Write your name here

Surname	Other names

Pearson Edexcel Certificate
Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit: KCH0/4CH0
Science (Double Award) KSC0/4SC0
Paper: 1C

Tuesday 13 May 2014 – Morning
Time: 2 hours

Paper Reference
KCH0/1C 4CH0/1C
KSC0/1C 4SC0/1C

You must have:
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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1/1/1/

P 4 2 8 6 5 A 0 1 3 2

PEARSON

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	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
3	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
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	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
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass

Symbol

Name

Atomic number

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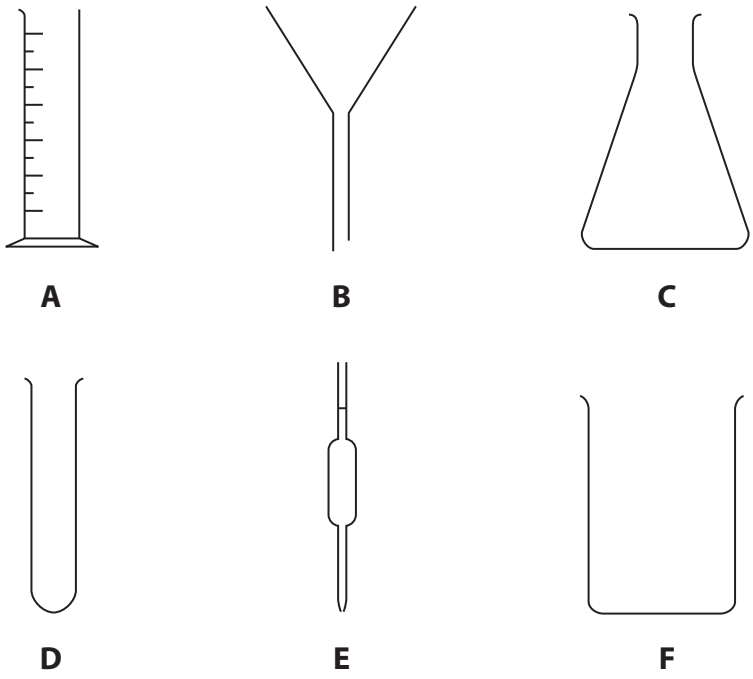
Answer ALL questions.

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



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

(4)

Letter	Name
A	measuring cylinder
B	
C	conical flask
D	
E	
F	

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

(2)

..... and .....

(Total for Question 1 = 6 marks)

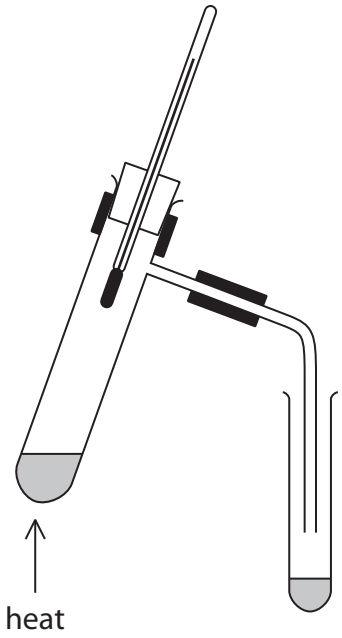
2 Crude oil is a mixture of substances.

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

(1)

- ☒ **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.

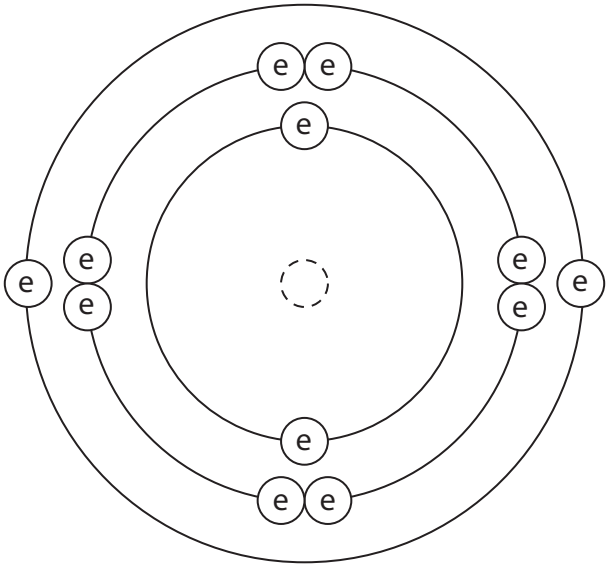
Put a letter in each box to show the correct order. One has been done for you.

