

Write your name here	
Surname	Other names
<b>Pearson Edexcel Certificate</b>	Centre Number
<b>Pearson Edexcel</b>	Candidate Number
<b>International GCSE</b>	
<h1>Chemistry</h1> <p><b>Unit: KCH0/4CH0</b>  <b>Science (Double Award) KSC0/4SC0</b>  <b>Paper: 1C</b></p>	
Tuesday 13 May 2014 – Morning	Paper Reference
<b>Time: 2 hours</b>	<b>KCH0/1C 4CH0/1C</b> <b>KSC0/1C 4SC0/1C</b>
<b>You must have:</b> Calculator, ruler	Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

### Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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# THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0 Group

Period

4	He	Helium	2
---	----	--------	---

1	H	Hydrogen	1
---	---	----------	---

7	Li	Lithium	3	9	Be	Beryllium	4	11	B	Boron	5	12	C	Carbon	6	14	N	Nitrogen	7	16	O	Oxygen	8	19	F	Fluorine	9	20	Ne	Neon	10
23	Na	Sodium	11	24	Mg	Magnesium	12	27	Al	Aluminium	13	28	Si	Silicon	14	31	P	Phosphorus	15	32	S	Sulfur	16	35.5	Cl	Chlorine	17	40	Ar	Argon	18
39	K	Potassium	19	40	Ca	Calcium	20	45	Sc	Scandium	21	48	Ti	Titanium	22	51	V	Vanadium	23	52	Cr	Chromium	24	59	Co	Cobalt	27	56	Fe	Iron	26
86	Rb	Rubidium	37	88	Sr	Strontium	38	89	Y	Yttrium	39	91	Zr	Zirconium	40	93	Nb	Niobium	41	96	Mo	Molybdenum	42	106	Pd	Palladium	46	101	Ru	Ruthenium	44
133	Cs	Caesium	55	137	Ba	Barium	56	139	La	Lanthanum	57	179	Hf	Hafnium	72	181	Ta	Tantalum	73	184	W	Tungsten	74	195	Pt	Platinum	78	192	Os	Osmium	76
223	Fr	Francium	87	226	Ra	Radium	88	227	Ac	Actinium	89	204	Tl	Thallium	81	201	Hg	Mercury	80	201	Hg	Mercury	80	197	Au	Gold	79	201	Hg	Mercury	80
115	In	Indium	49	112	Cd	Cadmium	48	115	In	Indium	49	119	Sn	Tin	50	122	Sb	Antimony	51	128	Te	Tellurium	52	127	I	Iodine	53	131	Xe	Xenon	54
207	Pb	Lead	82	207	Pb	Lead	82	207	Pb	Lead	82	207	Pb	Lead	82	207	Pb	Lead	82	207	Pb	Lead	82	210	Po	Polonium	84	210	Po	Polonium	84
209	Bi	Bismuth	83	209	Bi	Bismuth	83	209	Bi	Bismuth	83	209	Bi	Bismuth	83	209	Bi	Bismuth	83	209	Bi	Bismuth	83	210	Po	Polonium	84	210	Po	Polonium	84
210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84	210	Po	Polonium	84
222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86	222	Rn	Radon	86

Key

Relative atomic mass
Symbol
Name
Atomic number



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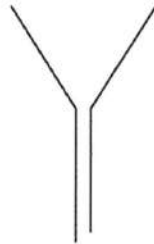


**Answer ALL questions.**

**1** The diagram shows some pieces of apparatus that you may find in a laboratory.



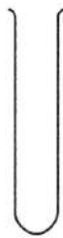
**A**



**B**



**C**



**D**



**E**



**F**

(a) Complete the table by giving the name of each piece of apparatus.

(4)

Letter	Name
<b>A</b>	measuring cylinder
<b>B</b>	Funnel
<b>C</b>	conical flask
<b>D</b>	Test tube
<b>E</b>	Pipette
<b>F</b>	Beaker

(b) Give the letters of the **two** pieces of apparatus that could each be used to measure an accurate volume of a liquid.

(2)

**A**

and

**E**

**(Total for Question 1 = 6 marks)**



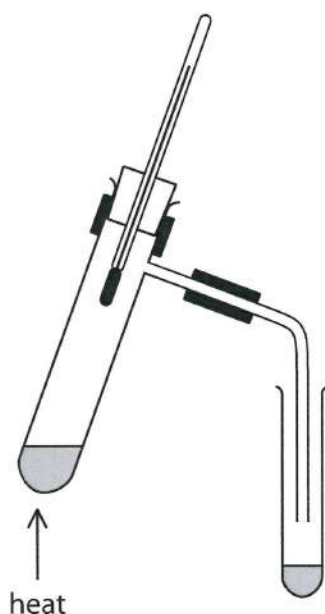
2 Crude oil is a mixture of substances.

(a) Which word best describes the main substances in crude oil?

(1)

- 4.07
- ☐ A bases
- ☐ B carbohydrates
- ☐ C elements
- ☒ D hydrocarbons

(b) This apparatus can be used to separate the substances present in a sample of crude oil into several fractions.



