keep this liquid for **(f)(ii)**.

observation .....

..... [2]

(ii) After two minutes, add an equal volume of distilled water and shake the test-tube. Decant off the liquid and divide the liquid into two approximately equal portions.

To the first portion add aqueous sodium hydroxide a little at a time until in excess.

observation .....

..... [2]

(iii) To the second portion add aqueous ammonia a little at a time until in excess.

observation .....

..... [2]

(g) Identify solid **D**?

.....

.....

..... [2]

[Total: 17]

ALTERNATIVE TO PRACTICAL question

4 Solid **E** was analysed. **E** was an aluminium salt. Some of the observations are shown below.

tests on solid E	observations
Appearance of solid **E**.	white crystalline solid
test 1 A little of solid **E** was heated in a test-tube.	colourless drops of liquid formed at the top of the tube

(a) A little of solid **E** was dissolved in distilled water.

The solution was divided into four test-tubes and the following tests were carried out.

Complete the observations for **tests 2** and **3**.

(i) **test 2**

Drops of aqueous sodium hydroxide were added to the first test-tube.

observations ..... [1]

(ii) Excess sodium hydroxide was then added.

observations ..... [1]

(iii) **test 3**

Drops of aqueous ammonia solution were added to the second test-tube. Excess ammonia solution was then added.

observations .....

..... [2]

Two further tests are carried out and the following observations made.

tests on solution of E	observations
test 4 To the third test-tube of solution, dilute hydrochloric acid was added, followed by barium nitrate solution.	no reaction
test 5 To the fourth test-tube of solution, aqueous sodium hydroxide and aluminium foil were added. The mixture was warmed carefully.	effervescence pungent gas given off gas turned damp litmus paper blue

(b) What does **test 1** tell you about solid **E**?

.....

..... [1]

(c) Identify the gas given off in **test 5**.

..... [1]

(d) What conclusions can you draw about solid **E**?

.....

..... [2]

(e) **Test 5** states that the mixture should be warmed carefully.

In terms of safety, explain why it is necessary to warm carefully.

.....

.....

.....

..... [2]

[Total: 10]

EXTENSION question

Extension 1

(iii) Complete the table that shows the reaction, if any, of the oxides with acid and alkali. Indicate a reaction with "R" and no reaction with "NR".

oxide	type of oxide	reaction with acid	reaction with alkali
magnesium oxide	basic		
aluminium oxide	amphoteric		
silicon(IV) oxide	acidic		

[3]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 22

22 Acids are compounds which donate protons (hydrogen ions).

$$NH_3(aq) + H_2O(l) \rightarrow NH_4^+(aq) + OH^-(aq)$$

Which compound in this equation is behaving as an acid?

A ammonia

B ammonium hydroxide

C none of them

D water

Paper 2 Question 23

23 The reactions of four different oxides W, X, Y and Z are shown.

W reacts with hydrochloric acid but not sodium hydroxide.

X reacts with both hydrochloric acid and sodium hydroxide.

Y does not react with either hydrochloric acid or sodium hydroxide.

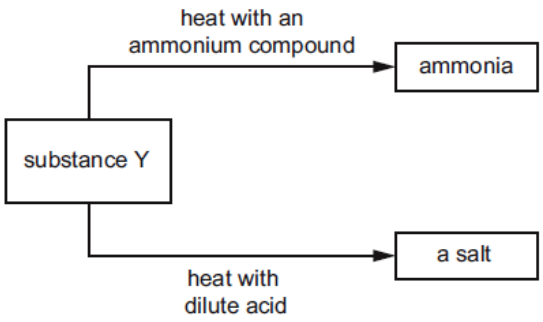
Z reacts with sodium hydroxide but not hydrochloric acid.

Which row shows the correct types of oxide?

	acidic	basic	amphoteric	neutral
A	W	Z	X	Y
B	X	Y	W	Z
C	Z	X	Y	W
D	Z	W	X	Y

Paper 2 Question 33

33 The diagram shows some reactions of substance Y.



Which type of substance is Y?

A an alcohol

B a base

C a catalyst

D a metal

Paper 4 Question 6

6 Soluble salts can be made using a base and an acid.

(a) Complete this method of preparing dry crystals of the soluble salt cobalt(II) chloride-6-water from the insoluble base cobalt(II) carbonate.

step 1
Add an excess of cobalt(II) carbonate to hot dilute hydrochloric acid.

step 2

.....

.....

step 3

.....

.....

step 4

.....

..... [4]

Acids, bases and salts – answers

Core 1

(d) **(i)** B

(ii) B

(iii) C

(iv) A

(v) B

(e) add hydrochloric acid to sodium hydroxide until neutralised / idea of titrating / neutralising
boil off / evaporate (some) water
leave to crystallise / allow to cool

Core 2

(a) several different substances present (not elements or compounds), which can be separated by physical means / not chemically bonded

(b) two (or more) elements / more than one type of atom, not substances chemically combined / bonded / joined

(c) **(i)** (thermal) decomposition

(ii) carbon dioxide / CO_2

(d) **(i)** slaked lime

(ii) pH above 7

(iii) turns red litmus paper blue

Alternative to practical 1

Plan to include five of the following points.

Measured equal amounts of tablets
Added specified volume of acid to tablet, e.g. drop by drop until stops fizzing / indicator is neutral
Repeated
Compared with other tablet
Concluded the most effective tablet requires the most acid

Specimen Paper 1

11 B

14 B

19 C

20 C

21 B

22 B

36 A

Specimen Paper 3

4 **(a)** calcium oxide
allow: CaO

(b) thermal decomposition

(c) carbon dioxide has been removed from the limestone / it comes from the limestone / carbon dioxide is a product

(d) neutralising acidic soils / treating acidic lakes / flue gas desulfurisation
allow: any suitable use

(g) add acid to carbonate;
bubble gas or carbon dioxide (evolved) through limewater / test gas or carbon dioxide with limewater;
limewater goes milky or cloudy;

6 **(e) (iii)** (damp) litmus (paper) / Universal Indicator (paper);
allow: indicator paper / pH paper

(f) **(i)** calcium chloride + water
not: calcium chlorine

(ii) 2 on left;
H_2 on right; not: 2H

Specimen Paper 5 (Practical Test)

2 **(a)** **(i)** white precipitate

(ii) no change / precipitate remains

(b) no precipitate / slight (white) precipitate

(c) Any two from:
effervescence / fizz / bubbles;
(damp) pH paper blue / purple;
ammonia smell;

(d) calcium;
nitrate;

(e) yellow / brown / orange colour when hot;
colour fades / goes white when cool;

(f) **(i)** effervescence / bubbles / fizz;
limewater turns milky;

(ii) white precipitate;
precipitate dissolves in excess / colourless solution formed;

(iii) white precipitate;
precipitate dissolves in excess / colourless solution formed;

(g) zinc;
allow: aluminium dependent on (f)(iii)

Specimen Paper 6 (Alternative to Practical)

4 **(a)** **(i)** white precipitate

(ii) precipitate dissolves in excess;

(iii) white precipitate;
no change / precipitate remains;

(b) contains water / hydrated

(c) ammonia
not: ammonium

(d) Any two from:
nitrate;
hydrated salt / contains water;
it is not a sulfate;

(e) sodium hydroxide is hazardous / irritant / caustic;
allow: toxic
boiling causes mixture to spit / blow-out;

Extension 1

(iii)

R	NR
R	R
NR	R

Specimen Paper 2

22 D

23 D

33 B

Specimen Paper 4

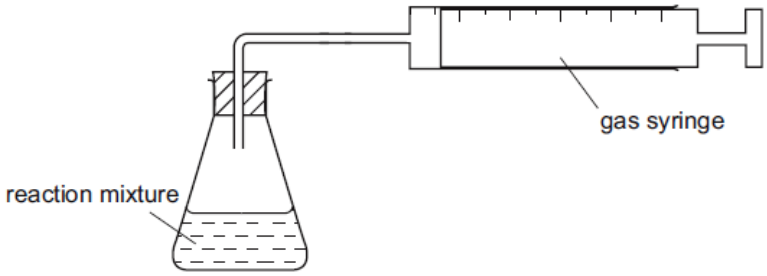
6 **(a)** filter / centrifuge / decant;
(partially) evaporate / heat / boil;
allow to crystallise / cool / let crystals form;
dry crystals / dry between filter paper / leave in a warm place to dry;

Reaction rates

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 15

15 The apparatus shown can be used to measure the rate of some chemical reactions.



For which two reactions would this apparatus be suitable?

reaction 1 $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

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

reaction 3 $MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$

reaction 4 $ZnCO_3(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + CO_2(g) + H_2O(l)$

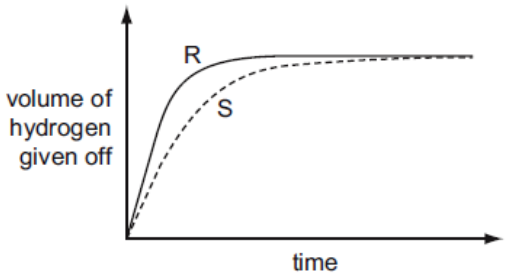
A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

Paper 1 Question 16

16 A student investigates the rate of reaction between magnesium and excess sulfuric acid.

The volume of hydrogen given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.



Which change in conditions would cause the difference between R and S?

A A catalyst is added in S.

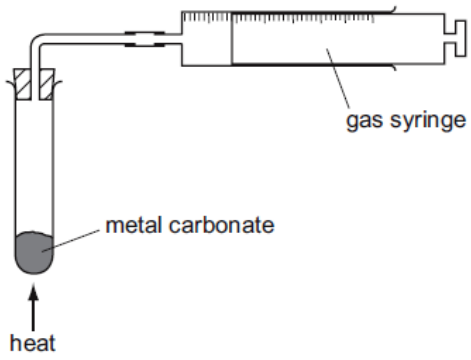
B The acid is more concentrated in R than in S.

C The magnesium is less finely powdered in R than in S.

D The temperature in R is lower than in S.

Paper 3 Question 4

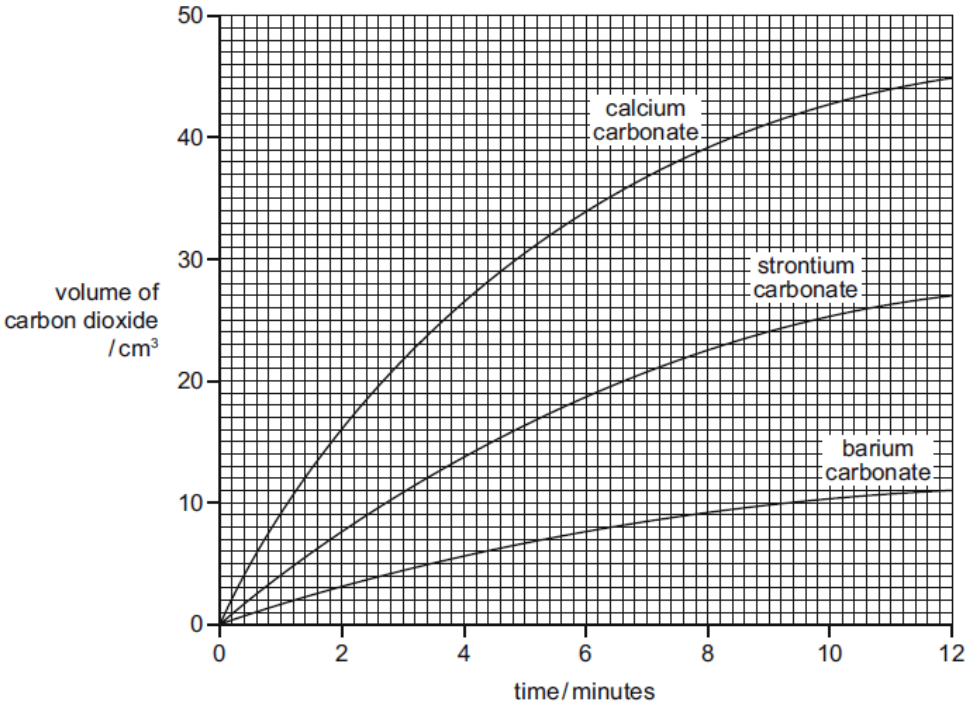
(e) A student compared the rates of reaction of three metal carbonates.
She measured the volume of gas released using the apparatus shown.



State **one** thing that must be kept constant if the rates of the three reactions are to be compared in a fair way.

..... [1]

(f) The graph shows the volume of carbon dioxide released when the three metal carbonates were heated.



(i) Which carbonate produced carbon dioxide at the highest rate?

.....

[1]

(ii) What volume of carbon dioxide was produced by strontium carbonate in twelve minutes?

.....

[1]

(iii) How do the rates of the reactions of these three metal carbonates relate to the position of calcium, strontium and barium in the Periodic Table?

.....

.....