(2)

	U			

(Total for Question 2 = 3 marks)

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



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

(1)

.....

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

Give a reason for your choice.

(2)

.....

.....

.....

.....

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

(1)

.....

(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.

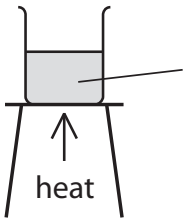
(3)

relative atomic mass of X = ...

(Total for Question 3 = 7 marks)

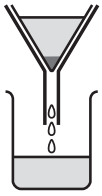
4 The diagram shows how hydrated copper(II) sulfate crystals can be made by reacting copper(II) oxide with dilute sulfuric acid.

stage 1



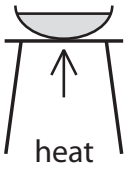
stage 2

stage 3



filter the mixture from stage 2

stage 4



heat the solution from stage 3 until a hot, saturated solution forms

stage 5

allow the solution to cool so that hydrated copper(II) sulfate crystals form

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

(1)

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

(1)

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

(1)

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

(1)

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

(1)

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

Suggest a suitable method of drying the crystals.

(1)

(Total for Question 4 = 6 marks)

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)

.....

.....

.....

.....

(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)

.....

.....

.....

.....

.....

.....

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

Use the Periodic Table on page 2 to help you.

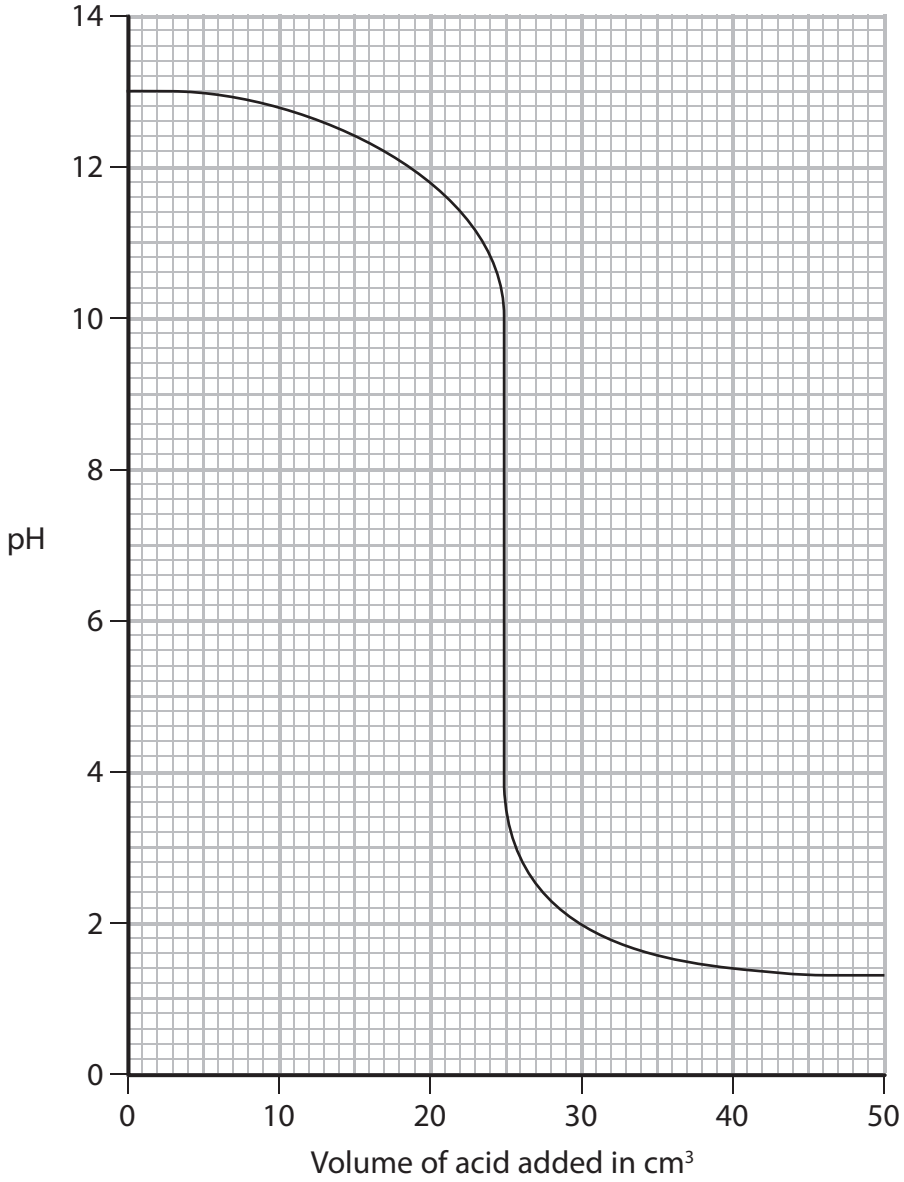
(2)