These sentences describe the steps in the method for separating the substances into fractions, but the steps are in the wrong order.

- R** Connect a delivery tube to the boiling tube.
- S** Pour crude oil into a boiling tube.
- T** Collect each fraction in a different test tube.
- U** Fit a thermometer into the boiling tube.
- V** Heat the crude oil gently at first, then more strongly.

Put a letter in each box to show the correct order. One has been done for you.

(2)

S	U	R	V	T
---	---	---	---	---

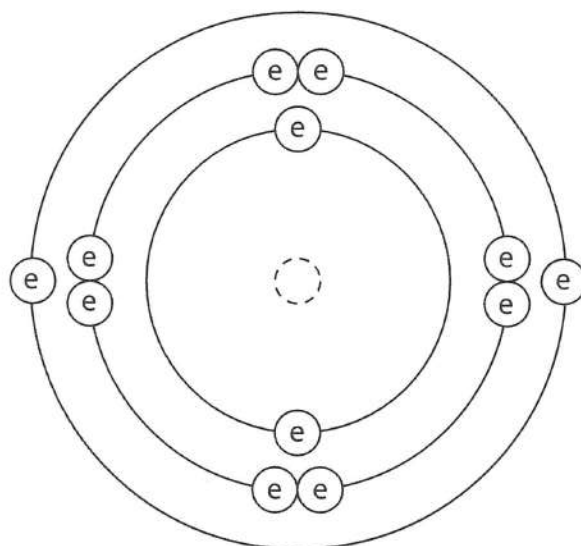
(Total for Question 2 = 3 marks)



P 4 2 8 6 5 A 0 5 3 2



3 The diagram shows the electronic configuration of an atom of element X.



key  
 ○ = nucleus  
 (e) = electron

(a) (i) How many protons does the nucleus of the atom contain?

(1)

1.15

12

(ii) Which group of the Periodic Table contains element X?

Give a reason for your choice.

(2)

1.18

2, 2 electrons in the outer shell

(iii) Give the formula of the ion formed by element X in its compounds.

(1)

3.8

X<sup>2+</sup>



(b) Element X has three isotopes.

The table gives the mass number of each isotope and its percentage abundance in a sample of element X.

Mass number	Percentage abundance (%)
24	79.0
25	10.0
26	11.0

Calculate the relative atomic mass ( $A_r$ ) of element X.

Give your answer to one decimal place.

(3)

1.17

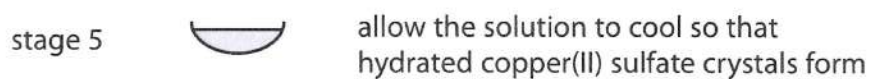
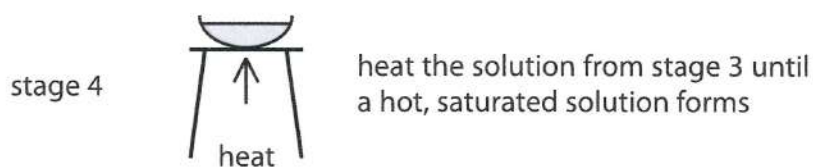
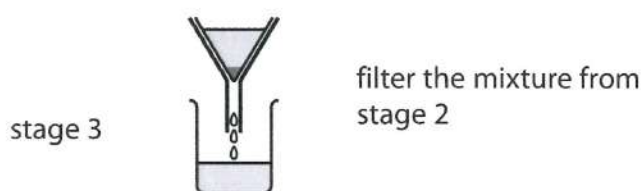
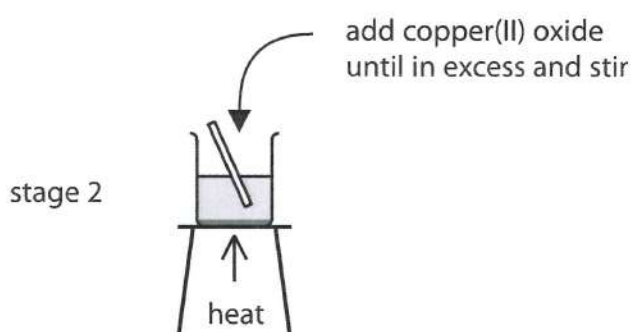
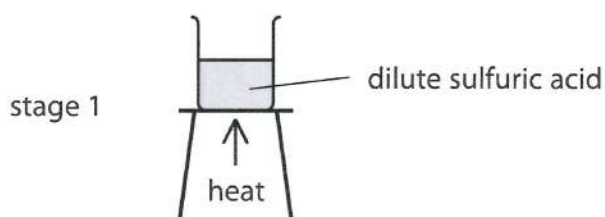
$$= \frac{(79 \times 24) + (10 \times 25) + (11 \times 26)}{100}$$
$$= 24.3$$

relative atomic mass of X = 24.3

(Total for Question 3 = 7 marks)



- 4 The diagram shows how hydrated copper(II) sulfate crystals can be made by reacting copper(II) oxide with dilute sulfuric acid.