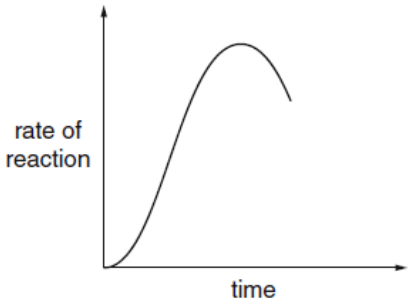
[2]

Paper 4 Question 8

(d) The alcohol ethanol can be made by fermentation. Yeast is added to aqueous glucose.

$$C_6H_{12}O_6(aq) \rightarrow 2C_2H_5OH(aq) + 2CO_2(g)$$

Carbon dioxide is given off and the mixture becomes warm, as the reaction is exothermic. The graph shows how the rate of reaction varies over several days.



(i) Suggest a method of measuring the rate of this reaction.

.....

..... [2]

(ii) Why does the rate initially increase?

.....

..... [1]

(iii) Suggest **two** reasons why the rate eventually decreases.

.....

..... [2]

Paper 5 (Practical Test) Question 1

1 You are going to investigate the reaction between excess magnesium and two different dilute acids, **X** and **Y**.

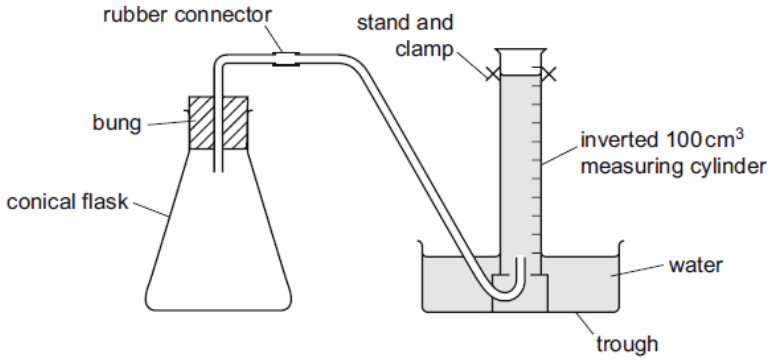
Read all the instructions below carefully before starting the experiments.

Instructions

You are going to carry out two experiments.

(a) Experiment 1

Set up the apparatus as shown in the diagram below.



Remove the bung from the conical flask and move the measuring cylinder away from the delivery tube without letting any water run out. Twist one of the strips of magnesium to break it into four pieces and place all four pieces into the conical flask.

Using a different measuring cylinder, measure 50 cm^3 of dilute acid **X**. Pour it into the conical flask and replace the bung firmly. Place the measuring cylinder back over the delivery tube and start the timer. In the table, record the volume of gas collected in the measuring cylinder every 30 seconds for three minutes.

time / s	0	30	60	90	120	150	180
volume of gas / cm^3							

[2]

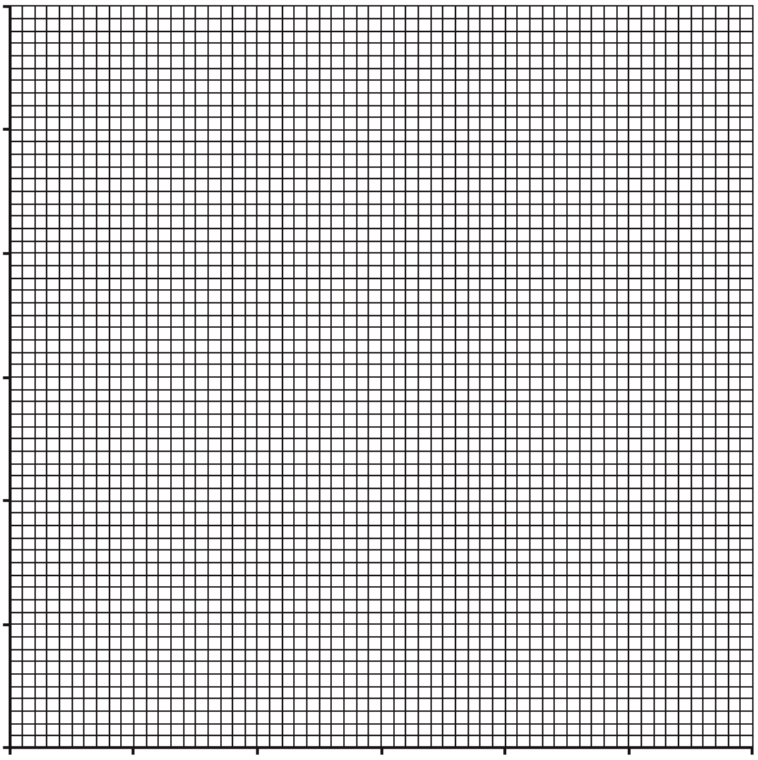
(b) Experiment 2

Repeat the whole of Experiment 1 using 50 cm^3 of dilute acid **Y**.
In the table, record the volume of gas collected in the measuring cylinder every 30 seconds for three minutes.

time / s	0	30	60	90	120	150	180
volume of gas / cm^3							

[2]

(c) Plot the results you have obtained for both experiments on the grid below. For each set of results, draw a smooth line graph. Indicate clearly which line represents Experiment 1 and which line represents Experiment 2.



[4]

(d) State which experiment had the faster rate of reaction **and** suggest why the rate was faster in this experiment.

.....

..... [1]

(e) From your graph, deduce the time required to collect 25 cm^3 of gas in Experiment 1.
Show clearly **on the graph** how you worked out your answer.

..... [1]

(f) The rate of this reaction can be calculated using:

$$\text{rate} = \frac{\text{volume of gas / cm}^3}{\text{time taken / s}}$$

For the experiment with the higher rate, calculate the rate of reaction for the first 30 seconds of the reaction. Deduce the units.

rate ..... [2]

(g) A student suggested that the magnesium should be rubbed with sandpaper before starting the experiment. Explain why the magnesium should be rubbed with sandpaper.

.....

..... [2]

(h) Give **one** advantage and **one** disadvantage of using a measuring cylinder to add the acids to the flask.

advantage .....

disadvantage ..... [2]

(i) Suggest **and** explain one improvement to this experiment.

.....

.....

..... [1]

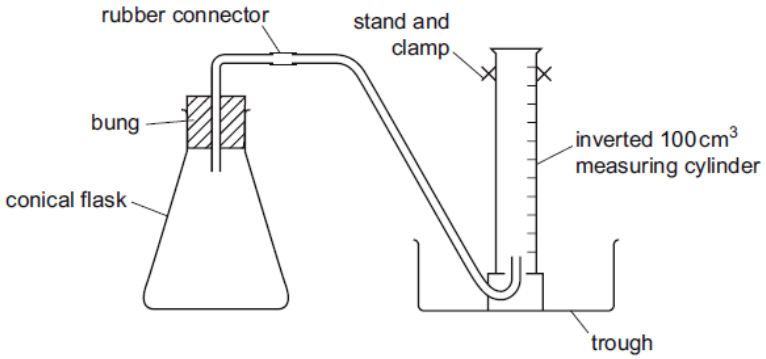
[Total: 17]

Practical Instructions for Paper 5 Question 1

For Question 1

Each candidate will require

(a) apparatus for a rate experiment



Note: The trough should be large enough to allow the measuring cylinder to be filled with water in the trough.

[F] **(b)** two 15 cm strips of magnesium ribbon

(c) 100 cm^3 of sulfuric acid of concentration 0.2 mol/dm^3, in a beaker labelled **acid X**

(d) 100 cm^3 of hydrochloric acid of concentration 0.2 mol/dm^3, in a beaker labelled **acid Y**

(e) one 250 cm^3 conical flask

(f) a stop-clock or timer which can measure to the nearest second

(g) access to water and distilled water

(h) one 100 cm^3 measuring cylinder

50 cm^3 of acid X + 15 cm of magnesium ribbon should produce approximately 50 cm^3 of gas in 3 minutes.

50 cm^3 of acid Y + 15 cm of magnesium ribbon should produce approximately 25 cm^3 of gas in 3 minutes.

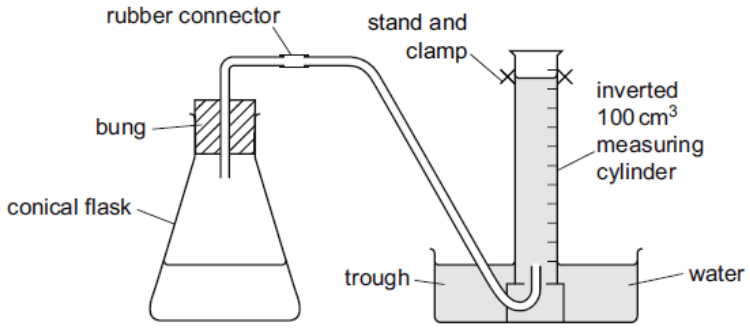
Paper 6 (Alternative to Practical) Question 2

2 A student investigated the rate of reaction between excess magnesium and two different dilute acids, **X** and **Y**.

Two experiments were carried out.

Experiment 1

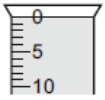
The apparatus was set up as shown in the diagram.



Using a measuring cylinder, 50 cm^3 of dilute acid **X** was poured into the conical flask.
0.5g of magnesium ribbon was added to the conical flask and the bung added.

The timer was started and the volume of gas collected in the measuring cylinder was measured every 30 seconds for three minutes.

(a) Use the measuring cylinder diagrams to record the volumes of gas collected.

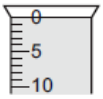
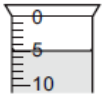
time / s	measuring cylinder diagram	total volume of gas collected / cm^3
0		
30		
60		
90		
120		
150		
180		

[2]

Experiment 2

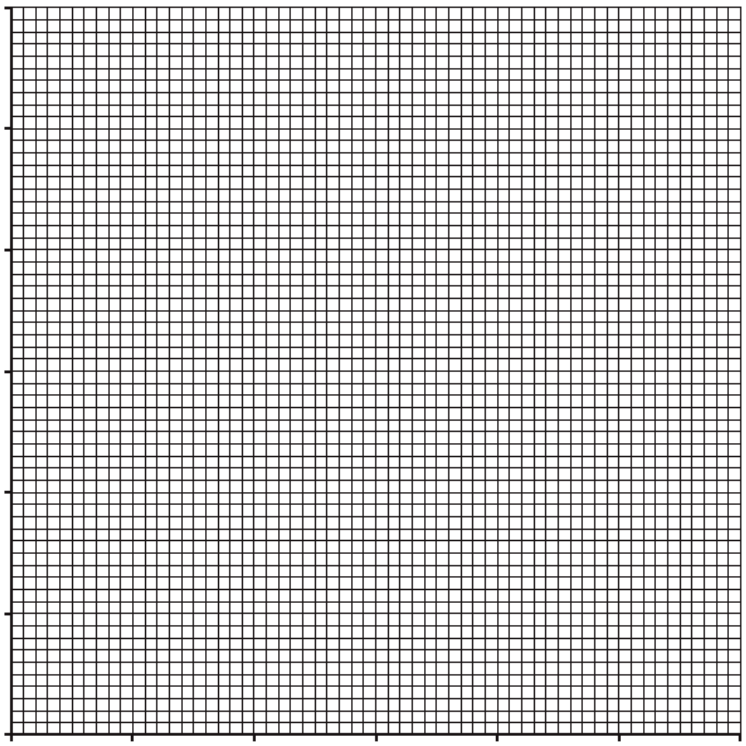
Experiment 1 was repeated using 50 cm^3 of dilute acid **Y**.

(b) Use the measuring cylinder diagrams to record the volumes of gas collected.

time / s	measuring cylinder diagram	total volume of gas collected / cm^3
0		
30		
60		
90		
120		
150		
180		

[2]

(c) Plot the results for both experiments on the grid below. For each set of results, draw a smooth line graph. Indicate clearly which line represents Experiment 1 and which line represents Experiment 2.



[4]

(d) State which experiment had the faster rate of reaction **and** suggest why the rate was faster in this experiment.

.....

..... [1]

(e) From your graph, deduce the time required to collect 25 cm^3 of gas in Experiment 1.
Show clearly **on the graph** how you worked out your answer.

..... [1]

(f) The rate of this reaction can be calculated using:

$$\text{rate} = \frac{\text{volume of gas / cm}^3}{\text{time taken / s}}$$

For the experiment with the higher rate, calculate the rate of reaction for the first 30 seconds of the reaction. Deduce the units.

rate ..... [2]

(g) Give **one** advantage and **one** disadvantage of using a measuring cylinder to add the acids to the flask.

advantage .....

disadvantage ..... [2]

(h) Suggest **and** explain one improvement to this experiment.

.....

.....

..... [1]

[Total: 15]

0620 Cambridge IGCSE Chemistry Past Paper (June 2013)

Paper 33 Question 2

2 One of the factors which determine the reaction rate of solids is particle size.

(a) A mixture of finely powdered aluminium and air may explode when ignited.
An explosion is a very fast exothermic reaction. This causes a large and sudden increase in temperature.

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

(i) Why is the reaction between finely powdered aluminium and air very fast?

.....

..... [2]

(ii) Explain why for most reactions the rate of reaction decreases with time.