relative formula mass = ...

(Total for Question 5 = 11 marks)

6 A total volume of 50 cm^3 of hydrochloric acid is added gradually to 50 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)

.....

(ii) What is the pH of the solution after 40 cm^3 of acid is added?

(1)

.....

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

(1)

.....

(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^3 and when the volume added is 35 cm^3.

(2)

Volume of hydrochloric acid added in cm^3	**Colour of solution**
20	
35	

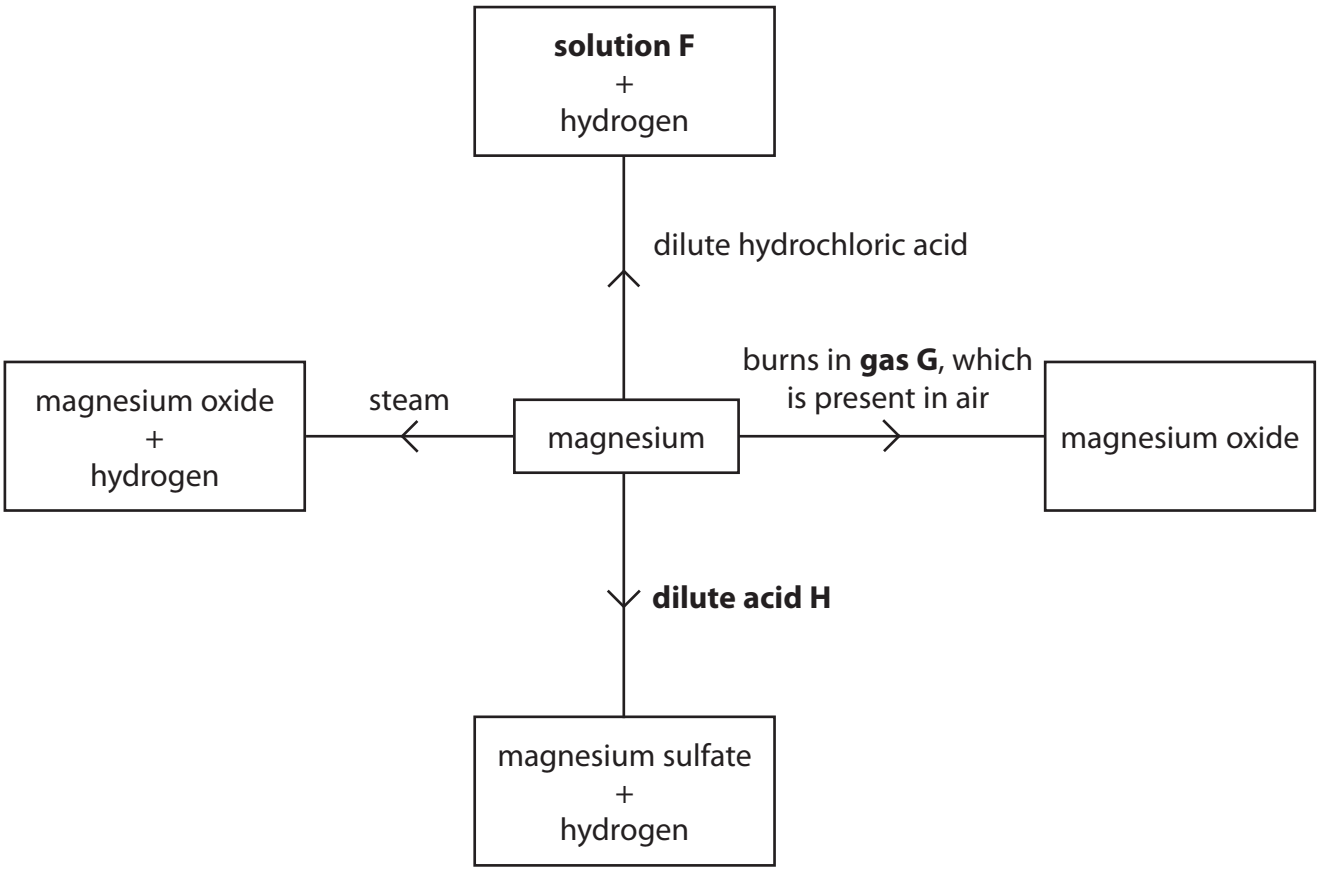
(c) Write a chemical equation for the reaction between sodium hydroxide and hydrochloric acid.

