Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	3	3	5	/	2	H	Signature	

Paper Reference(s)

4335/2H

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Chemistry

Paper 2H

Higher Tier

Monday 10 November 2008 – Afternoon

Time: 2 hours

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all stages in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 120. The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 10 questions in this question paper.
There are 28 pages in this question paper. All blank pages are indicated.
A Periodic Table is given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

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N 3 1 7 6 8 A 0 1 2 8

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

N 3 1 7 6 8 A 0 2 2 8

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TURN OVER FOR QUESTION 1

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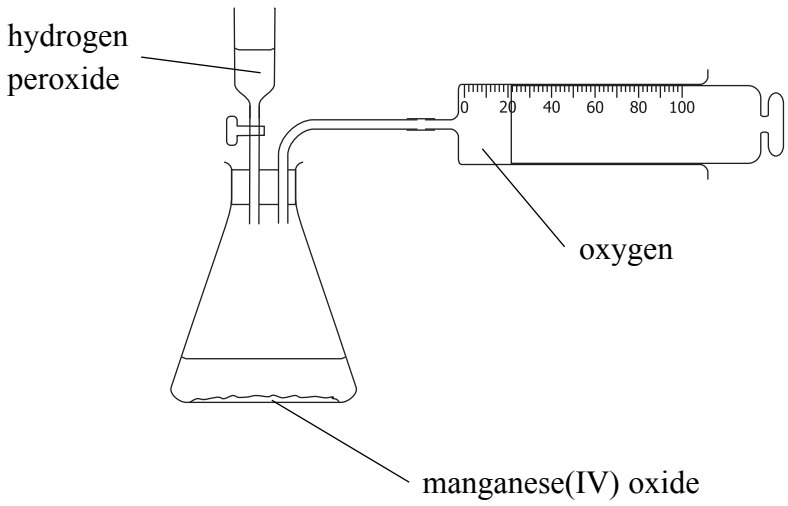
SECTION A

1. Oxygen gas can be prepared and collected in the laboratory using the apparatus shown in the diagram.



(a) Hydrogen peroxide decomposes very slowly to form water and oxygen.

(i) Write a word equation for this reaction.

.....

.....

(1)

(ii) The reaction is much faster if a small amount of manganese(IV) oxide is added. What type of substance is manganese(IV) oxide in this reaction?

.....

(1)

(b) The diagram shows oxygen gas being collected in a syringe. Suggest one other way to collect the gas.

.....

.....

(1)

(c) Describe the test for oxygen.

.....

.....

(1)

N 3 1 7 6 8 A 0 4 2 8

Leave blank

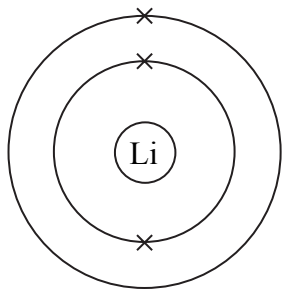
(d) Lithium burns in oxygen to form the ionic compound lithium oxide.

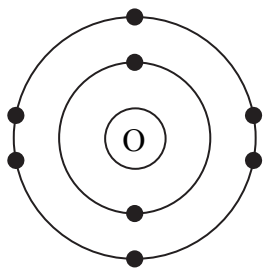
(i) State the colour of the flame when lithium burns.

.....

(1)

(ii) The diagrams show the electron configurations of an atom of lithium and an atom of oxygen.





Describe what happens, in terms of electrons, when lithium reacts with oxygen.

.....

.....

.....

.....

(3)

(iii) Write the formula of each of the ions in lithium oxide.

Lithium ion .....

Oxide ion .....

