Paper reference
1524/5H
1036/3H

H

For Examiner's use only

For Team Leader's use or

Question numbers	Lea bla
1	
2	
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5	
6	
7	
8	
9	
Total	

Centre Number						
Candidate Number						
Paper reference						
Surname						
Other Names						
Candidate signature						

London Examinations GCSE

Monday 14 June 1999 – Morning

Science: Double Award (Combined) [1524]

Paper 5H

Science: Chemistry [1036]

Paper 3H

HIGHER TIER

Time: 1 hour 30 minutes

Instructions to Candidates

In the boxes above, write your centre number, candidate number, the Paper reference, your surname, other names and signature.

The Paper reference is shown in the top left-hand corner. If more than one Paper reference is shown, you should write the one for which you have been entered.

Answer ALL questions in the spaces provided in this book.

Show all stages in any calculations and state the units. Calculators may be used.

Include diagrams in your answers where these are helpful.

Additional Answer Sheets may be used.

Information for Candidates

The marks for the various parts of questions are shown in round brackets: e.g. (2).

This paper has 9 questions. There are no blank pages.

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Turn over

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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 Sulphur 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

Leave Blank

1. The table gives some information about seven hydrocarbons.

Name of hydrocarbon	Number of carbon atoms in one molecule	Boiling point (°C)
methane	1	-164
ethane	2	-89
propane	3	-42
butane	4	0
pentane	5	36
hexane	6	
heptane	7	98

(a) Which ONE of these hydrocarbons is the main part of natural gas?

. . . . . .

(1)

(b) Name the hydrocarbon with the lowest boiling point.

. . . . . .

(1)

(c) Suggest the boiling point of hexane.

. . . . . °C

(1)

(d) Complete the sentence.

Hydrocarbons are compounds of carbon and . . . . . .

(1)

(e) Propane is used as a fuel.

Complete the word equation for the reaction that occurs when propane burns completely.

propane + oxygen ⟶ . . . . . + ...

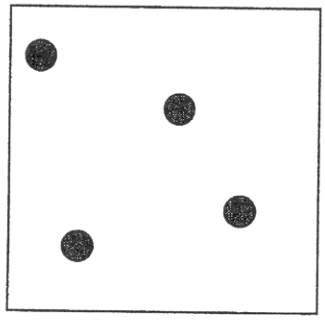
(2)

(Total 6 marks)

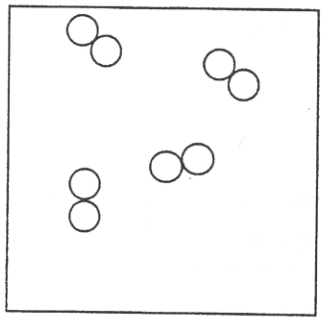
TURN OVER FOR QUESTION 2

Leave Blank

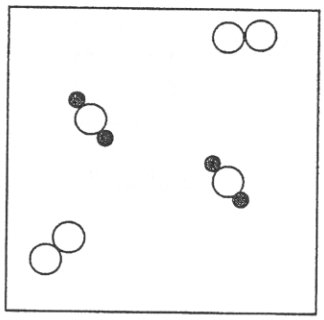
2. (a) The diagrams show the particles present in four samples of gas.
Each circle represents an atom.
Circles of the same size and shading represent atoms of the same element.



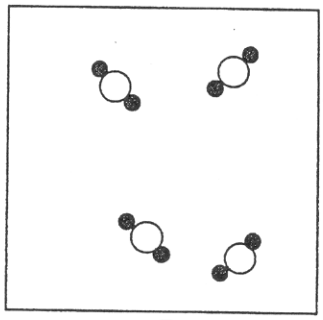
A



B



C



D

Which diagram represents:

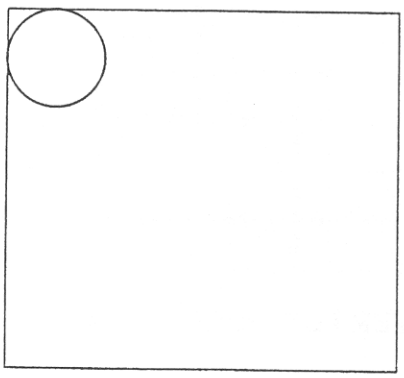
(i) oxygen, O_2; . . . . . (1)

(ii) steam, $H_2O(g)$; . . . . . (1)

(iii) a mixture of gases; . . . . . (1)

(iv) a monatomic gas? . . . . . (1)

(b) Draw circles, in the box below, to represent the arrangement of particles in a solid element. One particle has been drawn for you.