.....

..... [2]

(iii) Suggest an explanation why the rate of reaction in an explosion could increase rather than decrease with time.

.....

.....

..... [3]

(b) **(i)** Give another example of a substance other than a metal which, when finely powdered, might explode when ignited in air.

..... [1]

(ii) Describe a simple test-tube reaction which shows the effect of particle size on the rate at which a solid reacts with a solution.

.....

.....

..... [3]

[Total: 11]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 16

16 Water can be used to produce hydrogen gas.

$$2H_2O \rightarrow 2H_2 + O_2$$

Which row describes bond breaking in the reactant?

A	endothermic	heat absorbed
B	endothermic	heat released
C	exothermic	heat absorbed
D	exothermic	heat released

Paper 4 Question 7

(d) Calculate the overall energy change for the reaction between iodine and chlorine using the bond energy values shown.

$$I_2 + Cl_2 \rightarrow 2ICl$$

Bond	Energy / kJ per mol
I–I	151
Cl–Cl	242
I–Cl	208

Show your working.

[3]

(e) Draw a labelled energy level diagram for the reaction between iodine and chlorine using the information in **(d)**.

[2]

Reaction rates – answers

Specimen Paper 1

15 C

16 B

Specimen Paper 3

4 **(e)** temperature of Bunsen / distance of Bunsen from the tube / mass of carbonate used / owtte

Specimen Paper 4

8 **(d)** **(i)** measure volume of gas;
measure time;

(ii) increase in temperature / more yeast present / yeast multiplies

(iii) glucose used up;
concentration of ethanol high enough to kill yeast;

Specimen Paper 5 (Practical Test)

1 **(a)** volume, at time = 0 given;
volume correctly completed in ascending order;
allow: maximum of 2 consecutive identical numbers

(b) volume, at time = 0 given;
volume correctly completed in ascending order;
allow: maximum of 2 consecutive identical numbers

(c) appropriate scale on x-axis and y-axis **and** labels **and** units;
note: scale should cover at least half of grid
points plotted to ± half a small square accuracy;;
note: > 12 correct = 2, 10–12 correct = 1, < 10 correct = 0
two labelled smooth line graphs **and** must plot volume at t = 0;

(d) Experiment 1 / acid **X** **and** statement that acid **X** is stronger or more concentrated / ora

(e) value from graph to ± half a small square accuracy **and** indication shown on graph

(f) correct calculation of rate;
allow: ecf on **(d)**
cm^3 / s / $cm^3 s^{-1}$ / cm^3 per s;
allow: sec

(g) Any two from:
magnesium has an oxide coating;
rubbing exposes magnesium to the acid / removes oxide coating;
gives true rate / owtte;

(h) advantage: convenient / easy / quick to use;
disadvantage: reference to inaccurate measurement;

(i) graduated pipette / burette / gas syringe / mass of magnesium rather than strips / repeats and take average / take more frequent readings / suitable method for reducing initial loss of gas **and** any suitable comment on improved accuracy;
note: explanation must relate to reason

Specimen Paper 6 (Alternative to Practical)

2 **(a)** volume boxes completed correctly 0, 13, 22, 30, 36, 43, 49
note: all 7 correct = 2, 6 correct = 1, < 6 correct = 0

(b) volume boxes completed correctly 0, 5, 10, 13, 17, 20, 23
note: all 7 correct = 2, 6 correct = 1, < 6 correct = 0

(c) appropriate scale on x-axis and y-axis **and** labels **and** units;
note: scale should cover at least half of grid
points plotted to ± half a small square accuracy;;
note: > 12 correct = 2, 10–12 correct = 1, < 10 correct = 0
two labelled smooth line graphs **and** must plot volume at t = 0;

(d) Experiment 1 / acid **X** **and** statement that acid **X** is stronger or more concentrated / ora

(e) 71–73 s **and** indication shown on graph;
allow: ecf from incorrect graph

(f) 13 ÷ 30 = 0.43;
allow: 0.4
allow: ecf on plotting
cm^3 / s / cm^3 s^{-1} / cm^3 per s;
allow: sec

(g) advantage: convenient / easy / quick to use;
disadvantage: reference to inaccurate measurement;

(h) graduated pipette / burette / gas syringe / mass of magnesium rather than strips / repeats and take average / take more frequent readings / suitable method for reducing initial loss of gas **and** any suitable comment on improved accuracy;
note: explanation must relate to reason

Paper 33

2 **(a)** **(i)** large / high surface area

high collision rate / collide more / many collisions
(between oxygen molecules and aluminium atoms)
NOT faster collisions

(ii) concentration
of reactants decreases

allow one mark **ONLY** *for:*
for reactants used up **or** amount of reactant decreases

(iii) *any three of four from one strand:*

M1	increase in temperature	
M2	molecules move faster **or**	particles have more energy
M3	higher collision rate	
M4	more successful collisions **or**	more particles have enough energy to react / E_a

(b) (i) flour **or** wood dust **or** coal dust or carbon or sugar

(ii) any three from:
powder and larger pieces / different sized particles use
suitable named solid, e.g. magnesium
suitable named solution, e.g. named acid **or** copper sulfate(aq)
result – powder reacts faster than larger pieces
NOT Cu (with acid); K / Na with anything

Specimen Paper 2

16 A

Specimen Paper 4

7 (d) (bond breaking =) 151 + 242 = 393;
(bond making =) 208 × 2 = –416; not: 416
(overall =) 393 – 416 = –23; allow: ecf
note: sign must be given

(e) Any two from:
diagram shows exothermic reaction;
activation energy shown;
reactants and products labelled / both axes labelled;
note: labelling is one mark only
allow: ecf from **(d)**

Metals and the Reactivity Series

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 27

27 Aluminium is an important metal with many uses.

Some of its properties are listed.

1 It is a good conductor of heat.

2 It has a low density.

3 It has an oxide layer that prevents corrosion.

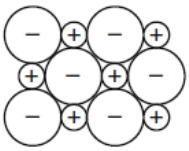
Which set of properties help to explain the use of aluminium for cooking and storing food?

A 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

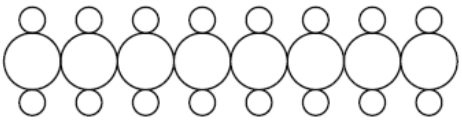
Paper 1 Question 28

28 Which diagram could represent the structure of an alloy?

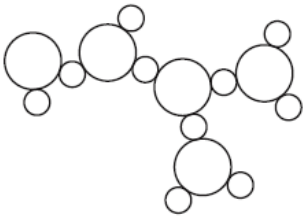
A



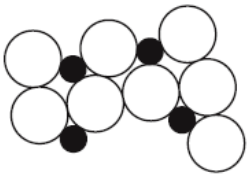
B



C



D



Paper 1 Question 29

29 The table shows the results of adding three metals, P, Q and R, to dilute hydrochloric acid and to water.

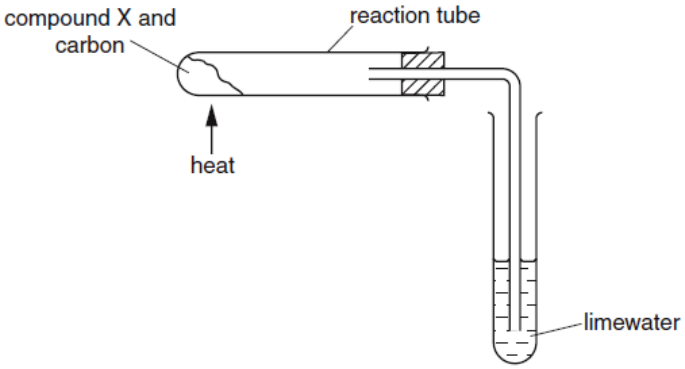
metal	dilute hydrochloric acid	water
P	hydrogen produced	hydrogen produced
Q	no reaction	no reaction
R	hydrogen produced	no reaction

What is the order of reactivity of the metals?

	most reactive →		least reactive
A	P	R	Q
B	P	Q	R
C	R	Q	P
D	R	P	Q

Paper 1 Question 31

31 Compound X is heated with carbon using the apparatus shown.



A brown solid is formed in the reaction tube and the limewater turns cloudy.

What is compound X?

A calcium oxide

B copper(II) oxide

C magnesium oxide

D sodium oxide

Paper 3 Question 4

(g) Describe how hydrochloric acid and limewater can be used to show that carbonate ions are present in calcium carbonate.

.....

.....

..... [3]

Paper 3 Question 5

5 Iron is a transition element.

(a) State **three** properties of transition elements which are **not** shown by the Group I elements.

1. .....
2. .....
3. ..... [3]

(d) Iron can be recycled.

Explain **two** advantages of recycling metals.

.....

.....

.....

..... [2]

(e) In the blast furnace, iron(III) oxide reacts with carbon monoxide.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Which substance gets reduced in this reaction?
Explain your answer.

substance .....

explanation .....

..... [2]

Paper 3 Question 7

(c) State **one** use of copper.

..... [1]

Paper 4 Question 1

1 The following table gives information about six substances.

substance	melting point / °C	boiling point / °C	electrical conductivity as a solid	electrical conductivity as a liquid
A	839	1484	good	good
B	–188	–42	poor	poor
C	776	1497	poor	good
D	–117	78	poor	poor
E	1607	2227	poor	poor
F	–5	102	poor	good

(a) Which substance could be a metal?

..... [1]

Paper 4 Question 4

4 Chromium is a transition element.

(a) (i) State **two** differences in the physical properties of chromium and sodium.

.....

..... [2]

(ii) State **two** differences in the chemical properties of chromium and sodium.

.....

.....

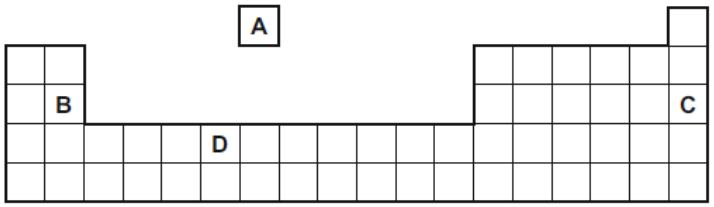
..... [2]

0620 Cambridge IGCSE Chemistry Past Papers (June 2013)

Paper 11 Question 5

5 The positions of four elements are shown on the outline of the Periodic Table.

Which element forms a coloured oxide?



Paper 11 Question 10

10 What is the balanced chemical equation for the reaction between calcium and water?

A $Ca + H_2O \rightarrow CaOH + H_2$

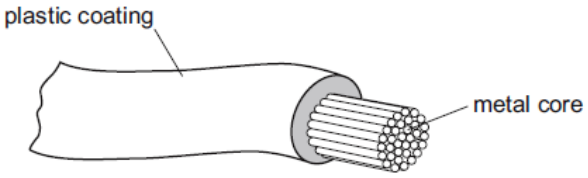
B $Ca + H_2O \rightarrow Ca(OH)_2 + H_2$

C $Ca + 2H_2O \rightarrow CaOH + H_2$

D $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

Paper 11 Question 11

11 The diagram shows an electrical cable.



Which statement about the substances used is correct?

A The coating is plastic because it conducts electricity well.

B The core is copper because it conducts electricity well.

C The core is copper because it is cheap and strong.

D The core is iron because it is cheap and strong.

Paper 11 Question 11

23 Which element is a transition metal?

	colour of chloride	melting point of element / °C
A	white	113
B	white	1495
C	yellow	113
D	yellow	1495

Paper 11 Question 26

26 Which element is a metal?

	charge on element ion	electrical conductivity
A	negative	low
B	positive	high
C	negative	high
D	positive	low

Paper 11 Question 27

27 Which property makes aluminium ideal for making food containers?

A conducts electricity

B conducts heat

C mechanical strength

D resistance to corrosion

Paper 11 Question 28

28 Which substance is **not** involved in the extraction of iron from hematite?

A carbon

B carbon monoxide

C calcium carbonate

D nitrogen

Paper 11 Question 29

29 Pure metals conduct electricity and can be hammered into different shapes.

Why are metals sometimes used as alloys?

A Alloys are cheaper than the metals they are made from.

B Alloys are easier to hammer into different shapes.

C Alloys are harder and keep their shape better.

D Alloys conduct electricity better.

Paper 11 Question 30

30 Below are some metals in decreasing order of reactivity.

magnesium

zinc

iron

copper

Titanium reacts with acid and cannot be extracted from its ore by heating with carbon.

Where should titanium be placed in this list?

A below copper

B between iron and copper

C between magnesium and zinc

D between zinc and iron

0620 Cambridge IGCSE Chemistry Past Papers (November 2013)

Paper 21 Question 1

(c) Many of the elements in the Periodic Table have metallic properties.
Describe **three** physical properties which are typical of most metals.

1. .....

2. .....

3. ..... [3]

Paper 21 Question 4

(e) Iron(III) oxide and coke (carbon) are raw materials used in the production of iron.
State the names of **two** other raw materials used in the blast furnace for the production of iron.

1. .....