(2)

Q1

(Total 10 marks)

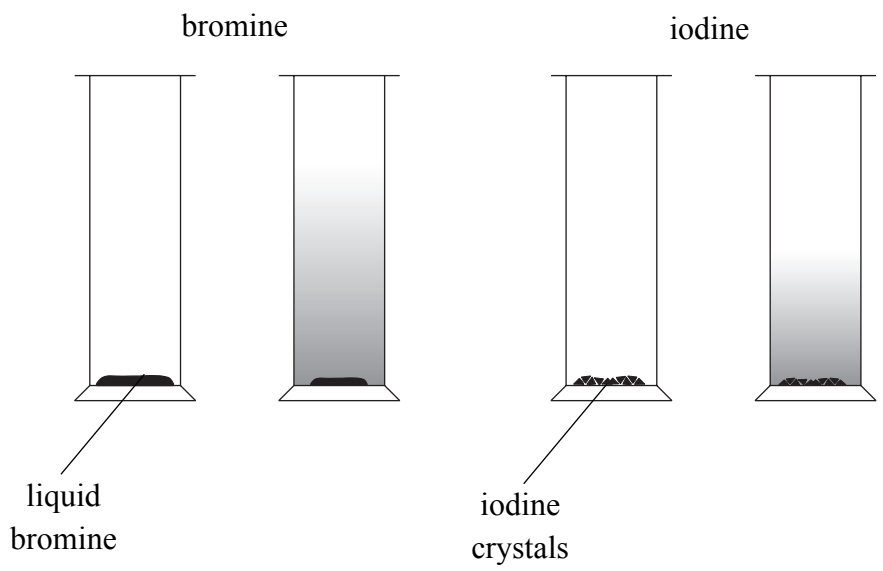
N 3 1 7 6 8 A 0 5 2 8

Turn over

Leave blank

2. A few drops of liquid bromine and a few crystals of solid iodine are placed in the bottom of separate gas jars and the open ends covered with lids. The jars are left for some time under the same conditions.

The diagrams show the jars just after the bromine and iodine are added, and after some time.



(a) State the colour of

liquid bromine .....

solid iodine .....

(2)

(b) The diagrams show that the particles of bromine and iodine spread out in the jars.

(i) What is the name of this process?

.....

(1)

(ii) The iodine changes into a gas before this process occurs.
The chemical equation for this change is

$$I_2(s) \rightarrow I_2(g)$$

The change involving bromine is called evaporation.
Write a chemical equation, including state symbols, for this change.

.....

(2)

N 3 1 7 6 8 A 0 6 2 8

Leave blank

(iii) Describe how the movement and spacing of the particles in $I_2(g)$ is different from that in $I_2(s)$.

Movement .....

Spacing .....

(2)

(c) The gases chlorine and hydrogen react together to form hydrogen chloride gas. Hydrogen chloride gas dissolves in water to form hydrochloric acid.

Bromine reacts in a similar way to chlorine.

(i) Write a word equation for the reaction between bromine and hydrogen.

.....

.....

(1)

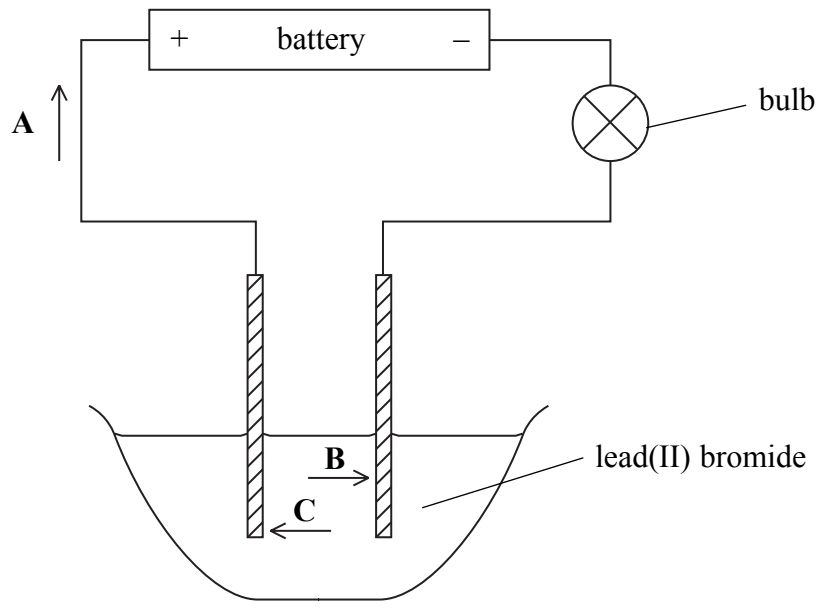
(ii) Suggest the name of the acid formed when the product in (c)(i) dissolves in water.