(2)

Leave Blank

(c) Describe how the arrangement and movement of particles in a solid change when it is heated until it is liquid.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

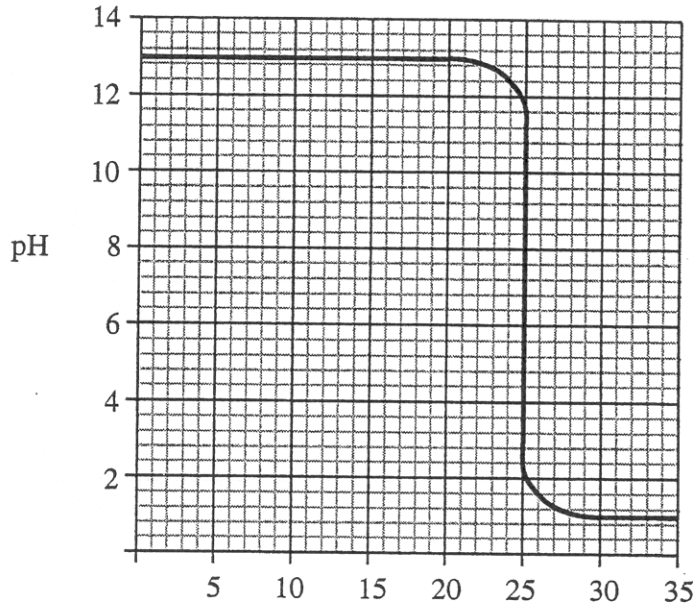
(3)

(Total 9 marks)

TURN OVER FOR QUESTION 3

Leave Blank

3. Dilute hydrochloric acid was added slowly to dilute sodium hydroxide solution in a beaker. The graph below shows how the pH of the solution in the beaker changed as the acid was added.



(a) What is the pH of the solution in the beaker when 30 cm^3 of dilute hydrochloric acid has been added?

. . . . . .

(1)

(b) The dilute sodium hydroxide solution in the beaker contained Universal indicator. What colour was the solution in the beaker when the following volumes of dilute hydrochloric acid had been added?

(i) 30.0 cm^3 . . . . . .

(1)

(ii) 10.0 cm^3 . . . . . .

(1)

Leave Blank

(c) (i) What is the pH of a neutral solution?

. . . . . .

(1)

(ii) What volume of dilute hydrochloric acid was added to neutralise the sodium hydroxide solution in the beaker?

. . . . . .

(1)

(iii) The neutral solution was evaporated to dryness to leave a solid salt.
What is the name of the salt which is formed?

. . . . . .

(1)

(iv) Describe what the salt looks like.

. . . . . .

. . . . . .

(1)

(v) State the type of bonding that is present in this salt.

. . . . . .

(1)

(vi) Complete the word equation for the reaction of sodium hydroxide with hydrochloric acid.

sodium hydroxide + hydrochloric acid ⟶ ..... + ...

(1)

(Total 9 marks)

TURN OVER FOR QUESTION 4

Leave Blank

4. (a) Magnesium is manufactured by electrolysis of magnesium chloride.

(i) Explain why this process is expensive to operate.

. . . . . .

. . . . . .

(1)

(ii) Complete the word equation for the electrolysis of magnesium chloride.

magnesium chloride ⟶ magnesium + ...

(1)

(b) (i) Draw a diagram to show the electronic structure of an **atom** of magnesium.

(2)

(ii) How does a magnesium atom (Mg) change when it forms a magnesium ion (Mg^{2+})?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(2)

(c) Magnesium (Mg) burns in oxygen to form magnesium oxide (MgO).

(i) Write a balanced equation for this reaction.

. . . . . .

(2)

(ii) Explain why magnesium is said to be oxidised in this reaction.

. . . . . .

. . . . . .

(1)

Leave Blank

(d) The reaction between magnesium and dilute sulphuric acid is exothermic.

(i) State what is meant by the term **exothermic**.

. . . . . .

. . . . . .

(1)

(ii) Describe how you could show that this reaction is exothermic.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

(Total 13 marks)

TURN OVER FOR QUESTION 5

Leave Blank

5. Hydrogen fluoride (HF) and hydrogen chloride (HCl) are both gases at room temperature.

(a) (i) Calculate the relative formula masses of the two gases.
(Relative atomic masses: H = 1, F = 19, Cl = 35.5)

HF . . . . . .

HCl . . . . . .

(2)

(ii) Hydrogen fluoride (HF) diffuses faster than hydrogen chloride (HCl).

Use your answer to part (i) above to suggest a reason for this.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(2)

(b) Chlorine has two isotopes, chlorine–35 and chlorine–37.
An atom of chlorine–35 contains 17 protons, 18 neutrons and 17 electrons.
How many protons, neutrons and electrons does an atom of chlorine–37 contain?

protons . . . . . neutrons . . . . . electrons . . . . . .

(3)

(c) Liquid hydrogen fluoride is a poor conductor of electricity.

