

Candidate Name _____

Centre Number

Candidate

Number

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CAMBRIDGE INTERNATIONAL EXAMINATIONS

**Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level**

SCIENCE

5124/3, 5126/3

PAPER 3 Chemistry

OCTOBER/NOVEMBER SESSION 2002

1 hour 15 minutes

Additional materials:

Answer paper

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on all separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer any **two** questions.

Write your answers on the lined pages provided and, if necessary, continue on separate answer paper.

At the end of the examination,

1. fasten any separate answer paper securely to the question paper;
2. enter the numbers of the **Section B** questions you have answered in the grid below.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

A copy of the Periodic Table is printed on page 12.

| FOR EXAMINER'S USE | |
|--------------------|--|
| Section A | |
| Section B | |
| | |
| | |
| TOTAL | |

This question paper consists of 9 printed pages and 3 lined pages.



Section A

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

- 1 Use the names of the substances in Fig. 1.1 to answer this question.

| | | | |
|-------------------|---------------|----------|--------|
| ammonium sulphate | ethanoic acid | graphite | helium |
| lime | methanol | oxygen | steel |

Fig. 1.1

Name

- (a) an allotrope of carbon,[1]
- (b) an alloy,[1]
- (c) a fertiliser,[1]
- (d) a noble gas,[1]
- (e) an oxide.[1]

- 2 The process of photosynthesis takes place in green plants.

- (a) Why are **green** plants essential to this process?
.....[1]
- (b) Name **two** substances that react together to produce glucose during this process.
.....
..... [2]
- (c) What type of energy is converted into chemical energy during this process?
..... [1]

- 3 Fig. 3.1 lists the solubility in water of several substances.

| substances | solubility in water |
|--------------------|---------------------|
| lead(II) carbonate | insoluble |
| sodium sulphate | soluble |
| calcium carbonate | insoluble |
| sodium hydroxide | soluble |
| lead(II) chloride | insoluble |
| lead(II) nitrate | soluble |
| sodium carbonate | soluble |
| hydrochloric acid | soluble |
| nitric acid | soluble |
| sulphuric acid | soluble |

Fig. 3.1

- (a) Name **two** substances from Fig. 3.1 that when mixed as aqueous solutions form lead(II) carbonate.

..... and[1]

- (b) (i) Name **two** substances from Fig. 3.1 that when mixed as aqueous solutions form sodium sulphate.

..... and[1]

- (ii) How would you obtain pure crystals of sodium sulphate from the mixture of solutions in (i)?

.....

[3]

4 The diagram in Fig. 4.1 represents the nuclei of five different atoms, **A**, **B**, **C**, **D** and **E**.

key:- proton ●

neutron ○

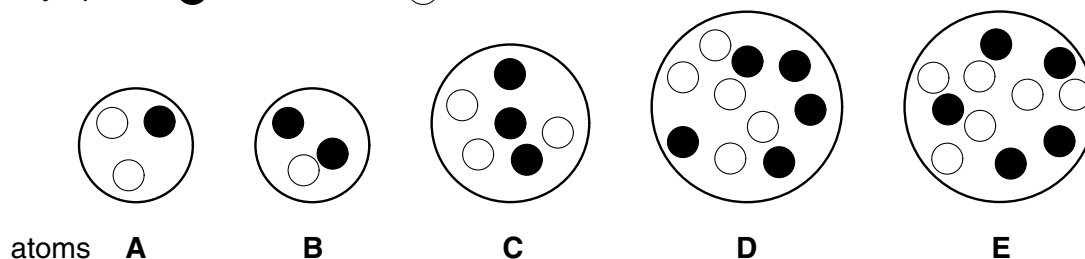


Fig. 4.1

Choose from the letters **A**, **B**, **C**, **D** and **E**, to answer the following questions.

(a) Which atom has a nucleon number of 6?

.....[1]

(b) Which **two** atoms have three electrons in their **outermost** electron shell?

..... and[2]

(c) Which **two** atoms are isotopes of the same element?

..... and[1]

(d) Which atom is an isotope of hydrogen?

.....[1]

5 Use the Periodic Table on page 12 to help answer this question.

(a) State one way in which the elements in Group I differ from the elements in Group VII.

.....[1]

(b) Which Group contains only

(i) relatively soft metals,[1]

(ii) diatomic non-metals?[1]

(c) Which element

(i) is in Group V and in period 3,[1]

(ii) has a proton number of 79?[1]

- 6 Fig. 6.1 shows some properties and reactions of several substances.