(a) Why is the sulfuric acid heated in stage 1?

(1)

Increase rate of reaction

(b) How would you know when the copper(II) oxide is in excess in stage 2?

(1)

Stops disappearing

(c) Why is the mixture filtered in stage 3?

(1)

Remove excess copper(II) oxide

(d) Why do crystals form when the hot saturated solution is cooled in stage 5?

(1)

Crystals are less soluble in cold water

(e) State the colour of the crystals formed in stage 5.

(1)

Blue

(f) The crystals are removed by filtration and then dried.

Suggest a suitable method of drying the crystals.

(1)

on filter paper / leave in a warm place

(Total for Question 4 = 6 marks)



P 4 2 8 6 5 A 0 9 3 2

5 The table shows some properties of four substances A, B, C and D.

Substance	Melting point in °C	Boiling point in °C	Conducts electricity when solid?	Conducts electricity when molten?
A	-101	-35	no	no
B	1063	2970	yes	yes
C	801	1413	no	yes
D	3550	4830	no	no

(a) Use the information in the table to identify the substance that

(i) is a metal

(1)

☐ A ☒ B ☐ C ☐ D

(ii) could be diamond

(1)

☐ A ☐ B ☐ C ☒ D

(iii) is a gas at 20°C

(1)

☒ A ☐ B ☐ C ☐ D

(iv) contains oppositely charged ions

(1)

☐ A ☐ B ☒ C ☐ D

(b) Some of the substances in the table are compounds.

What is meant by the term **compound**?

(2)

• Substance containing 2 or more elements  
chemically combined



(c) (i) The electronic configurations of atoms of sodium and chlorine are

Na 2.8.1

Cl 2.8.7

Describe the changes in the electronic configurations of sodium and chlorine when these atoms form sodium chloride.

(3)

• Na loses electron, 2.8

• Cl gains electron, 2.8.8

(ii) Calculate the relative formula mass of sodium chloride (NaCl).

Use the Periodic Table on page 2 to help you.

(2)

Na = 23  
Cl = 35.5

= 23 + 35.5

= 58.5

relative formula mass = 58.5

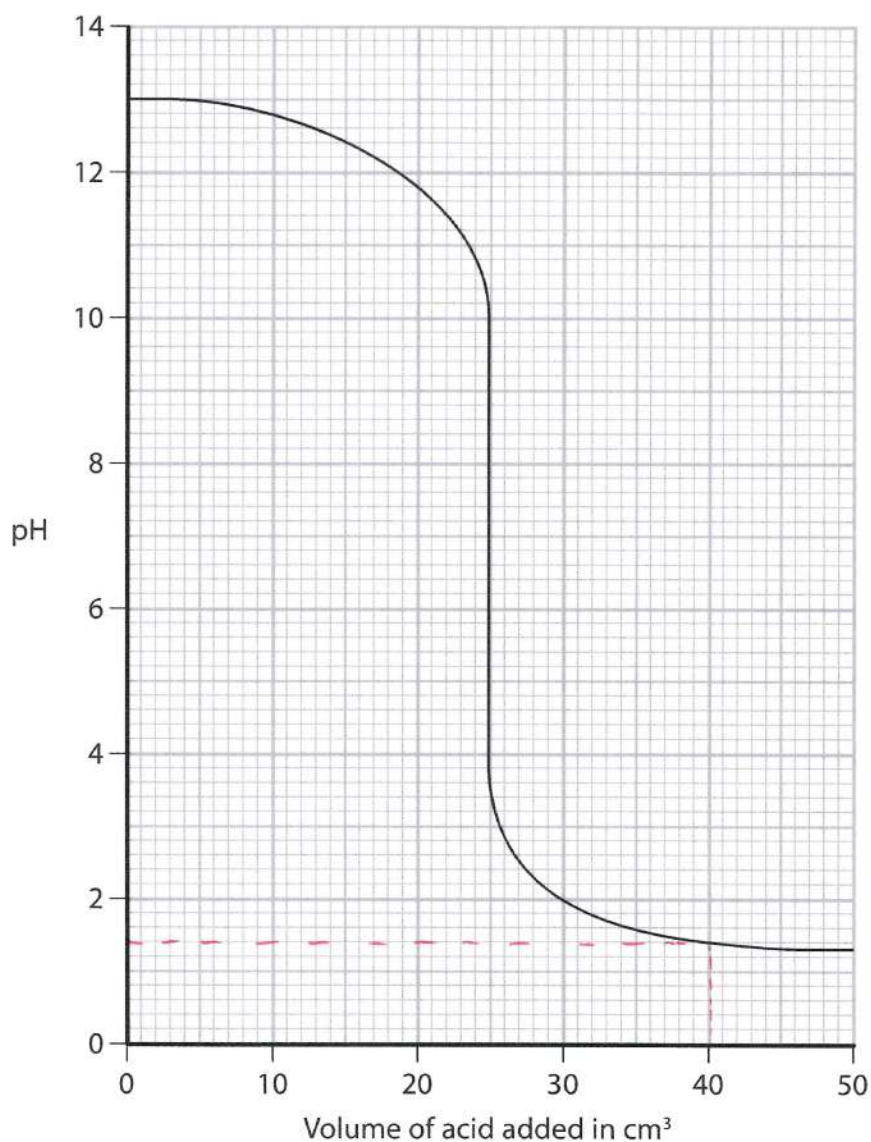
(Total for Question 5 = 11 marks)



P 4 2 8 6 5 A 0 1 1 3 2

- 6 A total volume of  $50 \text{ cm}^3$  of hydrochloric acid is added gradually to  $50 \text{ cm}^3$  of sodium hydroxide solution containing some universal indicator.