2. ..... [2]

Paper 21 Question 7

7 The table shows some properties of seven different substances.

substance	density /g per cm^3	relative strength	relative electrical conductivity	relative thermal conductivity
aluminium	2.7	15	42	200.0
ceramic	2.5	15	does not conduct	1.6
copper	8.9	20	63	385.0
iron	7.9	25	11	80.0
lead	11.4	15	5	38.0
poly(ethene)	0.9	1	does not conduct	0.3
steel	7.8	90	2	25.0

(a) Use the information in this table to answer the following questions.

(i) Which substance is the best conductor of heat?

..... [1]

(ii) Suggest why copper is preferred to iron for electrical wiring in houses.

..... [1]

(iii) What property of ceramic makes it a good electrical insulator?

..... [1]

(iv) Which pure metal in the table conducts electricity least well?

..... [1]

(v) Suggest why steel rather than iron is used in making machinery.

..... [1]

(vi) Which metal in the table is the most dense?

..... [1]

Paper 31 Question 2

2 **(a)** Give **three** differences in physical properties between the Group I metal, potassium, and the transition element, iron.

1. .....

2. .....

3. ..... [3]

(b) The following metals are in order of reactivity.

potassium
zinc
copper

For those metals which react with water or steam, name the products of the reaction, otherwise write 'no reaction'.

potassium .....

.....

zinc .....

.....

copper .....

..... [5]

[Total: 8]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 5

5 Iron is a metal. The structure of iron is described as a lattice of positive ions in a sea of electrons.

Which of the following statements about iron are correct?

1 iron conducts electricity because the electrons are free to move

2 iron has a high melting point due to the strong covalent bonds

3 iron is an alloy

4 iron is malleable because the layers of atoms can slide over one another

A 1 only

B 1 and 3

C 1 and 4

D 2, 3 and 4

Paper 2 Question 30

30 Zinc is extracted from zinc blende. Zinc blende is an ore of zinc and consists mainly of zinc sulfide.

One of the steps in the process involves zinc sulfide reacting with oxygen from the air.

What is the equation for this reaction?

A $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

B $2ZnS + O_2 \rightarrow 2Zn + SO_2$

C $2ZnS + O_2 \rightarrow 2ZnO + S$

D $ZnS + 2O_2 \rightarrow ZnSO_4$

0620 Cambridge IGCSE Chemistry Past Paper (June 2013)

Paper 11 Question 32

32 Iron rusts when it reacts with .....1.....

Rusting can be prevented by covering the iron with a more reactive metal, such as .....2.....

Which words correctly complete gaps 1 and 2?

	1	2
A	oxygen	copper
B	oxygen	magnesium
C	oxygen and water	copper
D	oxygen and water	magnesium

0620 Cambridge IGCSE Chemistry Past Paper (November 2013)

Paper 31 Question 6

6 Lead is an excellent roofing material. It is malleable and resistant to corrosion. Lead rapidly becomes coated with basic lead carbonate which protects it from further corrosion.

(a) Lead has a typical metallic structure which is a lattice of lead ions surrounded by a 'sea' of mobile electrons. This structure is held together by attractive forces called a metallic bond.

(i) Explain why there are attractive forces in a metallic structure.

.....

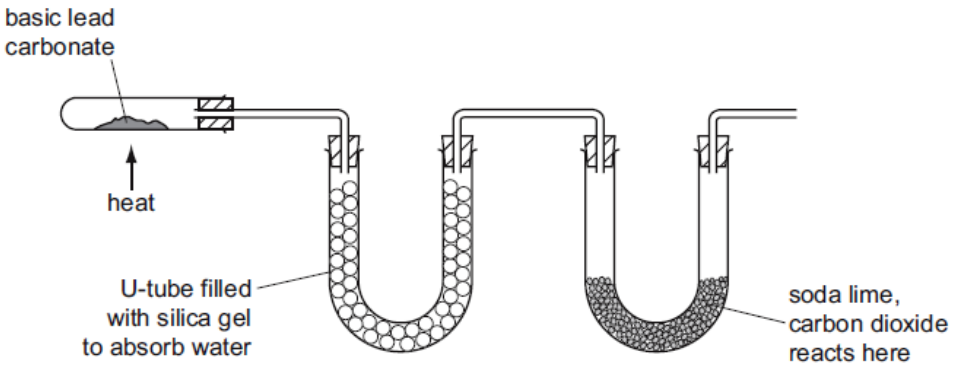
..... [2]

(ii) Explain why a metal, such as lead, is malleable.

.....

..... [2]

(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]

Metals and the Reactivity Series – answers

Specimen Paper 1

27 D

28 D

29 A

31 B

Specimen Paper 3

4 **(g)** add acid to carbonate;
bubble gas or carbon dioxide (evolved) through limewater / test gas or carbon dioxide with limewater;
limewater goes milky or cloudy;

5 **(a)** Any three of:
high melting / boiling point;
high density;
form coloured compounds or have coloured ions;
form ions of more than one charge / variable valency / variable oxidation state;
allow: form complex ions; hard / hardness; catalysts;

(d) Any two of:
recycling promotes sustainable development / owtte;
uses less energy than extraction;
preserves limited natural resources;
correct reference to cost;
reference to landfill;

(e) Fe_2O_3 / iron oxide;
it loses oxygen / gains electrons / iron decreases oxidation number;

7 **(c)** any suitable use, e.g. electrical conductor / electrical wiring / saucepans

Specimen Paper 4

1 **(a)** A

4 **(a)** **(i)** Any two from:
chromium
is harder;
has higher density;
has higher melting point / boiling point;
stronger;
ora;
note: comparison must be made

(ii) Any two from:

sodium is more reactive;
chromium has more than one oxidation state, sodium has one;
chromium forms coloured compounds, sodium compounds are white;
sodium reacts with cold water, chromium does not;
chromium forms complex ions, sodium does not;
chromium has catalytic properties, sodium does not;
note: difference must be clear

Paper 11 (June 2013)

5 D

10 D

11 B

23 D

26 B

27 D

28 D

29 C

30 C

Paper 21 (November 2013)

1 **(c)** Any 3 of:

conducts electricity / conducts heat / conducts
shiny / lustrous
ductile / can be drawn into wires
malleable / can be shaped
ALLOW: high boiling point / high melting point / solid at room temperature
ALLOW: rings when hit / sonorous

4 **(e)** limestone
air

7 **(a)** **(i)** copper
(ii) **(**copper is) better electrical conductor/iron is worse conductor
IGNORE: copper is a good conductor
(iii) does not conduct (electricity)
(iv) lead
(v) stronger/has more strength
IGNORE: tougher/harder/less malleable
(vi) lead

Paper 31 (November 2013)

2 **(a)** Any three of:

iron is harder
iron has higher density
ACCEPT: heavier **or** potassium lighter
iron has higher mp **or** bp
iron has higher tensile strength **or** stronger
iron has magnetic properties
NOTE: has to be comparison, e.g. iron is hard (0) but iron is harder
NOT: appearance, e.g. shiny
ACCEPT: comparative statements relating to potassium

(b)

potassium	hydrogen and potassium hydroxide
zinc	hydrogen and zinc oxide
copper	no reaction

Specimen Paper 2

5 C

30 A

Paper 11 (June 2013)

32 D

Paper 31 (November 2013)

6 (a) (i) (attractive force between) positive ions
and (negative) electrons
opposite charges attract ONLY [1]
electrostatic attraction ONLY [1]

(ii) lattice / rows / layers of lead ions / cations / positive ions
NOT: atoms / protons / nuclei
can slide past each other / the bonds are non-directional

(b) (i) anhydrous cobalt chloride becomes hydrated
ACCEPT: hydrous

(ii) carbon dioxide is acidic
sodium hydroxide and calcium oxide are bases / alkalis

(iii) Any two of:
water, calcium carbonate and sodium carbonate
ACCEPT: sodium bicarbonate

Covalent bonding

CORE questions

Core 1

(e) Graphite is used as a lubricant.
By referring to its structure, explain why graphite is used as a lubricant.

.....

.....[2]

Core 2

(e) The table shows some properties of lactose, sulphur and potassium nitrate.

property	lactose	sulphur	potassium nitrate
state at room temperature	solid	solid	solid
solubility in water	soluble	insoluble	soluble
electrical conductivity of a solution in water	does not conduct	no solution formed	conducts
structure	molecular	molecular	ionic giant structure

(i) Suggest how you can separate a solid mixture of lactose and sulphur.

.....

.....

.....[2]

(ii) Suggest why a solution of potassium nitrate in water conducts electricity.

.....

.....[2]

(iii) Suggest why a solution of lactose in water does not conduct electricity.

.....[1]

Core 3

(c) Hydrogen chloride, HCl, has a single covalent bond.

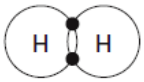
Draw a diagram to show how the electrons are arranged in a molecule of hydrogen chloride. Only the outer electron shells need be shown.

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

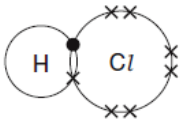
Paper 1 Question 10

10 Which diagram does **not** show the outer shell electrons in the molecule correctly?

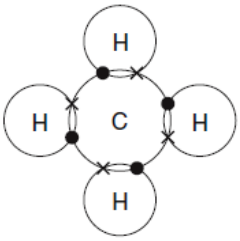
A



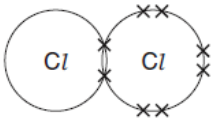
B



C

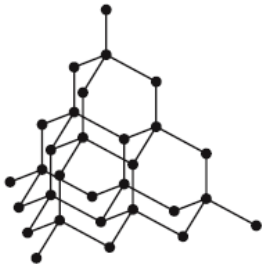


D



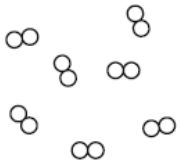
Paper 3 Question 1

1 The structures of diamond and chlorine are shown below.



diamond

● = carbon atom



chlorine

○ = chlorine atom

(a) Describe the structure of these two substances.
Use the list of words to help you.

covalent **diatomic** **giant** **macromolecule** **molecule** **structure**

diamond .....

.....

.....

chlorine .....

.....

..... [4]

(e) Potassium chloride is an ionic substance but iodine is a molecular substance.
How do most ionic and molecular substances differ in their

solubility in water? .....

.....

electrical conductivity? .....

..... [2]

Paper 3 Question 6

(e) When concentrated hydrochloric acid is electrolysed, chlorine is released.

(i) Draw the shells and the electronic structure in an atom of chlorine.

[1]

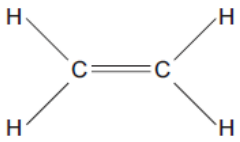
(ii) Draw the electronic structure of a chlorine molecule.
Show only the outer electron shells.

[2]

0620 Cambridge IGCSE Chemistry Specimen Paper (2016)

Paper 2 Question 7

7 Ethene is an unsaturated hydrocarbon.



Which description of the bonding in ethene is correct?

A All atoms in the molecule have a share of eight electrons.

B Each carbon atom shares two of its electrons with hydrogen atoms and two of its electrons with a carbon atom.

C Each carbon atom shares two of its electrons with hydrogen atoms and one of its electrons with a carbon atom.

D The two carbon atoms share a total of six electrons with other atoms.

Paper 4 Question 1

1 The following table gives information about six substances.

substance	melting point / °C	boiling point / °C	electrical conductivity as a solid	electrical conductivity as a liquid
A	839	1484	good	good
B	–188	–42	poor	poor
C	776	1497	poor	good
D	–117	78	poor	poor
E	1607	2227	poor	poor
F	–5	102	poor	good

(a) Which substance could be a metal?

..... [1]

(b) State **all** the substances that are liquid at room temperature?

..... [1]

(c) Which substance could have a macromolecular structure similar to that of silicon(IV) oxide?

..... [1]

(e) Which substance could be sodium chloride?

..... [1]

Covalent bonding – answers

Core 1

(e) layers of atoms
weak forces between layers / layers slide over each other

Core 2

(e) **(i)** dissolve lactose / add water
filter

(ii) (potassium nitrate) is ionic structure / contains ions
ions free to move

(iii) does not contain ions / it is a molecular structure

Core 3

(c) 7 electrons in outer shell of chlorine and 1 in outer shell of hydrogen
pair of electrons shared between the two atoms
symbols for C*l* and H

Specimen Paper 1

10 D

Specimen Paper 3

1 **(a)** diamond:
covalent;
giant structure / macromolecule;
chlorine: any two of:
molecule;
covalent;
diatomic;

(e) solubility in water:
ionic compounds are soluble and molecular compounds are not soluble
note: both needed for mark
electrical conductivity:
ionic compounds conduct electricity when molten / in (aqueous) solution
and molecular compounds do not
note: both needed for mark

6 **(e)** **(i)** 2,8,7 as shown in an electron shell diagram

(ii) pair of electrons between two chlorine atoms;
rest of electrons correct;

Specimen Paper 2

7 B

Specimen Paper 4

1 **(a)** A

(b) D and F note: both needed for mark

(c) E

(e) C

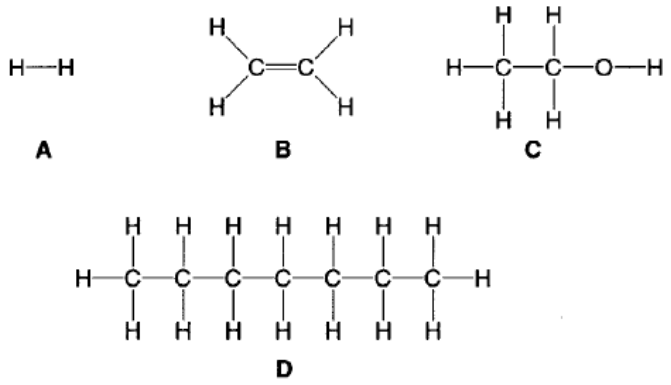
Organic 1

CORE questions

Core 1

Petroleum is a mixture of many different hydrocarbons.