.....

(1)

Leave blank

(d) The diagram shows apparatus for electrolysing lead(II) bromide.



(i) When the apparatus is set up as shown, electrolysis does not occur.
State what must be done before electrolysis can occur.

.....

.....
(1)

(ii) When electrolysis occurs, particles **A**, **B** and **C** move in the directions shown by the arrows in the diagram. Identify each of these particles.

A .....

B .....

C .....
(3)

(e) Explain why the reaction at the negative electrode is described as reduction.

.....
(1)

Q2

(Total 14 marks)

N 3 1 7 6 8 A 0 8 2 8

Leave blank

3. (a) Potassium hydroxide solution reacts with dilute nitric acid to form the salt potassium nitrate.

(i) State the type of reaction that occurs.

.....

(1)

(ii) Write a chemical equation for the reaction.

.....

(2)

(b) A titration is carried out to find the volume of dilute nitric acid that must be added to 25.0 cm^3 of potassium hydroxide solution for complete reaction.

(i) Which piece of apparatus is used to add the dilute nitric acid?

.....

(1)

(ii) Before the acid is added, a few drops of phenolphthalein are mixed with the potassium hydroxide solution. State the colour change of the phenolphthalein at the end point of the titration.

.....

(2)

(c) 35.00 cm^3 of dilute nitric acid reacted completely with 25.0 cm^3 of potassium hydroxide solution. Use this information to describe how you could obtain pure dry crystals of potassium nitrate, starting from the solutions of nitric acid and potassium hydroxide.

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(Total 11 marks)

Q3

Leave blank

4. Ethene can be converted to ethyl ethanoate as follows:

$$\text{ethene} \longrightarrow \underset{CH_3CH_2OH}{\text{ethanol}} \longrightarrow \text{ethyl ethanoate}$$

(a) In industry, ethene is converted to ethanol by reacting it with steam in the presence of a catalyst.

(i) Write the chemical equation for this reaction.

.....

.....

(1)

(ii) Name the catalyst used.

.....

(1)

(b) Ethanol can also be made by fermentation. Describe how this is done.

.....

.....

.....

.....

.....

.....

(4)

Leave blank

(c) Ethanol is converted to ethyl ethanoate by warming it with ethanoic acid in the presence of a catalyst.

(i) Write the chemical equation, including state symbols, for this reaction.

.....

.....

(3)

(ii) How can a student detect the formation of ethyl ethanoate in this reaction?

.....

.....

(1)

Q4

(Total 10 marks)

TOTAL FOR SECTION A: 45 MARKS

Leave blank

SECTION B

5. (a) The table shows the electronic configurations of atoms of the elements in Period 3 of the Periodic Table.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Electronic configuration	2.8.1	2.8.2	2.8.3	2.8.4	2.8.5	2.8.6	2.8.7	2.8.8

(i) How is the electronic configuration of an atom of an element related to its position in the Periodic Table?

.....

.....

(1)

(ii) Give the electronic configuration of an atom of the element directly below magnesium in the Periodic Table.

.....

(1)

(b) Explain the meaning of the term **isotopes**.

.....

.....

.....

(2)

N 3 1 7 6 8 A 0 1 2 2 8

Leave blank

(c) An element exists as three isotopes. The table gives some information about them.

Number of neutrons	Number of protons	Atomic number of isotope	Mass number of isotope	Percentage of each isotope in the element
		12	24	79
13	12	12		
14	12		26	11

(i) Complete the table for the isotopes of the element.