(i) Suggest the type of bonding present in hydrogen fluoride.

. . . . . .

(1)

(ii) How are electrons used to form this type of bond?

. . . . . .

(1)

(Total 9 marks)

Leave Blank

6. Propene (C_3H_6) can be obtained by cracking alkanes.

(a) Draw the structure of a molecule of propene showing **all** the bonds.

(1)

(b) One molecule of the alkane decane ($C_{10}H_{22}$) was cracked to give two molecules of propene and one molecule of another alkane.

Write the balanced equation for this reaction.

. . . . . .

(2)

(c) Propene is used to make poly(propene).

(i) What feature of a propene molecule enables it to form poly(propene)?

. . . . . .

(1)

(ii) Draw the structure of the repeating unit in poly(propene).

(2)

(iii) Poly(ethene) is used to make many types of bottle.
Suggest why the more expensive poly(propene) is used to make bottles for fizzy drinks.

. . . . . .

. . . . . .

(1)

(Total 7 marks)

Leave Blank

7. The equations show three displacement reactions involving metals and solutions of metal nitrates.

$$Cu + 2AgNO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$$

$$Pb + Cu(NO_3)_2 \longrightarrow Pb(NO_3)_2 + Cu$$

$$Zn + Pb(NO_3)_2 \longrightarrow Zn(NO_3)_2 + Pb$$

(a) (i) Use this information to find the order of reactivity of the four metals.

most reactive . . . . . .

. . . . . .

. . . . . .

least reactive . . . . . .

(1)

(ii) Calculate the mass of copper needed to displace 5.0 g of silver from silver nitrate solution.

$$Cu + 2AgNO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$$

(Relative atomic masses: Ag = 108, Cu = 63.5)

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

(iii) Write an equation, including state symbols, for the reaction between lead and aqueous silver nitrate.

. . . . . .

(3)

Leave Blank

(b) Zinc and bromine undergo displacement reactions as shown by the equations below. Zinc is oxidised and bromine is reduced during these reactions.

$$Zn\,(s) + 2H^+\,(aq) \longrightarrow Zn^{2+}\,(aq) + H_2\,(g)$$

$$Br_2\,(aq) + 2I^-\,(aq) \longrightarrow 2Br^-\,(aq) + I_2\,(aq)$$

(i) Name one compound containing H^+ ions and another containing I^- ions, which would be suitable for these reactions.

compound containing H^+ . . . . . .

compound containing I^- . . . . . .

(2)

(ii) Explain why zinc is said to be oxidised in its reaction.

. . . . . .

. . . . . .

(1)

(iii) Complete the half equation to show the oxidising action of bromine.

. . . . . $I^- \longrightarrow I_2 +$ . . . . . .

(2)

(Total 12 marks)

TURN OVER FOR QUESTION 8

Leave Blank

8. Ammonia (NH_3) is manufactured from hydrogen and nitrogen in the Haber Process.

(a) (i) Write a balanced equation for the formation of ammonia in the Haber Process.

. . . . . .

(2)

(ii) Draw a dot and cross diagram to show the bonding in a molecule of ammonia.

(2)

(iii) Explain, in terms of the bonds broken and formed, why the formation of ammonia from nitrogen and hydrogen is exothermic.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

Leave Blank

(b) The manufacture of methanol from carbon monoxide and hydrogen requires similar conditions to those used in the Haber process.
The equation for the manufacture of methanol is

$$CO\ (g) + 2H_2\ (g) \longrightarrow CH_3OH\ (g)$$

This reaction is exothermic.
The reaction conditions are a pressure of 200 atm and a temperature of 400 °C.

(i) State ONE advantage of using a pressure higher than 200 atm.
Explain your answer.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

(ii) State ONE disadvantage of using a pressure higher than 200 atm.

. . . . . .

. . . . . .

(1)

(iii) State ONE advantage of using a temperature lower than 400 °C.
Explain your answer.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

(iv) State ONE disadvantage of using a temperature lower than 400 °C.
Explain your answer.

. . . . . .

. . . . . .

. . . . . .

(2)

(Total 16 marks)

Leave Blank

9. Two samples of rock from different parts of a volcanic island had the same chemical composition but different crystal sizes.

(a) Name this type of rock and describe how it was formed, accounting for the difference between the samples.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(4)

(b) Analysis of another rock showed that it contained an oxide of tin in which 3.57 g of tin was combined with 0.96 g of oxygen.

(i) Calculate the empirical formula of the tin oxide present in the rock.
(Relative atomic masses: O = 16, Sn = 119)

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(3)

(ii) The melting point of the tin oxide was found to be over 1000 °C.
Explain why tin oxide has a high melting point and suggest the type of structure it has.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(2)

(Total 9 marks)

TOTAL MARKS 90

END