(a) Which **two** of the structures **A**, **B**, **C** and **D** are hydrocarbons?



A **B** **C**

D

structure 1 .....

structure 2 .....

[1]

(b) The mixture of hydrocarbons in petroleum is separated into different fractions.

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

.....

.....[1]

(ii) What is the name of the process used to separate these fractions?

.....[1]

(iii) During this process, the mixture of hydrocarbons is vaporised and then condensed. Explain what is meant by

vaporised, ...

condensed. .....

[2]

(iv) The separation of the fractions depends on one physical property of the hydrocarbons.

State this property.

.....[1]

Core 1

(c) Octane is a hydrocarbon which can be cracked to produce two different hydrocarbons, hexane and ethene.

$$\underset{\text{octane}}{C_8H_{18}} \rightarrow \underset{\text{hexane}}{C_6H_{14}} + \underset{\text{ethene}}{C_2H_4}$$

(i) State two conditions which are used to crack octane.

1. .....

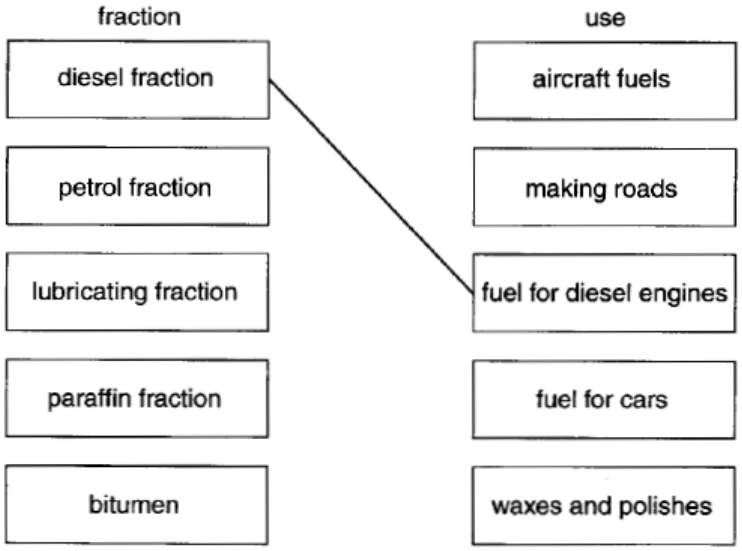
2. .....

[2]

(ii) Which of the three hydrocarbons in the equation above is used to make a polymer?

.....[1]

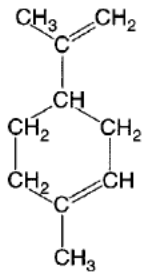
(d) In the diagram below, the boxes on the left give the names of some petroleum fractions. The boxes on the right show some uses of these fractions.
Draw lines between the boxes to link the fractions to their correct uses.
The first one has been done for you.



[4]

Core 2

(a) The structure of limonene is shown below.



(i) What is the molecular formula of limonene?

.....[1]

(ii) Some limonene was added to a few drops of aqueous bromine.
What colour change would you see in the aqueous bromine?

.....[2]

(iii) What feature of a limonene molecule is responsible for this colour change?

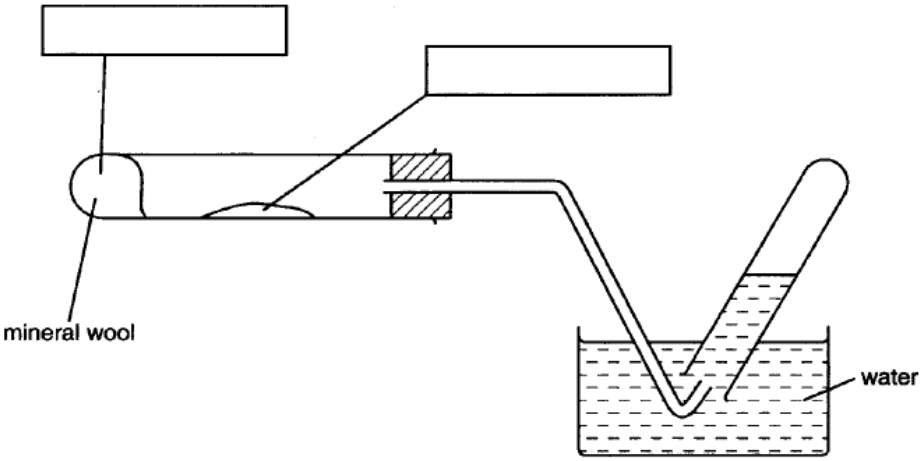
.....[1]

(iv) Name the two substances formed when limonene is burnt in an excess of oxygen.

..... and .....[2]

Alternative to Practical 1

Ethene is made when ethanol is passed over hot aluminium oxide.



(a) Complete the boxes to show the chemicals used. [2]

(b) Show on the diagram with an arrow where the heat is applied. [1]

(c) Label on the diagram where the ethene is collected. [1]

(d) Why must the delivery tube be removed from the water before the heating is stopped?

.....

.....

.....[2]

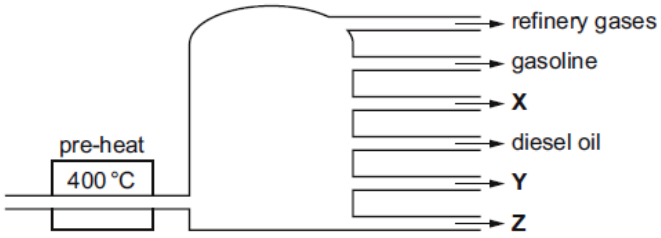
(e) When ethene is shaken with aqueous bromine, the colour changes from ..... to ..... . [2]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 37

37 In an oil refinery, petroleum is separated into useful fractions.

The diagram shows some of these fractions.

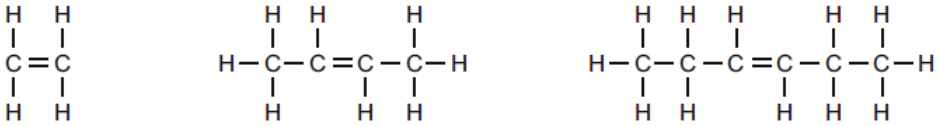


What are fractions X, Y and Z?

	X	Y	Z
A	fuel oil	bitumen	paraffin (kerosene)
B	fuel oil	paraffin (kerosene)	bitumen
C	paraffin (kerosene)	bitumen	fuel oil
D	paraffin (kerosene)	fuel oil	bitumen

Paper 1 Question 38

38 The structures of three compounds are shown.



Why do these substances all belong to the same homologous series?

A They all contain an even number of carbon atoms.

B They all contain the same functional group.

C They are all hydrocarbons.

D They are all saturated.

Paper 1 Question 39

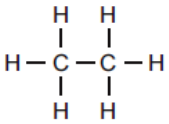
39 Which bond is **not** in a molecule of ethanoic acid?

A C–O **B** C=O **C** C=C **D** O–H

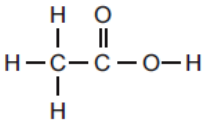
Paper 1 Question 40

40 Which structure is **incorrect**?

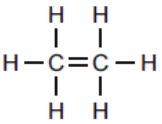
A



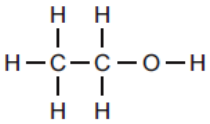
B



C



D



Paper 3 Question 8

8 Ethene, C_2H_4, is manufactured by cracking petroleum fractions.

(a) (i) What do you understand by the term *fraction?*

.....

..... [1]

(ii) Complete the symbol equation for the manufacture of ethene from dodecane, $C_{12}H_{26}$.

$$C_{12}H_{26} \rightarrow C_2H_4 + ...$$

[1]

(b) Two fractions obtained from the distillation of petroleum are refinery gas and gasoline.
State **one** use of each of these fractions.

refinery gas .....

gasoline ..... [2]

(c) Ethene is an unsaturated hydrocarbon.
What do you understand by the following terms?

unsaturated .....

hydrocarbon ..... [2]

(d) Ethene is used to make ethanol.

(i) Which of these reactions is used to make ethanol from ethene?
Tick one box.

catalytic addition of steam	☐
fermentation	☐
oxidation using oxygen	☐
reduction using hydrogen	☐

[1]

(ii) Draw the structure of ethanol, showing all atoms and bonds.

[2]

(e) Ethene is used to make poly(ethene).
Complete the following sentences about this reaction.
Use words from the list below.

additions **carbohydrates** **catalysts** **monomers** **polymers**

The ethene molecules which join to form poly(ethene) are the ..... .

The poly(ethene) molecules formed are ..... . [2]

[Total: 11]

Paper 4 Question 9

(b) Some plastics, formed by polymerisation, are non-biodegradable.

Describe **two** pollution problems that are caused by non-biodegradable plastics.

.....

.....

.....

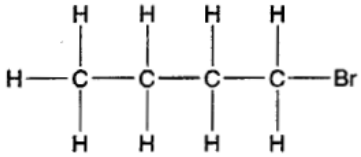
..... [2]

EXTENSION question

Extension 4

Organic compounds that contain the halogens can have chloro, bromo or iodo in their names.

(a) The following diagram shows the structure of 1-bromobutane.



(i) Draw the structure of an isomer of this compound.

(ii) Draw a possible structure of a dibromobutane.

(iii) Name two chemicals that react together to make only one product – dibromobutane.

..... and .....

[4]

(b) Draw a diagram to show the arrangement of the valency electrons in the covalent compound chloromethane.
Use o to represent an electron from carbon
Use x to represent an electron from hydrogen
Use ⊗ to represent an electron from chlorine

[3]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 37

37 Which reaction does **not** take place in the dark?

A $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

B $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

C $C_2H_4 + H_2O \rightarrow C_2H_5OH$

D $C_2H_4 + H_2 \rightarrow C_2H_6$

Paper 2 Question 38

38 Ethane and ethene are both hydrocarbons.

Ethane reacts with chlorine and ethene reacts with bromine.

Which row describes the type of reaction that ethane and ethene undergo?

	ethane	ethene
A	addition	addition
B	addition	substitution
C	substitution	substitution
D	substitution	addition

Paper 4 Question 8

8 The alcohols form an homologous series.

(a) Give **three** characteristics of an homologous series.

.....

.....

.....

..... [3]

(b) The following two alcohols are members of an homologous series and they are isomers.

$CH_3 — CH_2 — CH_2 — CH_2 — OH$ and $(CH_3)_2CH — CH_2 — OH$

(i) Explain why they are isomers.

.....

.....

..... [2]

(ii) Deduce the structural formula of another alcohol which is also an isomer of these alcohols.