(5)

(ii) Use the information in the table and the Periodic Table on page 2 to identify the element.

.....

(1)

(iii) Use the information in the table to calculate the relative atomic mass of the element. Give your answer to **three** significant figures.

(3)

(iv) When a sample of the element containing only atoms with a mass number of 24 was added to dilute sulphuric acid, effervescence was seen.
What would be seen if a sample of the element containing only atoms with a mass number of 26 was added to dilute sulphuric acid? Explain your answer.

Observation .....

.....

Explanation .....

.....

(2)

(Total 15 marks)

Q5

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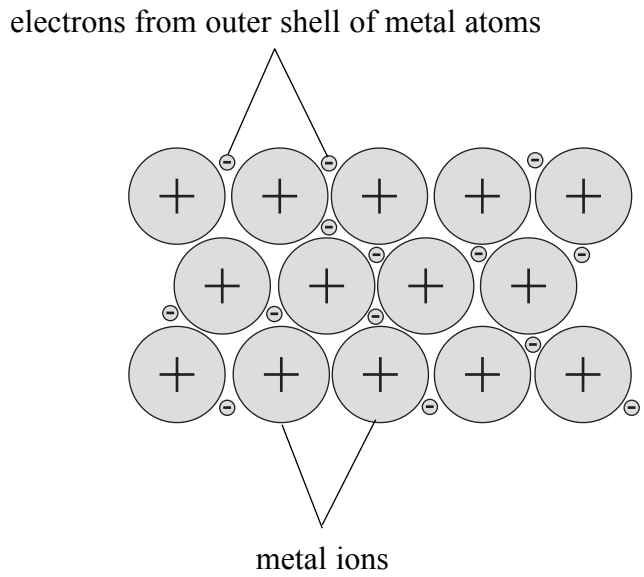
6. (a) The diagram represents the structure of a metal.



Use the diagram to help you explain

(i) why a metal conducts electricity

.....

.....

.....

(2)

(ii) why a metal is malleable.

.....

.....

.....

(2)