(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	
gas G	
dilute acid H	

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

(1)

.....

(Total for Question 7 = 4 marks)

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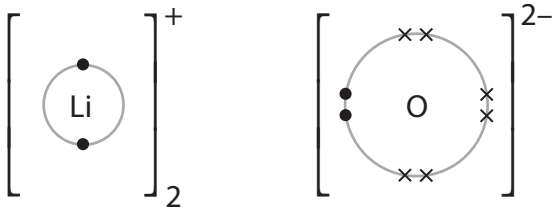
8 When lithium is burned in air, the two compounds lithium oxide (Li_2O) and lithium nitride (Li_3N) are formed.

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

$$4Li + O_2 \rightarrow 2Li_2O$$

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)

$Li_3N(s) + 3H_2O(\ldots\ldots) \rightarrow 3LiOH(\ldots\ldots) + NH_3(\ldots\ldots)$

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

Give a reason for your answer.

(2)

pH.....

reason.....

.....

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

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

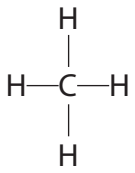
(1)

.....

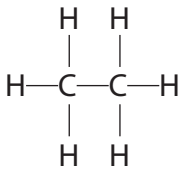
.....

(Total for Question 8 = 9 marks)

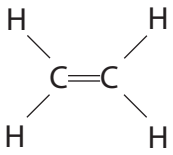
9 The diagram shows the displayed formulae of five hydrocarbons A, B, C, D and E.



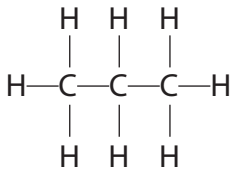
A



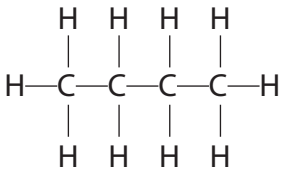
B



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)

.....

(ii) Which other hydrocarbon is produced, together with D, when pentane (C_5H_{12}) is cracked?

(1)

.....

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

(1)

.....

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

(2)

molecular formula .....

empirical formula .....

(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 .....

general formula .....

(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.