[1]

Organic 1 – answers

Core 1

(a) B and D

(b) **(i)** substance or group of substances with a specific boiling range or condensed at a similar temperature

(ii) distillation / fractional distillation / fractionation

(iii) vaporised — change of state to gas / vapour state
condensed — change of state from gas / vapour to liquid

(iv) boiling point

(c) **(i)** high temperature and catalyst

(ii) ethane / C_2H_4

(d) petrol → fuel for cars
lubricating fraction → waxes and polishes
paraffin → aircraft fuels
bitumen → making roads

Core 2

(a) **(i)** $C_{10}H_{16}$

(ii) brown / orange / red
to colourless

(iii) C = C bond / carbon – carbon double bond

(iv) carbon dioxide and water

Alternative to Practical 1

(a) left hand box – ethanol
right hand box – aluminium oxide

(b) underneath aluminium oxide

(c) ethene label to test-tube

(d) water sucked back
cracks / breaks tube

(e) brown / red / orange / yellow to colourless

Specimen Paper 1

37 D

38 B

39 C

40 C

Specimen Paper 3

8 **(a)** **(i)** (group of) molecules with similar boiling points / (group of) molecules with similar relative molecular masses / molecules with limited range of boiling points / molecules with limited range of molecular masses / molecules coming off at the same place in the fractionation column / owtte

(ii) $C_{10}H_{22}$
allow: reasonable mixtures, e.g. $C_7H_{16} + C_3H_6$

(b) refinery gas: (fuel) for heating / (fuel) for cars / (fuel) for cooking;
gasoline: (fuel) for cars / mowers, etc.;

(c) unsaturated: contains double bonds / contains C=C bonds;
hydrocarbon: containing carbon and hydrogen only;

(d) **(i)** 1st box down ticked (catalytic addition of steam)

(ii) correct structure of ethanol;
bond between O–H;

(e) monomers;
polymers;

Specimen Paper 4

9 **(b)** Any two from:
ingestion can be fatal to animals / owtte;
animals can be caught in plastics, e.g. fishing line / owtte;
combustion releases toxins / owtte;
land-fill uses natural resources / owtte;
allow: any appropriate example

Extension 4

(a) **(i)** correct formula of an isomer
$CH_3.CH_2.CHBr.CH_3$
or $CH_3.CH(CH_3).CH_2Br$
or $(CH_3)_3CBr$

(ii) any correct formula for a dibromomethane

(iii) butene

bromine

(b) correct formula CH_3Cl showing 8e around C and Cl and 2e around hydrogen

Specimen Paper 2

37 B

38 D

Specimen Paper 4

8 **(a)** Any three from:
same general formula;
consecutive members differ by CH_2;
similar chemical properties;
same functional group;
physical properties vary in a predictable way / give trend such as mp increases with n;

(b) **(i)** they have the same molecular formula;
not: general formula
different structures / structural formulae;

(ii) $CH_3–CH_2–CH(OH)–CH_3$ / $(CH_3)_3C–OH$
allow: butan–2–ol and 2–methylpropan–2–ol

Amount of substance

CORE question

Core 1

(c) Cement is made by roasting clay with crushed chalk. Chalk is largely calcium carbonate. When cement is made, some of the calcium carbonate breaks down to calcium oxide.

$$\underset{\text{calcium carbonate}}{CaCO_3(s)} \rightarrow \underset{\text{calcium oxide}}{CaO(s)} + \underset{\text{carbon dioxide}}{CO_2(g)}$$

(i) What type of chemical reaction is this?

.....[1]

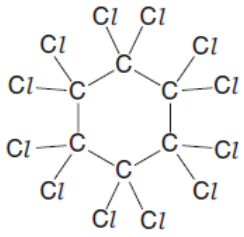
(ii) Which of the three chemicals in this reaction (calcium carbonate, calcium oxide or carbon dioxide) has the lowest relative formula mass?

.....[1]

0620 Cambridge IGCSE Chemistry Specimen Paper (2016)

Paper 3 Question 1

(b) The structure of a compound containing carbon and chlorine is shown below.



What is the molecular formula of this compound?

..... [1]

EXTENSION questions

Extenion 1

A sample of impure copper was dissolved in nitric acid. The solution of copper(II) nitrate was filtered to remove solid impurities and evaporated to dryness. The solid nitrate was heated to constant mass to leave only copper(II) oxide.

Results
Mass of impure copper = 4.21 g
Mass of copper oxide = 4.80 g

$2Cu(NO_3)_2(s) \longrightarrow 2CuO(s) + 4NO_2(g) + O_2(g)$

(i) Complete the following to determine the percentage purity of the sample of copper.

The mass of one mole of CuO = 80 g

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

mass of copper in copper(II) oxide = ... [1]

percentage of copper = ... [1]

(ii) Calculate the total volume of gas formed at r.t.p.

total number of moles of gas formed = ... [2]

volume of gas formed = ...dm^3 [1]

Extension 4

(b) Given below are the formulae of the oxides of some of the elements. They are given in the same order as in the Periodic Table.

MgO	Al_2O_3	SiO_2	P_2O_3
CaO			
SrO			

(i) Use the electronic structures of the elements to explain why oxides of elements in the same group have the same type of formula.

.....

.....

.....[2]

(ii) Use the electronic structures of the elements to explain why oxides of elements in the same period have different formulae.

.....

.....

.....[1]

Extension 5

(d) Use the following information to calculate *x* and *y* and to write the formula for the basic lead(II) carbonate.

$$PbCO_3 \longrightarrow PbO + CO_2$$
$$Pb(OH)_2 \longrightarrow PbO + H_2O$$

The basic lead(II) carbonate when heated gave 1.056 g of carbon dioxide and 0.216 g of water.

The mass of one mole of CO_2 = ... g [1]

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

The mass of one mole of H_2O = 18 g

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

Therefore *x* = ... and *y* = ...

The formula for the basic carbonate is ..... [1]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 8

8 What is the relative molecular mass, M_r, of butanol?

A 15 **B** 37 **C** 74 **D** 148

Paper 2 Question 10

10 What is the concentration of a solution containing 1.0 g of sodium hydroxide in 250 cm^3 of solution?

A 0.025 mol / dm^3

B 0.10 mol / dm^3

C 0.25 mol / dm^3

D 1.0 mol / dm^3

Paper 2 Question 11

11 Four students prepared hydrated copper(II) sulfate by adding an excess of dilute sulfuric acid to copper(II) oxide.

Each student used a different mass of copper(II) oxide.

$$CuO \xrightarrow{\text{dilute sulfuric acid}} CuSO_4.5H_2O$$

$M_r = 80$ $\qquad$ $M_r = 250$

After the copper(II) sulfate had crystallised the students dried and weighed the crystals.

Which student produced the highest percentage yield of hydrated copper(II) sulfate?

	mass of copper(II) oxide used / g	mass of crystals produced / g
A	4.0	11.5
B	8.0	23.5
C	12.0	35.0
D	16.0	46.5

Paper 2 Question 12

12 20 cm^3 of ethyne, C_2H_2, are reacted with 500 cm^3 of oxygen.

The equation for the reaction is

$$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$$

What is the total volume of gas remaining at the end of the reaction?

(all volumes are measured at room temperature and pressure)

A 400 cm^3

B 450 cm^3

C 490 cm^3

D 520 cm^3

Paper 4 Question 6

(b) (i) 5.95 g of cobalt(II) carbonate were added to 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3.

Calculate the maximum yield of cobalt(II) chloride-6-water and show that the cobalt(II) carbonate was in excess.

$$CoCO_3 + 2HCl \rightarrow CoCl_2 + CO_2 + H_2O$$

$$CoCl_2 + 6H_2O \rightarrow CoCl_2.6H_2O$$

maximum yield:

number of moles of HCl used = ...

number of moles of $CoCl_2$ formed = ...

number of moles of $CoCl_2.6H_2O$ formed = ...

mass of one mole of $CoCl_2.6H_2O$ = 238 g

maximum yield of $CoCl_2.6H_2O$ = ... g

to show that cobalt(II) carbonate is in excess:

number of moles of HCl used = ... (use your value from above)

mass of one mole of $CoCO_3$ = 119 g

number of moles of $CoCO_3$ in 5.95 g of cobalt(II) carbonate = ... [5]

(ii) Explain how these calculations show that cobalt(II) carbonate is in excess.

..... [1]

Amount of substance – answers

Core 1

(c) **(i)** thermal decomposition

(ii) carbon dioxide CO_2

Specimen Paper 3

1 **(b)** C_6Cl_{12}

Extension 1

(i) 4.8 / 80 = 0.06

64*0.06 = 3.84 g

3.84 / 4.21*100 = 91%

(ii) moles of CuO = 0.06

total moles of gas = 0.06 × 2.5 = 0.15

0.15 × 24 = 3.6 dm^3

Extension 4

(b) **(i)** have same number of outer electrons
same valency or need to lose or gain same number

(ii) have different number of outer electrons

Extension 5

(d) 44 g
1.056 / 44 = 0.024
0.216 / 18 = 0.012
x = 2 and y = 1
2PbCO3.yPb(OH)2

Specimen Paper 2

8 C

10 B

11 B

12 C

Specimen Paper 4

6 (b) (i) number of moles of HCl used = 0.04 × 2 = 0.08;
number of moles $CoCl_2$ formed = 0.04;
number of moles $CoCl_2.6H_2O$ formed = 0.04;
maximum yield of $CoCl_2.6H_2O$ = 9.52;
allow: 9.5
allow: ecf on number of moles of HCl
number of moles of HCl used = 0.08 note: must use their value
allow: ecf
number of moles of $CoCO_3$ in 5.95 g of cobalt(II) carbonate = 5.95 / 119 = 0.05;

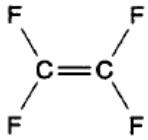
(ii) 0.05 > 0.04 or stated in words;
allow: ecf on number of moles of $CoCl_2$ formed

Organic 2

CORE question

Core 1

(a) The structure of tetrafluoroethene is shown below.

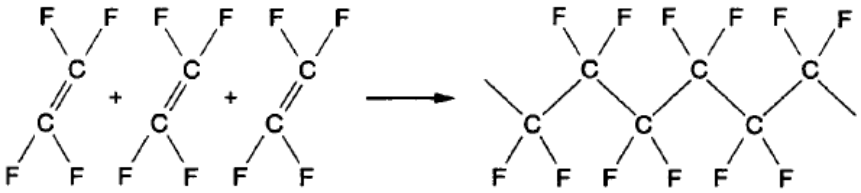


(i) Use the Periodic Table to help you calculate the relative molecular mass of tetrafluoroethene.

[2]

(ii) Teflon is used to make non-stick coatings for saucepans.

Teflon is made when many molecules of tetrafluoroethene join together.



What type of chemical reaction is shown in this equation?

.....[2]

EXTENSION questions

Extension 2

(a) The structure of the synthetic polymer *Terylene* is given below.

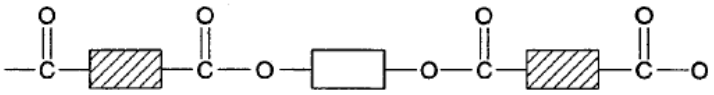


Fig. 2

(i) Name the type of linkage in this polymer.

.....[1]

(ii) What naturally occurring substance contains the same linkage?

.....[1]

(b) Another synthetic polymer is nylon. Draw the structure of a nylon.

[3]

(c) Complex carbohydrates such as starch are natural polymers.

(i) Name the **three** elements present in carbohydrates.

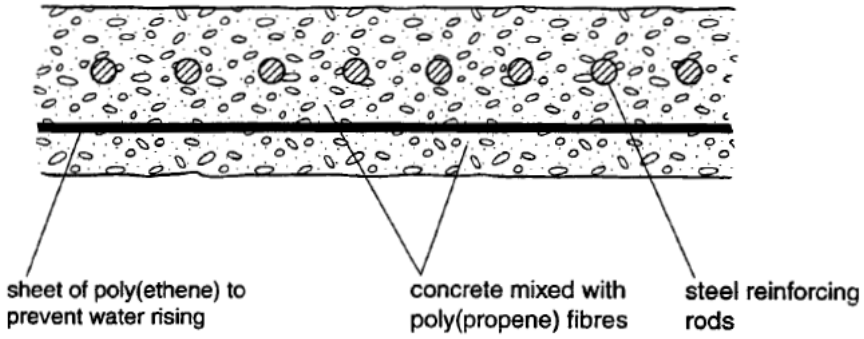
.....[1]

(ii) Draw the structure of a complex carbohydrate.

[2]

Extension 3

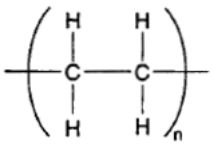
The diagram below shows a correctly constructed concrete floor.



(a) (i) What type of reaction is used to make both of the polymers, poly(ethene) and poly(propene)?

.....

(ii) A diagram of the structure of poly(ethene) is given below.

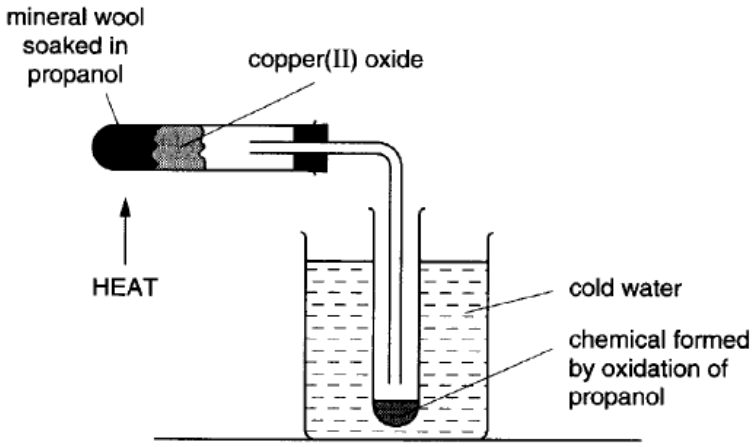


Draw a similar diagram to show the structure of poly(propene).

[3]

Extension 5

(b) Some alcohols are easily oxidised.



The chemical formed has a pH of 2. Give the name and structural formula of the chemical formed.

name .....[1]

structural formula

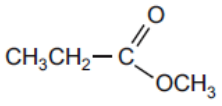
[1]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 39

39 Esters are made by reacting an alcohol with a carboxylic acid.

Which acid and alcohol react together to form the following ester?