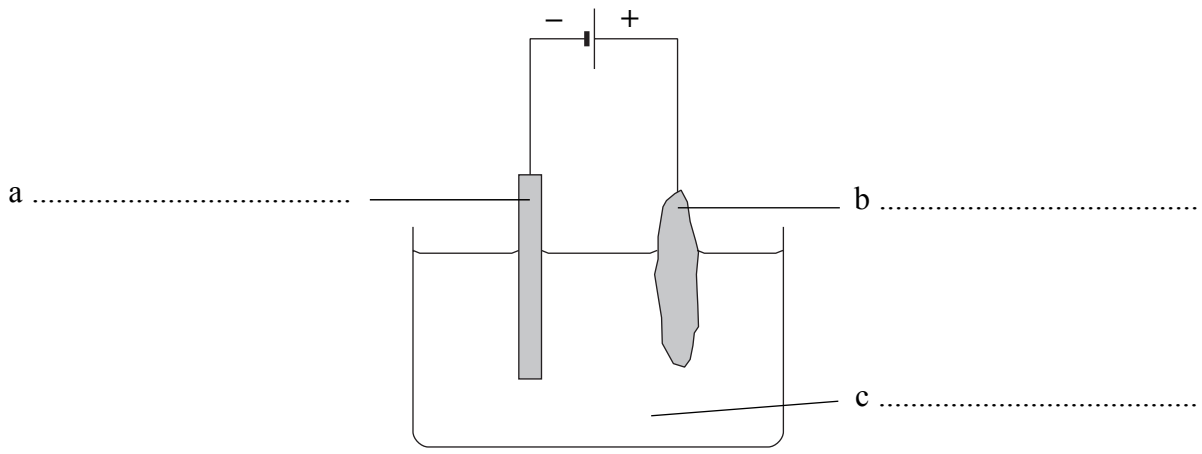
N 3 1 7 6 8 A 0 1 5 2 8

Turn over

Leave blank

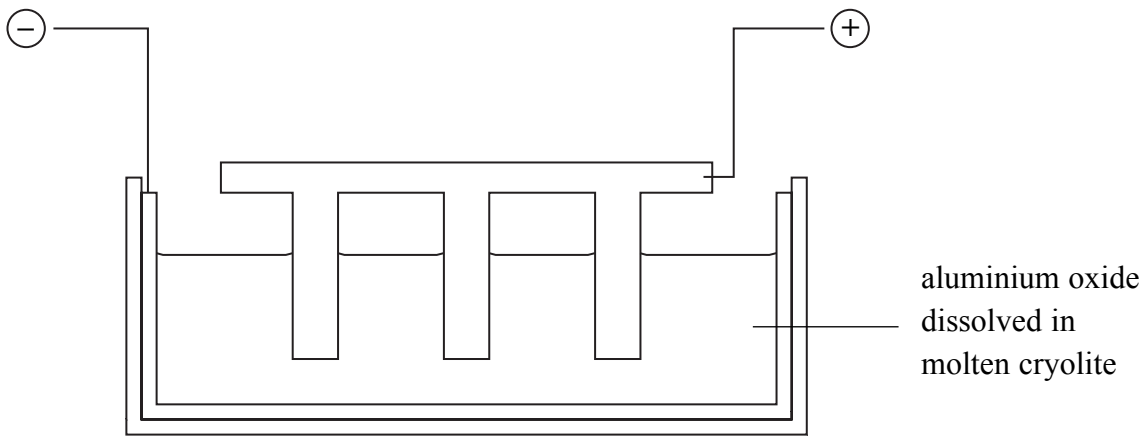
(b) Copper is purified by electrolysis.

Label the diagram of the apparatus used.



(3)

(c) Aluminium is obtained from aluminium oxide using electrolysis.



(i) Explain why the aluminium oxide is dissolved in molten cryolite.

.....

.....

(1)

(ii) Name the element used for both the positive and negative electrodes.

.....

(1)

N 3 1 7 6 8 A 0 1 6 2 8

Leave blank

(d) Both copper and aluminium have many uses. Give a different use for each of these metals and give a property of the metal on which that use depends.

Use of copper .....

Property on which use depends .....

Use of aluminium .....

Property on which use depends .....

(4)

(e) Titanium is a metal that has a similar reactivity to aluminium. Rutile is an ore that contains titanium dioxide, TiO_2.
Suggest how titanium could be obtained from this ore and explain your answer.

.....

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.....

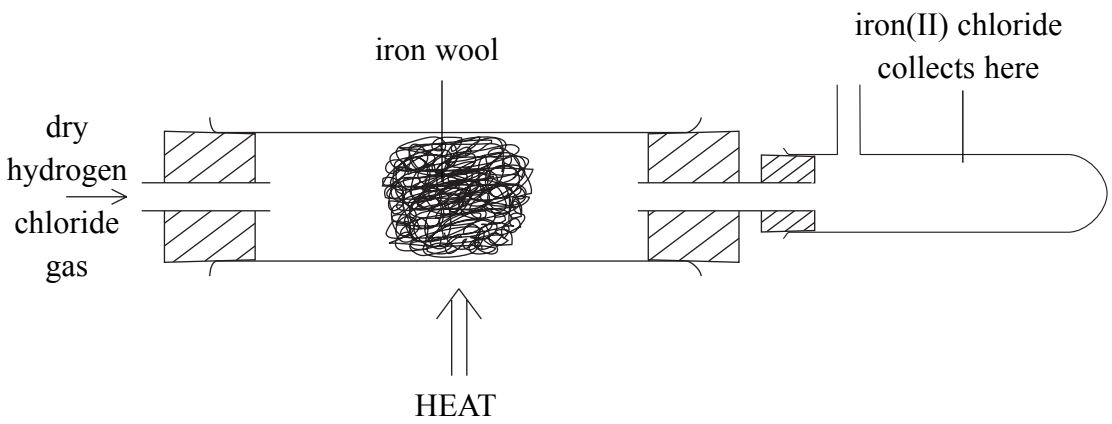
(2)

Q6

(Total 15 marks)

Leave blank

7. (a) The apparatus shown can be used to react iron with dry hydrogen chloride gas.