Equation for reaction 1 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Equation for reaction 2 $CH_4 + 1½O_2 \rightarrow CO + 2H_2O$

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

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 9 = 11 marks)

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)

1 .....

2 .....

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

(2)

1 .....

2 .....

(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)

.....

.....

.....

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

(1)

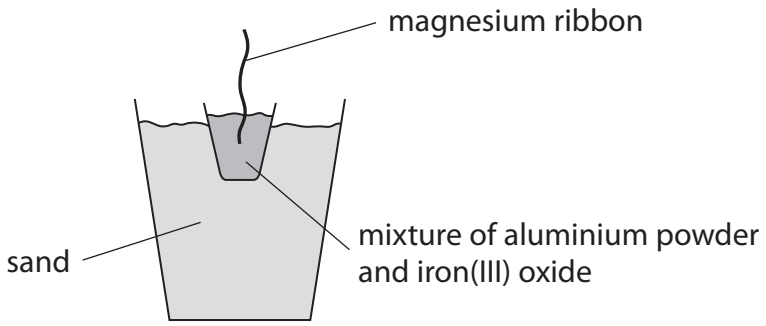
.....

.....

.....

(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

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$$

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

(1)

.....

.....

.....

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

Explain your answer.

(2)

.....

.....

.....

.....

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

Give a reason for your answer.

(2)

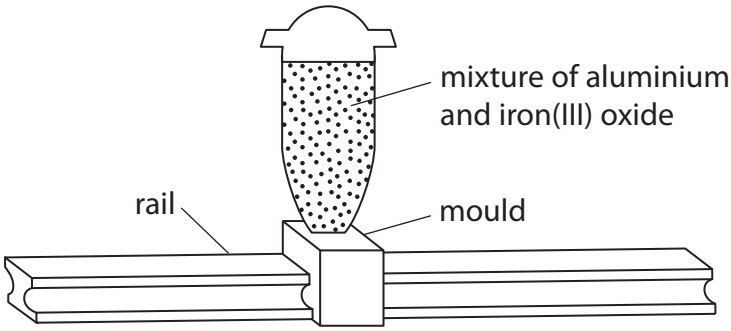
.....

.....

.....

.....

(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)

.....

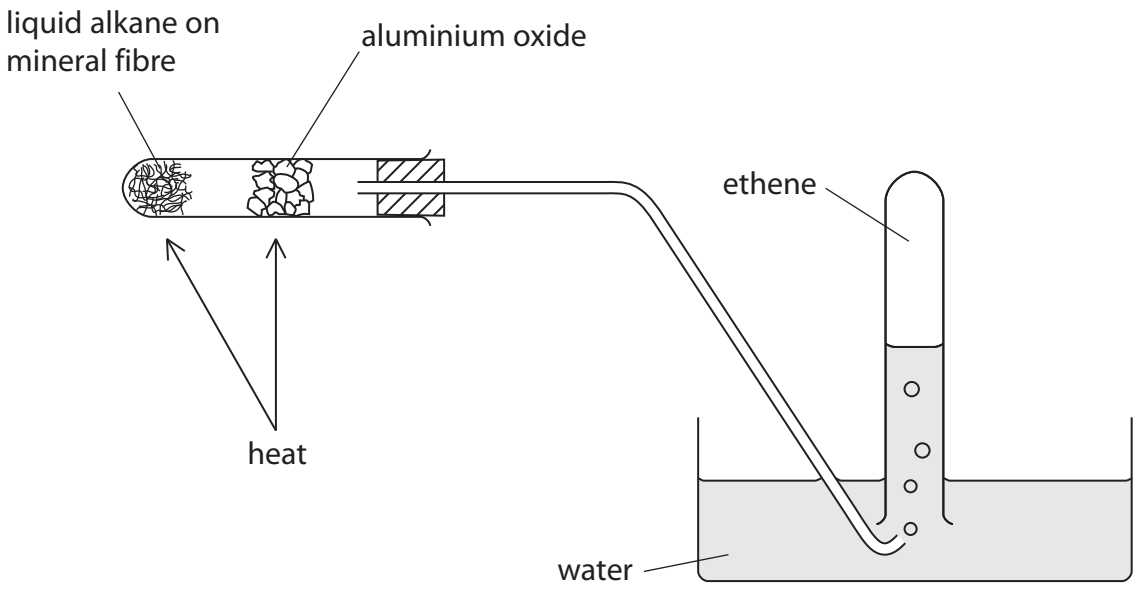
.....