A propanoic acid and ethanol

B propanoic acid and methanol

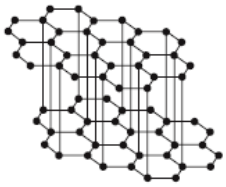
C ethanoic acid and ethanol

D ethanoic acid and methanol

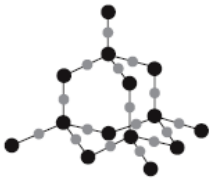
Paper 2 Question 40

40 Which structure represents a polymer?

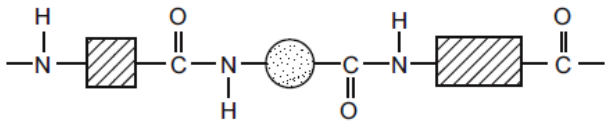
A



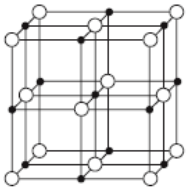
B



C

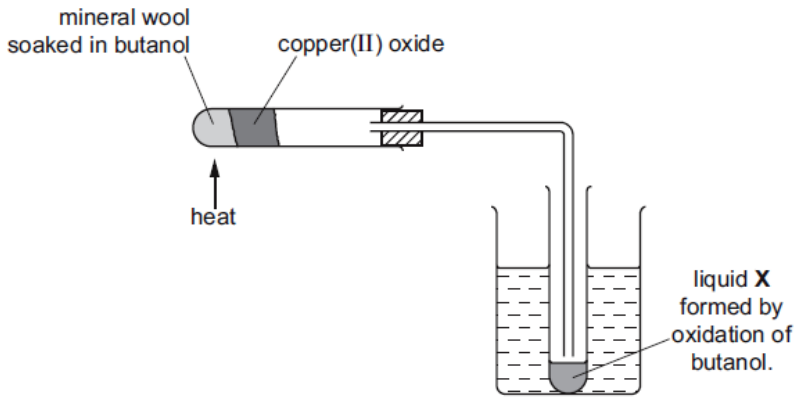


D



Paper 4 Question 8

(c) Copper(II) oxide can oxidise butanol to liquid **X**, whose pH is 4.



(i) Give the name of another reagent which can oxidise butanol.

..... [1]

(ii) Which homologous series does liquid **X** belong to?

..... [1]

(iii) State the formula of liquid **X**.

..... [1]

Paper 4 Question 9

9 There are two types of polymerisation, addition and condensation.

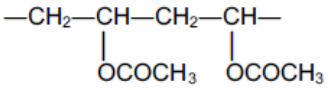
(a) Explain the difference between these two types of polymerisation.

.....

.....

..... [2]

(c) The polymer known as PVA is used in paints and adhesives. Its structural formula is shown below.



Deduce the structural formula of its monomer.

[1]

(d) A condensation polymer can be made from the following monomers.

$HOOC(CH_2)_4COOH$ and $H_2N(CH_2)_6NH_2$

Draw the structural formula of this polymer.

[3]

Organic 2 – answers

Core 1

(a) **(i)** 100

(ii) addition or polymerisation

Extension 2

(a) **(i)** ester or polyester

(ii) fats or vegetable oils or lipids

(b) –NHCO(CH_2)$_4$CONH(CH_2)$_6$NHCO
or –NHCO–■–CONH–○–NHCO
or –NHCO-■–NHCO–■–NHCO

(c) **(i)** carbon, hydrogen and oxygen

(ii) –■–●–■–●–■–●–■–●

Extension 3

(a) **(i)** addition or addition polymerisation

(ii) correct repeat unit showing branched CH_3

Extension 5

(b) propanoic acid
CH_3CH_2COOH

Specimen Paper 2

39 B

40 C

Specimen Paper 4

8 **(c)** **(i)** (acidified) potassium manganate(VII)
allow: oxygen / air / (acidified) potassium chromate(VI)

(ii) carboxylic acid
allow: aldehyde / ketone

(iii) $CH_3–CH_2–CH_2–COOH$ / C_3H_7COOH / $C_4H_8O_2$
allow: C_4H_7OOH
allow: ecf on **(c)(ii)**

9 **(a)** addition: polymer is the only product / only one product;

condensation: polymer and water formed / small molecule formed;

(c) $CH_2=CHOCOCH_3$
note: double bond does not need to be shown

(d) $–OC(CH_2)_4CONH(CH_2)_6NH–$
amide linkage correct;
correct repeat units;
continuation bonds shown;

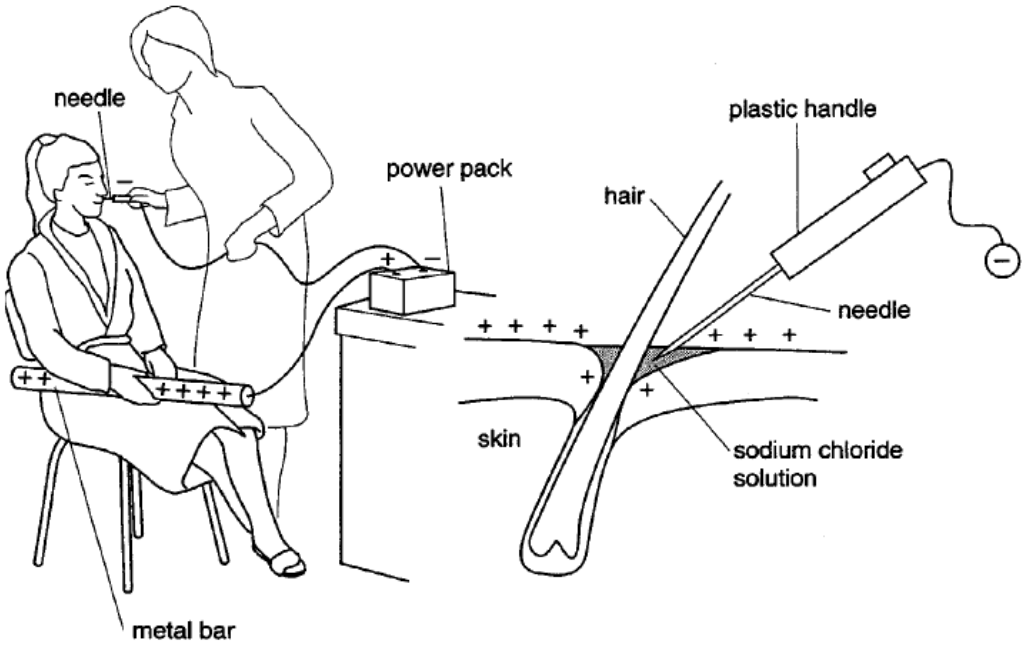
Redox, electrochemistry and Group VII

CORE questions

Core 1

Unwanted hair on a person's face can be removed by electrolysis.

The skin is given a small positive charge when the person holds on to a metal bar. The metal bar acts as a positive electrode. A needle is the negative electrode.



(a) What is the name given to

(i) a positive electrode,

.....[1]

(ii) a negative electrode?

.....[1]

(b) What property must an electrode have if electrolysis is to work?

.....[1]

(c) The needle, which is the negative electrode, is held by the operator.

Suggest why the needle has a plastic handle, rather than a metal handle.

.....[1]

Core 1

(d) The liquid on the skin around the tip of the needle is mainly a solution of sodium chloride.

(i) Give the chemical formula for sodium chloride.

.....[1]

(ii) Explain the meaning of the word *solution*.

.....[1]

(iii) Sodium chloride can be made by adding an acid to an alkali.

Name an acid and alkali you can use to make sodium chloride.

acid .....

alkali .....[2]

(iv) Starting with this acid and alkali, describe how you can obtain sodium chloride crystals.

.....

.....

.....

.....[2]

(e) When the electrolysis is carried out on the surface of the skin, a gas forms around the tip of the needle.

Name this gas.

.....[1]

Core 2

Black lead sulphide is formed when oil paints containing lead compounds react with pollutants in the atmosphere.

When hydrogen peroxide is used to clean dirty oil paintings, the following reaction occurs.

$$PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$$

lead sulphide	hydrogen peroxide	white compound

(i) Name the white compound of lead formed in this reaction.

.....[1]

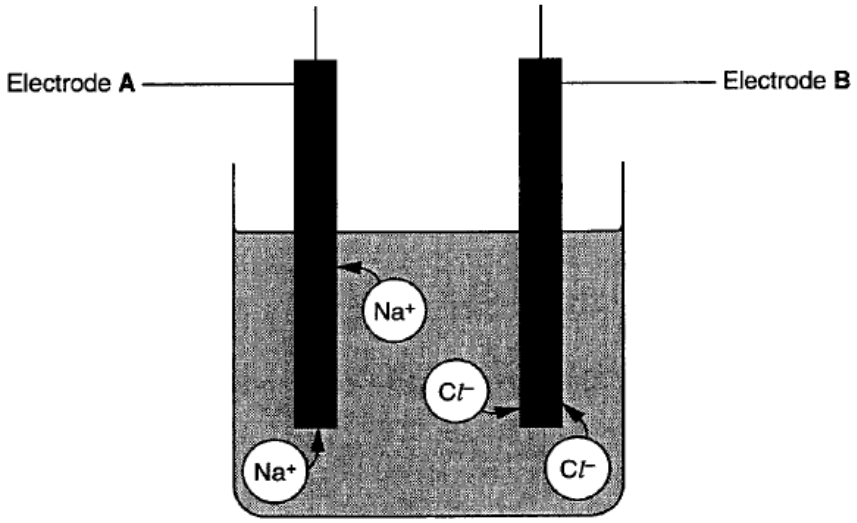
(ii) Use the information in the equation to explain how you know the lead sulphide has been oxidised.

.....[1]

ALTERNATIVE TO PRACTICAL question

Alternative to Practical 1

The diagram shows the movement of the ions Na^+ and Cl^- during the electrolysis of molten sodium chloride.



(a) Which electrode, **A** or **B**, is the positive electrode? Explain your choice.

.....

.....[2]

(b) Which ion is attracted to the cathode?

.....[1]

(c) Name the two elements formed by the electrolysis of molten sodium chloride.

1. .....

2. .....[2]

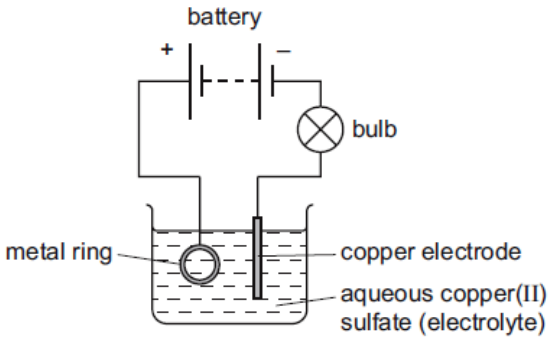
(d) Give **one** expected observation during this electrolysis.

.....[1]

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 12

12 The diagram shows apparatus used in an attempt to electroplate a metal ring with copper.



The experiment did not work.

Which change is needed in the experiment to make it work?

A Add solid copper(II) sulfate to the electrolyte.

B Increase the temperature of the electrolyte.

C Replace the copper electrode with a carbon electrode.

D Reverse the connections to the battery.

Paper 1 Question 13

13 Three electrolysis cells are set up. Each cell has inert electrodes.

The electrolytes are listed below.

cell 1	aqueous sodium chloride
cell 2	dilute sulfuric acid
cell 3	molten lead(II) bromide

In which of these cells is a gas formed at **both** electrodes?

A 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only

Paper 1 Question 18

18 The red colour in some pottery glazes may be formed as a result of the reactions shown.

$$CuCO_3 \xrightarrow{\text{heat}} CuO + CO_2$$

$$CuO + SnO \longrightarrow Cu + SnO_2$$

These equations show that .....1..... is oxidised and .....2..... is reduced.

Which substances correctly complete gaps 1 and 2 in the above sentence?

	1	2
A	CO_2	SnO_2
B	$CuCO_3$	CuO
C	CuO	SnO
D	SnO	CuO

Paper 1 Question 23

23 Astatine is an element in Group VII of the Periodic Table. It has only ever been produced in very small amounts.

What are the likely properties of astatine?

	colour	state	reaction with aqueous potassium iodide
A	black	solid	no reaction
B	dark brown	gas	brown colour
C	green	solid	no reaction
D	yellow	liquid	brown colour

Paper 3 Question 1

(c) Chlorine is a halogen.

(i) State the colour of chlorine.

..... [1]

The table shows some properties of the halogens.

element	boiling point / °C	density in liquid state / g per cm^3	colour
fluorine	–188	1.51	yellow
chlorine	–35	1.56	
bromine	–7		red-brown
iodine	+114	4.93	grey-black

Use the information in the table to answer the following questions.

(ii) Predict the density of liquid bromine.

..... [1]

(iii) Describe the trend in boiling point of the halogens down the group.

..... [1]

(d) **(i)** Complete the word equation for the reaction of bromine with aqueous potassium iodide.

bromine + potassium iodide → ..... + ...

..... [2]

(ii) Suggest why bromine does not react with aqueous potassium chloride.

..... [1]

(e) Potassium chloride is an ionic substance but iodine is a molecular substance.
How do most ionic and molecular substances differ in their

solubility in water? .....