The graph shows how the pH of the solution changes as the acid is added.



(a) Use the graph to answer these questions.

- (i) What is the pH of the sodium hydroxide solution before any acid is added?

(1)

2.30  
↓  
13

- (ii) What is the pH of the solution after  $40 \text{ cm}^3$  of acid is added?

(1)

1.4

- (iii) What volume of acid is needed to completely neutralise the sodium hydroxide?

(1)

25





(b) The table shows the colour of universal indicator at different pH values.

pH	0-2	3-4	5-6	7	8-9	10-12	13-14
Colour	red	orange	yellow	green	blue	indigo	violet

Complete the table below to show the colour of the solution when the volume of hydrochloric acid added is 20 cm<sup>3</sup> and when the volume added is 35 cm<sup>3</sup>.

(2)

Volume of hydrochloric acid added in cm <sup>3</sup>	Colour of solution
20	Indigo
35	Red

(c) Write a chemical equation for the reaction between sodium hydroxide and hydrochloric acid.

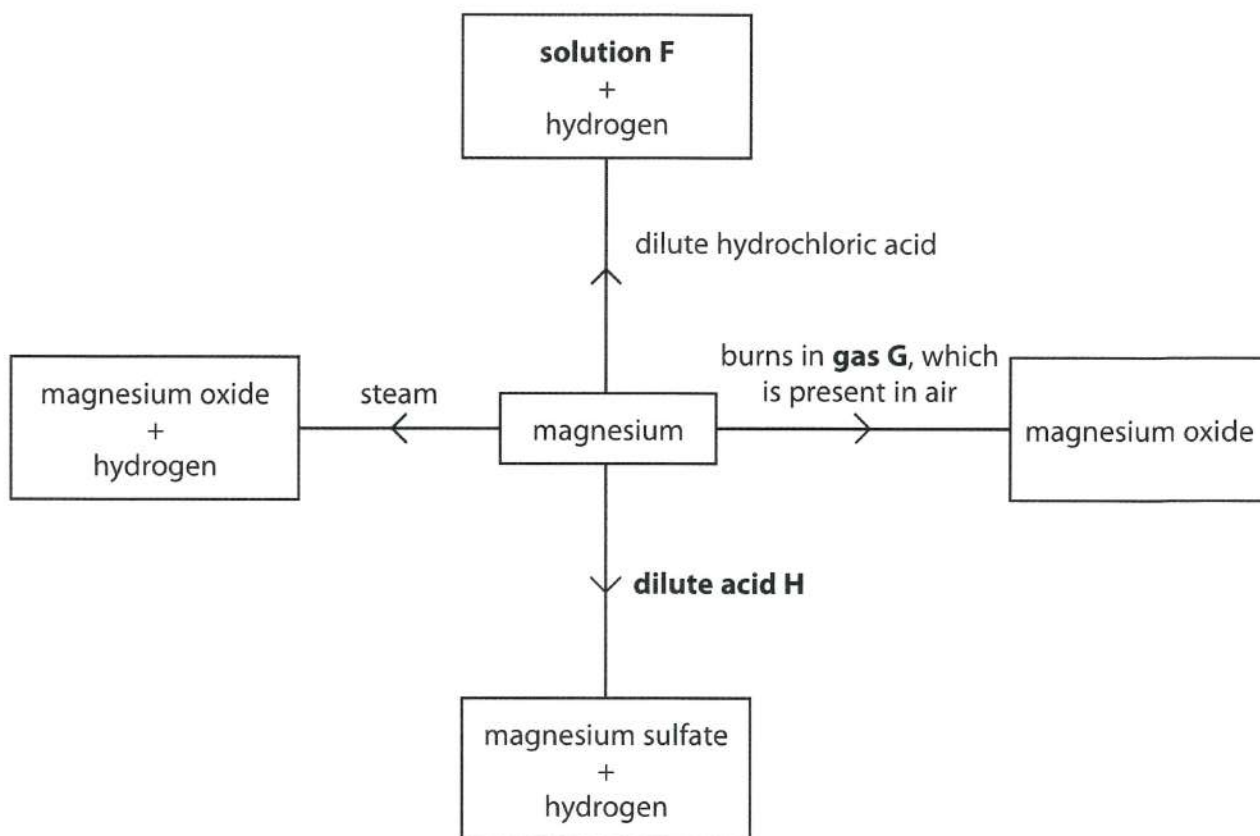
(1)



(Total for Question 6 = 6 marks)



7 The diagram shows some of the reactions of magnesium.



(a) Complete the table to give the identity of substances F, G and H.