One of the products is iron(II) chloride.

Write a chemical equation for the reaction.

.....

(3)

(b) When hot iron wool is plunged into a gas jar containing dry chlorine gas, a rapid reaction occurs. The iron wool glows brightly and a dense smoke of iron(III) chloride is seen.

What does the fact that the iron wool glows brightly tell you about the reaction?

.....

(1)

N 3 1 7 6 8 A 0 1 8 2 8

Leave blank

(c) Sodium hydroxide reacts with both iron(II) chloride and with iron(III) chloride.

Describe how you could use sodium hydroxide solution to distinguish between solid samples of iron(II) chloride and iron(III) chloride. Give brief details of what you would do and what you would observe in each case.

.....

.....

.....

.....

.....

.....

.....

(4) **Q7**

(Total 8 marks)

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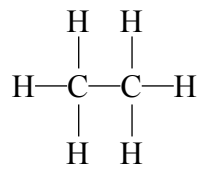
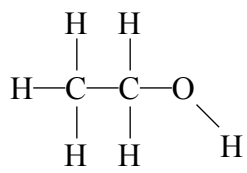
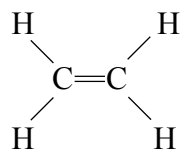
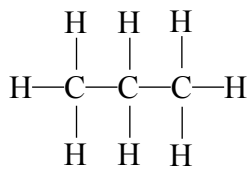
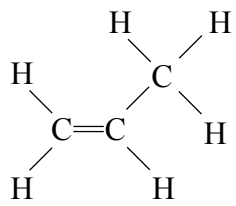
8. (a) The table shows the displayed formulae of some organic compounds.

Compound	Displayed formula
A	
B	
C	
D	
E	

(i) Give one reason why compound **B** is not a hydrocarbon.

.....

(1)

(ii) State the empirical formula of compound **A**.

.....

(1)

(iii) Both **A** and **D** are members of the same homologous series.
What is a homologous series?

.....

.....

.....

(2)

Leave blank

(iv) Draw a dot and cross diagram to show the bonding in compound **A**.

(2)

(v) What is the name of the addition polymer formed by compound **E**?

.....

(1)

(vi) Draw the repeat unit of the addition polymer of compound **E**.

(2)

(vii) Compound **E** reacts rapidly with bromine water but the addition polymer of compound **E** does not. Explain this difference in behaviour.

.....

.....

.....

(2)

Leave blank

(b) Draw the displayed formulae of three isomers with molecular formula C_4H_8.

(3)

Q8

(Total 14 marks)

Leave blank

9. At a high temperature, calcium oxide reacts with carbon to form calcium carbide, CaC_2.

$$CaO(s) + 3C(s) \rightarrow CaC_2(s) + CO(g)$$

(a) Calcium oxide reacts with carbon to make 128 g of calcium carbide. Calculate

(i) the relative formula mass of calcium carbide.

(1)

(ii) the amount, in moles, of calcium carbide made in the reaction.

(1)

(iii) the minimum amount, in moles, of carbon that is required to make this amount of calcium carbide.

(1)

(iv) the minimum mass, in g, of carbon required.

(1)

(b) Calcium carbide reacts with water to make the gas ethyne, C_2H_2, and a compound of calcium.

(i) Complete the chemical equation for this reaction:

$$CaC_2 + 2H_2O \rightarrow C_2H_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

(1)

(ii) Ethyne, C_2H_2, is highly flammable.

Predict the products of the complete combustion of ethyne.

.....