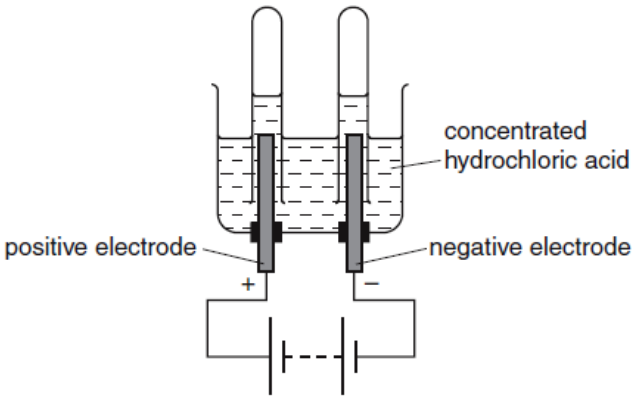
.....

electrical conductivity? .....

..... [2]

Paper 3 Question 6

6 Concentrated hydrochloric acid can be electrolysed using the apparatus shown.



(a) Define the term *electrolysis?*

.....

..... [1]

(b) What is the name given to the positive electrode?
Put a ring around the correct answer.

anion **anode** **cathode** **cation** **electrolyte**

[1]

(c) State the name of the gas given off at the negative electrode.

..... [1]

(d) Complete the following sentence about electrolysis using words from the list.

inert **magnesium** **platinum** **reactive** **solid**

Electrodes made of graphite or ..... are generally used in electrolysis because they are ..... . [2]

(e) When concentrated hydrochloric acid is electrolysed, chlorine is released.

(i) Draw the shells and the electronic structure in an atom of chlorine.

[1]

(ii) Draw the electronic structure of a chlorine molecule.
Show only the outer electron shells.

[2]

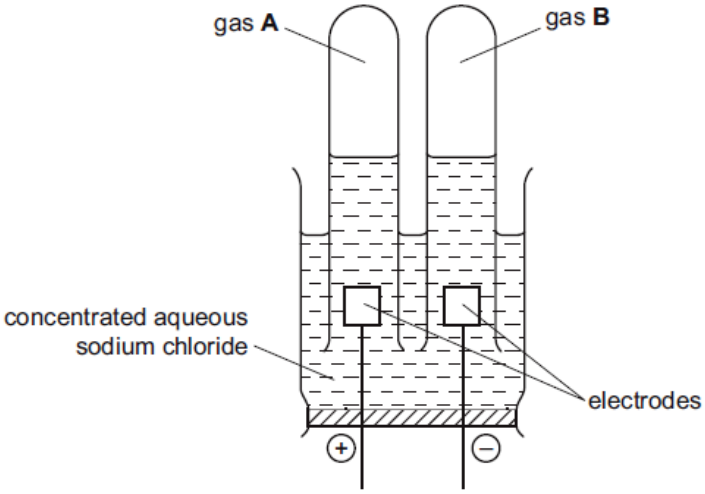
(iii) Describe a test for chlorine.

test .....

result ..... [2]

Paper 6 Question 3

3 Concentrated aqueous sodium chloride was broken down by electricity using the apparatus shown.



(a) Suggest a suitable material from which to make the electrodes.

.....[1]

(b) Gas **A** is chlorine. Give a test for chlorine.

test .....

result ..... [2]

(c) Gas **B** pops when tested with a lighted splint. What is gas **B**?

.....[1]

[Total: 4]

EXTENSION questions

Extension 1

When aqueous solutions of germanium(II) chloride and of iron(III) chloride are mixed, the following reaction occurs.

$$GeCl_2 + 2FeCl_3 \longrightarrow 2FeCl_2 + GeCl_4$$

or $Ge^{2+} + 2Fe^{3+} \longrightarrow 2Fe^{2+} + Ge^{4+}$

(i) Is the germanium(II) chloride acting as an oxidising agent or reducing agent? Explain your choice using the idea of electron transfer.

.....

.....[2]

(ii) Describe a test to show that an iron(III) salt had been changed into an iron(II) salt.

test .....

result for iron(III)salt .....

result for iron(II) salt .....

[3]

Extension 2

(c) The following diagram shows a simple cell.

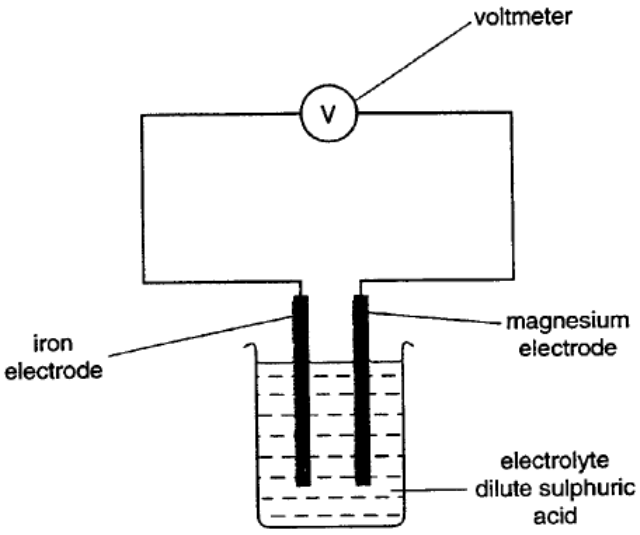


Fig. 2

(i) What is a *cell*?

.....

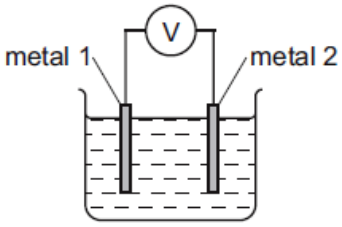
.....[2]

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

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 2 Question 13

13 Different metals were tested using the apparatus shown.



Which pair of metals would produce the largest voltage?

A copper and silver

B magnesium and silver

C magnesium and zinc

D zinc and copper

Paper 2 Question 15

15 The statements refer to the electrolysis of concentrated copper(II) chloride solution.

1 Electrons are transferred from the cathode to the copper(II) ions.

2 Electrons move around the circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

Which statements about the electrolysis of concentrated copper(II) chloride are correct?

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

Paper 2 Question 20

20 Which of these reactions shows only reduction?

A $Cu^{2+} + 2e^- \rightarrow Cu$

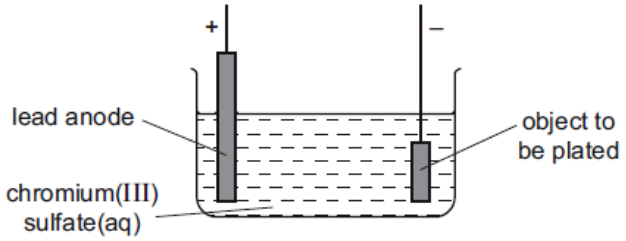
B $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

C $HCl + NaOH \rightarrow NaCl + H_2O$

D $Mg + ZnSO_4 \rightarrow Zn + MgSO_4$

Paper 4 Question 4

(b) Chromium is used to electroplate steel objects. The diagram shows how this could be done.



(i) Give **two** reasons why steel objects are plated with chromium.

.....

..... [2]

(ii) The formula of the chromium(III) ion is Cr^{3+} and of the sulfate ion is SO_4^{2-}. Give the formula of chromium(III) sulfate.

..... [1]

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

..... [2]

(iv) A colourless gas, which relights a glowing splint, is formed at the positive electrode (anode).

State the name of this gas.

..... [1]

(v) During electroplating, it is necessary to add more chromium(III) sulfate but during copper plating using a copper anode, it is not necessary to add more copper(II) sulfate.

Explain this difference.

.....

.....

..... [2]

Redox, electrochemistry and Group VII – answers

Core 1

(a) **(i)** anode

(ii) cathode

(b) conducts electricity

(c) does not conduct electricity (to operator) / plastic is an insulator / so operator does not get an electric shock

(d) **(i)** NaCl

(ii) substance dissolved in liquid / contains dissolved substance

(iii) hydrochloric acid
sodium hydroxide / sodium carbonate / sodium bicarbonate

(iv) add acid to the alkali until neutral / use titration
evaporate off water / boil off water / leave to crystallise

(e) hydrogen / H_2

Core 2

(i) lead sulfate

(ii) oxygen has been added to it

Alternative to practical 1

(a) B – Cl^- attracted

(b) Na^+ / cation / positive ion

(c) sodium chloride

(d) bubbles / silvery metal / green yellow gas

Specimen Paper 1

12 D

13 A

18 D

23 A

Specimen Paper 3

1 **(c)** **(i)** green / yellow-green / light green

(ii) value between 2.5–4(.0) (g per dm^3) (actual = 3.12)

(iii) increases

(d) **(i)** potassium bromide
not: potassium bromine

iodine
not: iodide

(ii) chlorine is more reactive than bromine / ora
not: chloride is more reactive than bromide

(e) solubility in water:
ionic compounds are soluble **and** molecular compounds are not soluble
note: both needed for mark

6 **(a)** break down (of substance / electrolyte) by electricity / splitting up of substance by electricity / decomposition by electricity
allow: current / voltage for electricity

(b) anode

(c) hydrogen
allow: H_2

(d) platinum;
inert;

(e) **(i)** 2,8,7 as shown in an electron shell diagram

(ii) pair of electrons between two chlorine atoms;
rest of electrons correct;

(iii) (damp) litmus (paper) / Universal indicator (paper);
allow: indicator paper / pH paper bleaches / goes white / goes red then bleaches;

Specimen Paper 6

3 **(a)** platinum / graphite / carbon

(b) damp blue litmus paper / Universal indicator paper / pH paper;
bleaches / turns white;

(c) hydrogen

Extension 1

(i) reducing

germanium or Ge^{2+} loses / donates electrons

or $Ge^{2+} - 2e \rightarrow Ge^{4+}$

iron or Fe^{3+} gains electrons

or $Fe^{3+} + e \rightarrow Fe^{2+}$

(ii) sodium hydroxide or aqueous ammonia

iron(III) salt brown precipitate

iron(II) salt green precipitate

(other possible reagents include iodide, thiocyanate, hexacyanoferrates, bromine, zinc, potassium manganate(VII))

Extension 2

(c) (i) produces electrical energy or voltage or current
from chemical energy or chemical reactions

or

two different electrodes
in electrolyte

(ii) from magnesium to iron through external circuit

Specimen Paper 2

13 B

15 A

20 A

Specimen Paper 4

4 (b) (i) Any two from:
appearance / shiny / more attractive / decoration;
resists corrosion / resists rusting;
hard surface;

(ii) $Cr_2(SO_4)_3$
ignore: correct charges on ions

(iii) $Cr^{3+} + 3e \rightarrow Cr$
note: one mark for equation and one mark for correct balancing

(iv) oxygen / O_2

(v) to replace chromium ions (used to plate steel) / chromium ions used up;
copper ions replaced from copper anode;

Equilibria

0620 Cambridge IGCSE Chemistry Specimen Papers (2016)

Paper 1 Question 35

35 To grow rose plants, a fertiliser containing nitrogen, phosphorus and potassium is often used.

For the best rose flowers, the fertiliser should contain a high proportion of potassium.

Which fertiliser is best for producing rose flowers?

fertiliser	proportion by mass		
	N	P	K
A	9	0	25
B	13	13	20
C	29	5	0
D	29	15	5

Paper 2 Question 34

34 Which row shows the conditions for the manufacture of sulfuric acid?

	pressure / atm	temperature / °C	catalyst
A	2	450	vanadium(V) oxide
B	2	250	iron
C	200	450	iron
D	200	250	vanadium(V) oxide

Paper 4 Question 7

7 Iodine reacts with chlorine to form dark brown iodine monochloride.

$$I_2 + Cl_2 \rightarrow 2ICl$$

This reacts with more chlorine to give yellow iodine trichloride.
An equilibrium forms between these iodine chlorides.

$$\underset{\text{dark brown}}{ICl(l)} + Cl_2(g) \rightleftharpoons \underset{\text{yellow}}{ICl_3(s)}$$

(a) What do you understand by the term *equilibrium*?

.....

.....

..... [2]

(b) When the equilibrium mixture is heated, it becomes a darker brown colour.
Suggest if the reverse reaction is endothermic or exothermic. Give a reason for your choice.

.....

.....

..... [1]

(c) The pressure on the equilibrium mixture is decreased.

(i) How would this affect the position of equilibrium? Give a reason for your choice.

It would move to the .....

reason .....

..... [1]

(ii) Describe what you would observe.

.....

..... [1]

Equilibria – answers

Specimen Paper 1

35 B

Specimen Paper 2

34 A

Specimen Paper 4

7 **(a)** rates equal;
concentrations do not change / macroscopic properties remain constant;

(b) endothermic **and** because this direction is favoured by high temperatures;
note: reason is required

(c) **(i)** move to left hand side / reactants favoured **and** because bigger volume / more moles on left hand side
note: reason is required

(ii) less (yellow) solid / more (dark brown) liquid / green gas visible / turns darker brown / smell chlorine
allow: ecf from **(c)(i)**