(3)

Substance	Identity
solution F	$MgCl_2$
gas G	$O_2$
dilute acid H	$H_2SO_4$

(b) Write a chemical equation for the reaction between magnesium and steam.

(1)



(Total for Question 7 = 4 marks)





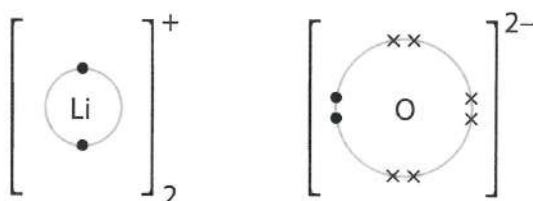
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- 8 When lithium is burned in air, the two compounds lithium oxide ( $\text{Li}_2\text{O}$ ) and lithium nitride ( $\text{Li}_3\text{N}$ ) are formed.

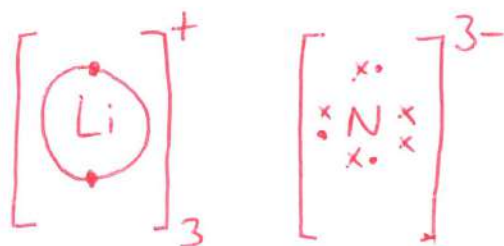
Both compounds are ionic and their ions can be represented by dot and cross diagrams.

The dot and cross diagram for the ions in lithium oxide is

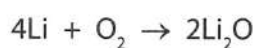


- (a) Draw a dot and cross diagram for the ions in lithium nitride.

(3)



- (b) The chemical equation for the reaction between lithium and oxygen is



Write a chemical equation for the reaction between lithium and nitrogen.

(2)



- (c) (i) Lithium nitride reacts violently with water to form a solution of lithium hydroxide and ammonia gas.

Complete the following equation by inserting the appropriate state symbols.

(1)



- (ii) Suggest a value for the pH of the solution formed.

Give a reason for your answer.

(2)

2.31 pH 8-14

reason LiOH is a base / OH<sup>-</sup> present

- (d) Solid lithium nitride conducts electricity and is used in batteries.

1.43 Why would you expect solid lithium nitride **not** to conduct electricity?

(1)

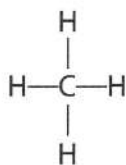
Ions cannot move

(Total for Question 8 = 9 marks)

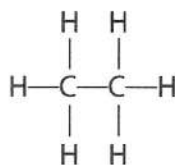


P 4 2 8 6 5 A 0 1 7 3 2

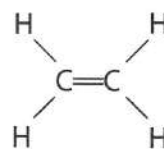
9 The diagram shows the displayed formulae of five hydrocarbons A, B, C, D and E.



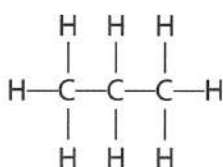
**A**



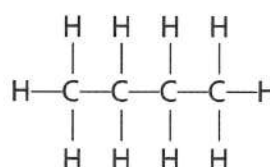
**B**



**C**



**D**



**E**

(a) Give the letter of a hydrocarbon to answer these questions.

You may use each letter once, more than once or not at all.

(i) Which hydrocarbon is the main component of natural gas?

(1)

A

(ii) Which other hydrocarbon is produced, together with D, when pentane ( $\text{C}_5\text{H}_{12}$ ) is cracked?

(1)

C

(iii) Which hydrocarbon can undergo an addition reaction with hydrogen to form B?

(1)

C

(b) Give the molecular formula and the empirical formula of E.

(2)

molecular formula.....

$\text{C}_4\text{H}_{10}$

empirical formula.....

$\text{C}_2\text{H}_5$



(c) Hydrocarbons A, B, D and E all belong to the same homologous series.

(i) Give the name and the general formula of this homologous series.

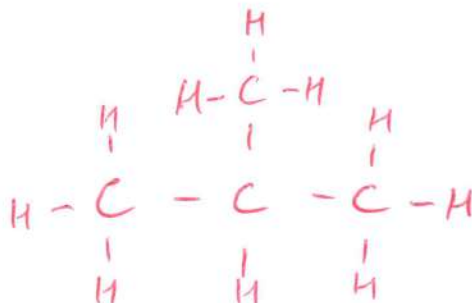
(2)

name Alkane

general formula  $C_nH_{2n+2}$

(ii) Draw the displayed formula of an isomer of E.

(1)



(d) Two reactions that can occur when hydrocarbon A is burned in air are represented by these equations.



Explain why a different product is formed in reaction 2 and why this product is dangerous.

(3)

4.12 • Incomplete combustion

4.13 • CO is poisonous

• Reduces capacity of blood to transport oxygen

(Total for Question 9 = 11 marks)



P 4 2 8 6 5 A 0 1 9 3 2

10 Aluminium and iron have some similar properties.

Both metals

- are malleable
- are ductile (can be drawn into a wire)
- are good conductors of electricity
- are good conductors of heat
- have a high melting point

(a) (i) Choose two properties from the list that make iron a suitable metal for saucepans.