(2)

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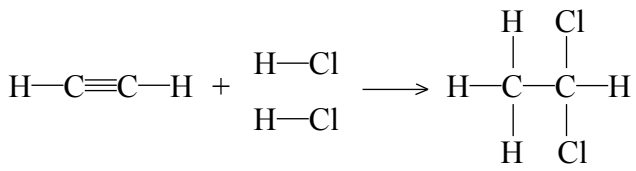
(c) Ethyne reacts with hydrogen chloride gas.



The table shows some average bond dissociation energies.

Bond	**Average bond dissociation energy (kJ / mol)**
H—C	412
C≡C	837
H—Cl	431
C—C	348
C—Cl	338

(i) Calculate the energy, in kJ, required to break all of the bonds in the reactants.

(2)

(ii) Calculate the energy, in kJ, given out when all of the bonds in the product are formed.

(2)

(iii) Calculate the value of ΔH, in kJ / mol, for the reaction.

(1)

(Total 12 marks)

Q9

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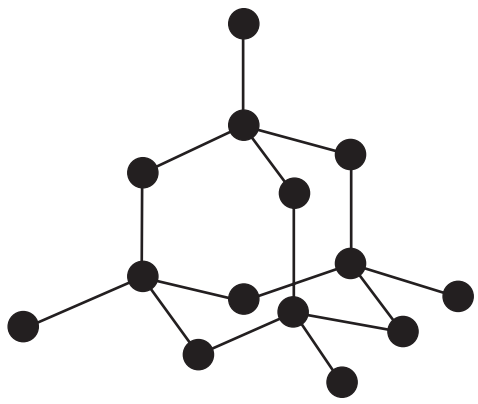
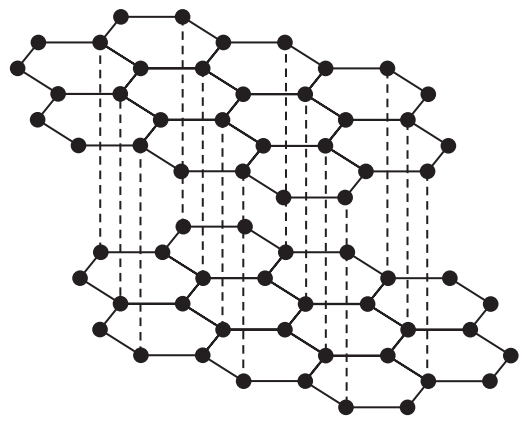
10. The diagrams show the structures of diamond and graphite.
They are different structural forms of the element carbon.



diamond



graphite

(a) What type of structure are both diamond and graphite?

.....

(1)

(b) Diamond has a high sublimation temperature. Explain why.

.....

.....

.....

.....

.....

(3)

(c) Graphite can be used as a lubricant. Explain why.

.....

.....

.....

(2)

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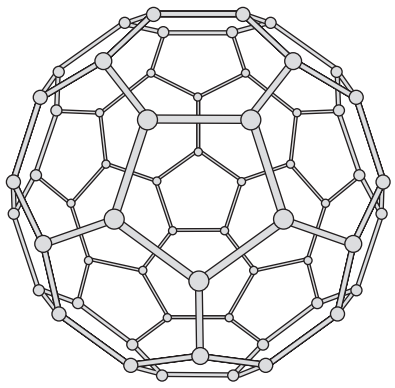
(d) During the twentieth century another structural form of carbon was discovered. In this structural form the molecules have the formula C_{60} and are shaped like footballs.



(i) C_{60} has a much lower sublimation temperature than diamond. Suggest why.

.....

.....

.....

.....

(3)

(ii) Would you expect C_{60} to act as a lubricant? Explain your answer.

.....

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.....

.....

(2)

(Total 11 marks)

Q10

TOTAL FOR SECTION B: 75 MARKS

TOTAL FOR PAPER: 120 MARKS

END

N 3 1 7 6 8 A 0 2 7 2 8

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