.....

.....

(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)

.....

.....

.....

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

(2)

.....

.....

.....

(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)

catalyst .....

temperature .....

(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 $CFCl_2$

(3)

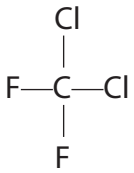
(ii) The relative formula mass of the CFC is 204.

Deduce the molecular formula of the CFC.

(2)

molecular formula .....

(b) The displayed formula of another CFC is



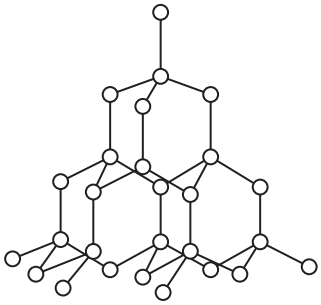
Draw a dot and cross diagram of this CFC.

Show only the outer electrons.

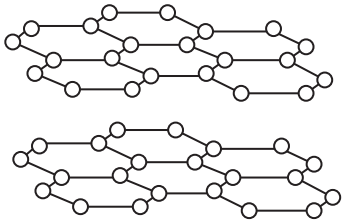
(2)

(Total for Question 12 = 7 marks)

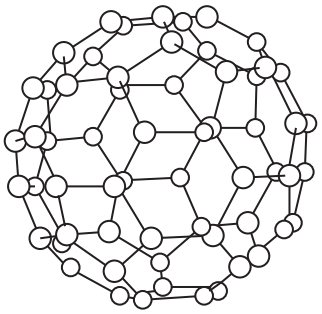
13 The diagram shows three different forms of carbon.



diamond structure



graphite structure



fullerene molecule

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

(1)

.....

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

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Fullerene has a simple molecular structure.

Explain why it has a low melting point.

(2)

.....

.....

.....

.....

.....

(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)

.....

.....

.....

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

$$C(\text{graphite}) \rightleftharpoons C(\text{diamond}) \qquad \Delta H = +1.9 \text{ kJ/mol}$$

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

Give a reason for your choice.

(1)

.....

.....

.....

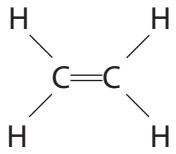
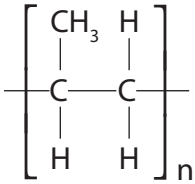
.....

(Total for Question 13 = 9 marks)

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)			
			water pipes

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

(2)

1 .....

.....

2 .....

.....

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

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

(1)

.....

.....

(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)

burning.....

.....

landfill.....

.....

(Total for Question 14 = 9 marks)

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^3 of solution.

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

(3)

amount = ... mol

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

(2)

concentration = ... mol/dm^3

(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 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.

start end

Complete the table, giving all values to the nearest 0.05 cm^3.

(3)

burette reading at end in cm^3	
burette reading at start in cm^3	
volume of acid added in cm^3	

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

(2)

colour at start .....

colour at end .....

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

(1)

.....

.....

QUESTION 15 CONTINUES ON NEXT PAGE

(c) Sodium hydroxide reacts with carbon dioxide.

The equation for this reaction is

$$2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

A solution of sodium hydroxide of concentration 2.00 mol/dm^3 is used.

(i) Calculate the amount, in moles, of sodium hydroxide in 200 cm^3 of this solution.

(2)

amount of sodium hydroxide = ... mol

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

(2)

mass of carbon dioxide = ... g

(Total for Question 15 = 15 marks)

TOTAL FOR PAPER = 120 MARKS