(2)

Any 2

1

• Good conductor of heat

2

• High melting point

• Malleable

(ii) Choose two properties from the list that make aluminium a suitable metal for power cables.

(2)

1

Ductile

2

Good conductor of electricity





(b) Steel is an alloy containing iron.

These are three differences between steel and aluminium.

- steel can rust but aluminium resists corrosion
- steel has a higher density than aluminium
- steel is much stronger than aluminium

(i) Use information from the list to suggest why steel is the better metal for making bridges.

(1)

Stronger

(ii) Use information from the list to suggest why aluminium is the better metal for making aircraft bodies.

(1)

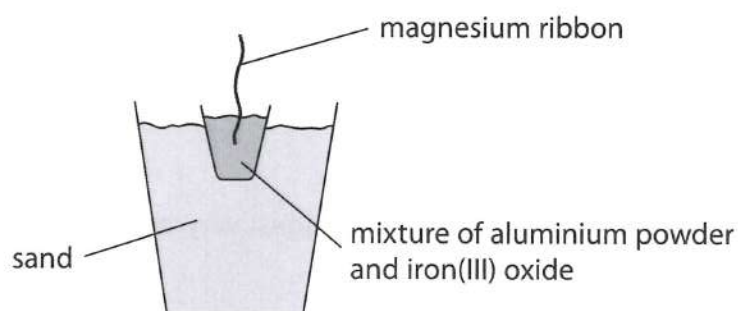
Lower density / Resists corrosion



P 4 2 8 6 5 A 0 2 1 3 2

(c) The reaction between aluminium and iron(III) oxide is known as a thermite reaction.

The diagram shows how this thermite reaction can be carried out.



The magnesium ribbon is lit to ignite the reaction mixture.

The reaction is highly exothermic.

The equation for the reaction is



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

(1)

Heat energy given out

(ii) What does the reaction suggest about the reactivity of aluminium compared to the reactivity of iron?

Explain your answer.

(2)

• Al is more reactive

• Al displaces Fe



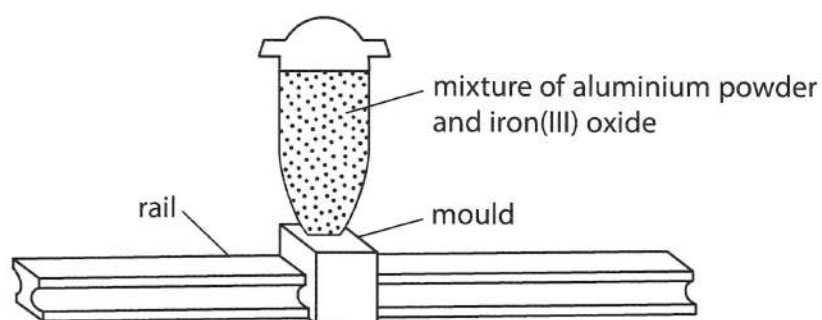
(iii) Which element is oxidised in this thermite reaction?

Give a reason for your answer.

(2)

2.20 • Aluminium, gains oxygen

(d) This thermite reaction can be used to join together two rails on a railway line.



The reaction mixture is ignited and molten iron pours into the mould. The mould is removed and the molten iron solidifies to create a join between the two rails.

Explain why the iron produced in the reaction is molten.

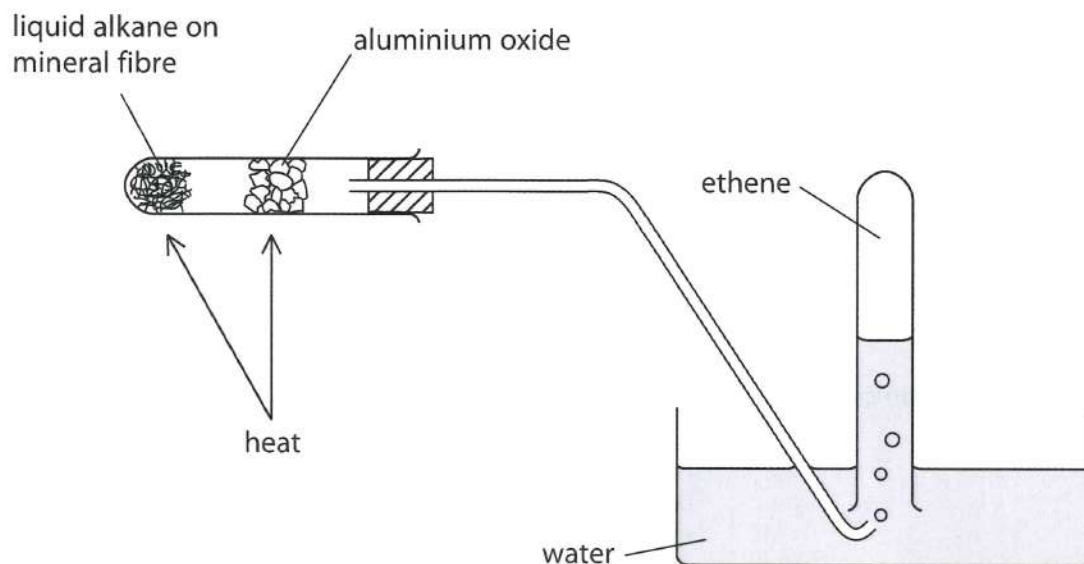
(1)

0.00 • Temperature reached  $\geq$  m.p. of iron

(Total for Question 10 = 12 marks)



11 This apparatus can be used to obtain ethene by cracking a liquid alkane.



(a) What is meant by the term **cracking**?

(1)

4.17 • Large hydrocarbons are converted into smaller hydrocarbons

(b) Give a chemical test to show that the gas collected is unsaturated.

(2)

4.28 Bromine water, turns colourless

(c) Cracking is also carried out in industry.

Give the name of the catalyst and the temperature used in the catalytic cracking of hydrocarbons.

(2)

4.17 catalyst Silica / alumina

temperature 600-700°C

(Total for Question 11 = 5 marks)



12 A sample of a chlorofluorocarbon (CFC) contains 0.24 g of carbon, 0.38 g of fluorine and 1.42 g of chlorine.

(a) (i) Show, by calculation, that the empirical formula of the CFC is  $\text{CFCl}_2$

(3)

$$\begin{array}{ccc}
 \text{C} & \text{F} & \text{Cl} \\
 \hline
 0.24 & 0.38 & 1.42 \\
 12 & 19 & 35.5 \\
 \hline
 0.02 & 0.02 & 0.04 \\
 0.02 & 0.02 & 0.02 \\
 \hline
 1 & 1 & 2
 \end{array}$$

(ii) The relative formula mass of the CFC is 204.

Deduce the molecular formula of the CFC.

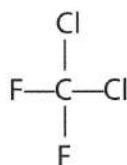
(2)

$$M_r(\text{CFCl}_2) = 102$$

$$\frac{204}{102} = 2$$

molecular formula  $\text{C}_2\text{F}_2\text{Cl}_4$

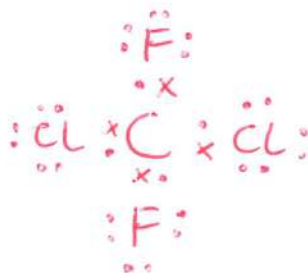
(b) The displayed formula of another CFC is



Draw a dot and cross diagram of this CFC.

Show only the outer electrons.

(2)



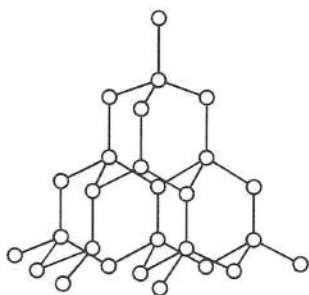
(Total for Question 12 = 7 marks)



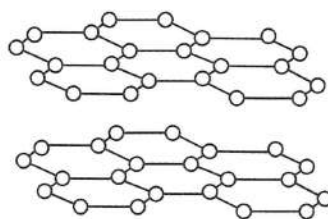
P 4 2 8 6 5 A 0 2 5 3 2



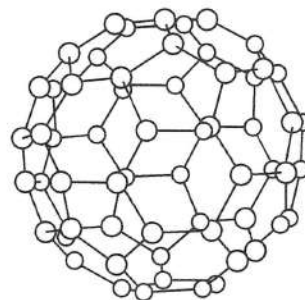
13 The diagram shows three different forms of carbon.



diamond structure



graphite structure



fullerene molecule

(a) Name the type of bond that exists between the carbon atoms in all three structures.

(1)

covalent

(b) (i) Explain why diamond has a very high melting point.

(4)

• Giant covalent lattice

~~very strong covalent~~

• Many strong covalent bonds

• Lots of energy required to break the bonds

(ii) Fullerene has a simple molecular structure.

Explain why it has a low melting point.

(2)

• weak intermolecular forces of attraction

∴ little energy required to overcome





(c) There are two theories used to explain why graphite can act as a solid lubricant.

Theory A      The forces of attraction between the layers are weak, allowing the layers to slide over one another.

Theory B      Gas molecules are trapped between the layers allowing the layers to slide over one another.

The table shows the ability of graphite to act as a lubricant in different locations.

Location	Ability to act as a lubricant
Earth's surface	good
high altitude	average
outer space	very poor

Suggest which theory is supported by the evidence in the table.

Give a reason for your choice.

(1)

B, No gas molecules in space

(d) Graphite and diamond can be changed from one form to the other according to the equation



Would a low or a high temperature favour the conversion of graphite into diamond?

Give a reason for your choice.

(1)

High, Forward reaction is endothermic

(Total for Question 13 = 9 marks)



P 4 2 8 6 5 A 0 2 7 3 2

14 (a) The table shows information about two common addition polymers.

Complete the table for these two polymers.

(4)

Name of polymer	Structure of monomer	Structure of polymer	One use for the polymer
poly(ethene)	$\begin{array}{c} \text{H} & & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{H} \end{array}$	$\left( \begin{array}{cc} \text{H} & \text{H} \\   &   \\ -\text{C} & - & \text{C}- \\   &   \\ \text{H} & \text{H} \end{array} \right)_n$	Plastic bags (check mark scheme)
Poly(propene)	$\begin{array}{c} \text{H} & & \text{CH}_3 \\   & &   \\ \text{C} & = & \text{C} \\   & &   \\ \text{H} & & \text{H} \end{array}$	$\left[ \begin{array}{cc} \text{CH}_3 & \text{H} \\   &   \\ -\text{C} & - & \text{C}- \\   &   \\ \text{H} & \text{H} \end{array} \right]_n$	water pipes

(b) State two changes that occur in the formation of an addition polymer from its monomer.

(2)

ANY 2

1. Many monomers join up
2. Becomes saturated
- Increase in chain length



(c) Addition polymers such as poly(ethene) are very difficult to dispose of because they do not biodegrade easily.

4.47 (i) State a reason why addition polymers do not biodegrade easily.

(1)

inert

(ii) Burning and landfill (burying in the ground) are two methods used to dispose of addition polymers.

Suggest a problem with each method of disposal.

(2)

4.47 burning

produces toxic gases

landfill

uses up land

(Total for Question 14 = 9 marks)



P 4 2 8 6 5 A 0 2 9 3 2

15 (a) A student made a solution of sodium hydroxide by dissolving 10.0 g of solid sodium hydroxide in distilled water to make 250 cm<sup>3</sup> of solution.

(i) Calculate the amount, in moles, of NaOH in 10.0 g of sodium hydroxide.

(3)

$$M_r(\text{NaOH}) = 40$$

$$n(\text{NaOH}) = \frac{10}{40} \\ = 0.25 \text{ mol}$$

amount = 0.25 mol

(ii) Calculate the concentration, in mol/dm<sup>3</sup>, of this solution of sodium hydroxide.

(2)

$$\text{conc}(\text{NaOH}) = \frac{0.25}{\left(\frac{250}{1000}\right)} \\ = 1.0 \text{ mol/dm}^3$$

concentration = 1.0 mol/dm<sup>3</sup>

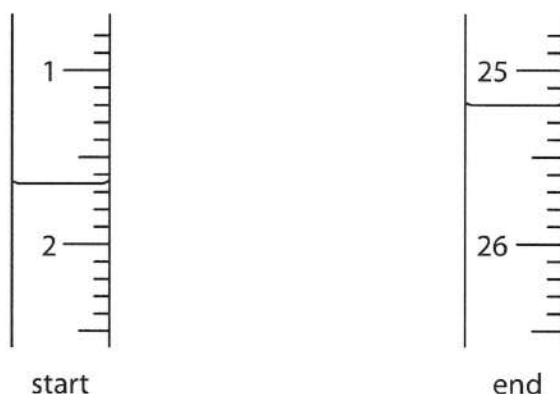


- (b) (i) The student uses the sodium hydroxide solution to find the concentration of a solution of hydrochloric acid.

He uses this method

- use a pipette to put  $25.0 \text{ cm}^3$  of the sodium hydroxide solution into a conical flask
- add a few drops of methyl orange indicator to the solution
- gradually add the hydrochloric acid from a burette until the solution in the flask just changes colour

The diagram shows his burette readings.



Complete the table, giving all values to the nearest  $0.05 \text{ cm}^3$ .

(3)

burette reading at end in $\text{cm}^3$	25.20
burette reading at start in $\text{cm}^3$	1.65
volume of acid added in $\text{cm}^3$	23.55

- (ii) State the colour of the methyl orange at the start and at the end of the experiment.

(2)

colour at start ..... yellow

colour at end ..... orange

- (iii) Why is a burette used instead of a pipette for adding the acid?

(1)

different volumes can be measured / addition  
can be controlled

QUESTION 15 CONTINUES ON NEXT PAGE





(c) Sodium hydroxide reacts with carbon dioxide.

The equation for this reaction is



A solution of sodium hydroxide of concentration  $2.00 \text{ mol/dm}^3$  is used.

(i) Calculate the amount, in moles, of sodium hydroxide in  $200 \text{ cm}^3$  of this solution.

(2)

$$\begin{aligned} n(\text{NaOH}) &= 2 \times \left( \frac{200}{1000} \right) \\ &= 0.40 \text{ mol} \end{aligned}$$

amount of sodium hydroxide = 0.40 mol

(ii) Deduce the maximum mass, in grams, of carbon dioxide that can react with this solution of sodium hydroxide.

(2)

$$\begin{aligned} n(\text{CO}_2) &= 0.20 \text{ mol} \\ \text{mass}(\text{CO}_2) &= 0.20 \times 44 \\ &= 8.80 \text{ g} \end{aligned}$$

mass of carbon dioxide = 8.80 g

(Total for Question 15 = 15 marks)

**TOTAL FOR PAPER = 120 MARKS**