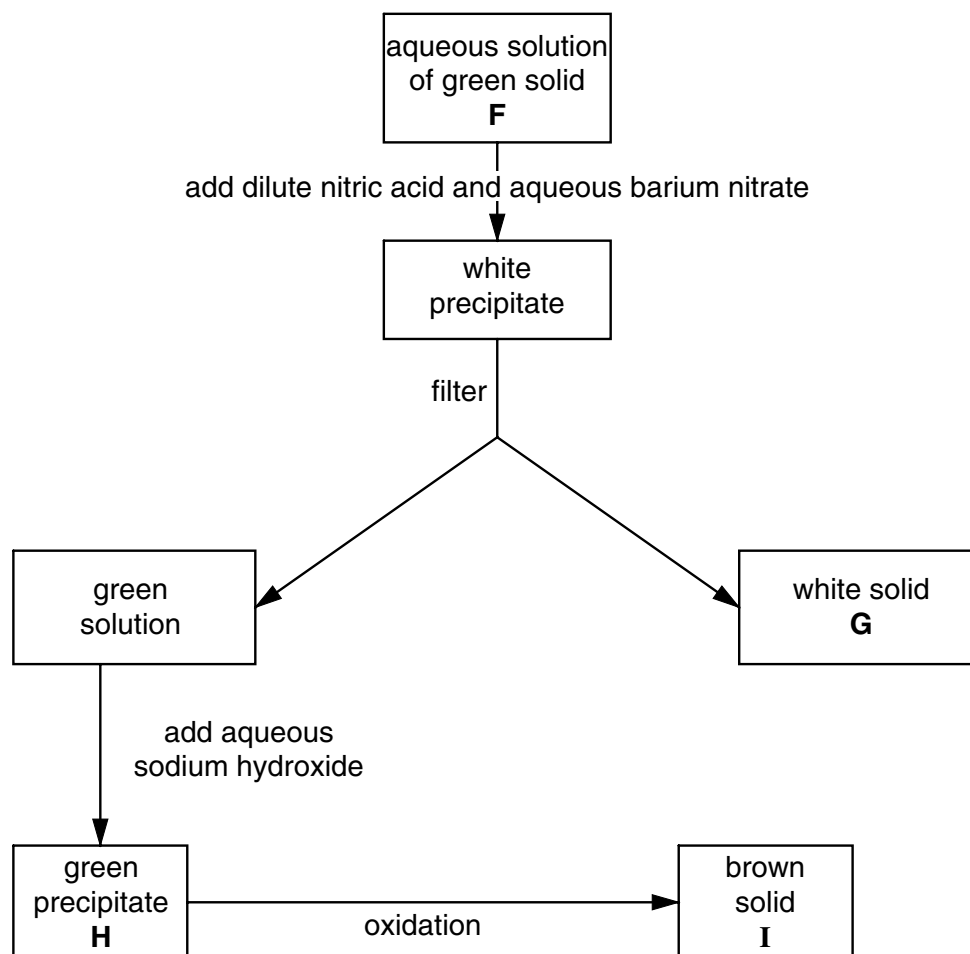


Fig. 6.1

(a) Identify:

- (i) white solid **G**,[1]
- (ii) green precipitate **H**,[1]
- (iii) brown solid **I**,[1]
- (iv) green solid **F**.[1]

(b) Write an equation for any **one** of the reactions in Fig. 6.1.

.....[2]

7 (a) Complete the table in Fig. 7.1.

| solution | colour with Universal Indicator solution |
|--|--|
| (i) 0.1 mol / dm ³ hydrochloric acid | |
| (ii) 0.1 mol / dm ³ sodium hydroxide solution | |
| (iii) a mixture of equal volumes of (i) and (ii) | |

Fig. 7.1

[3]

(b) Calculate the relative molecular mass of sodium hydroxide, NaOH.

[Relative atomic masses: A_r : H, 1; O, 16; Na, 23]

.....
[1]

(c) Calculate the mass of sodium hydroxide in

(i) 1000 cm³ of 1.0 mol / dm³ sodium hydroxide solution,

.....
[1]

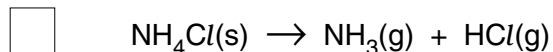
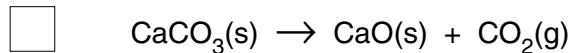
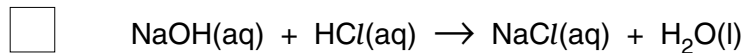
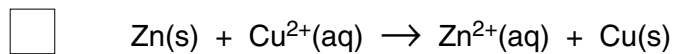
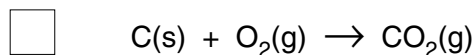
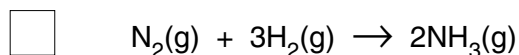
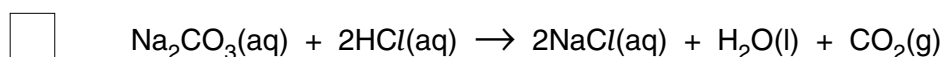
(ii) 1000 cm³ of 0.1 mol / dm³ sodium hydroxide solution,

.....
[1]

(iii) 20 cm³ of 0.1 mol / dm³ sodium hydroxide solution.

.....
[1]

8 Which three of the reactions below involve **both** oxidation **and** reduction?
 Show these reactions by ticking **three** of the boxes.



[3]

9 The diagrams in Fig. 9.1 show the structures of five compounds.

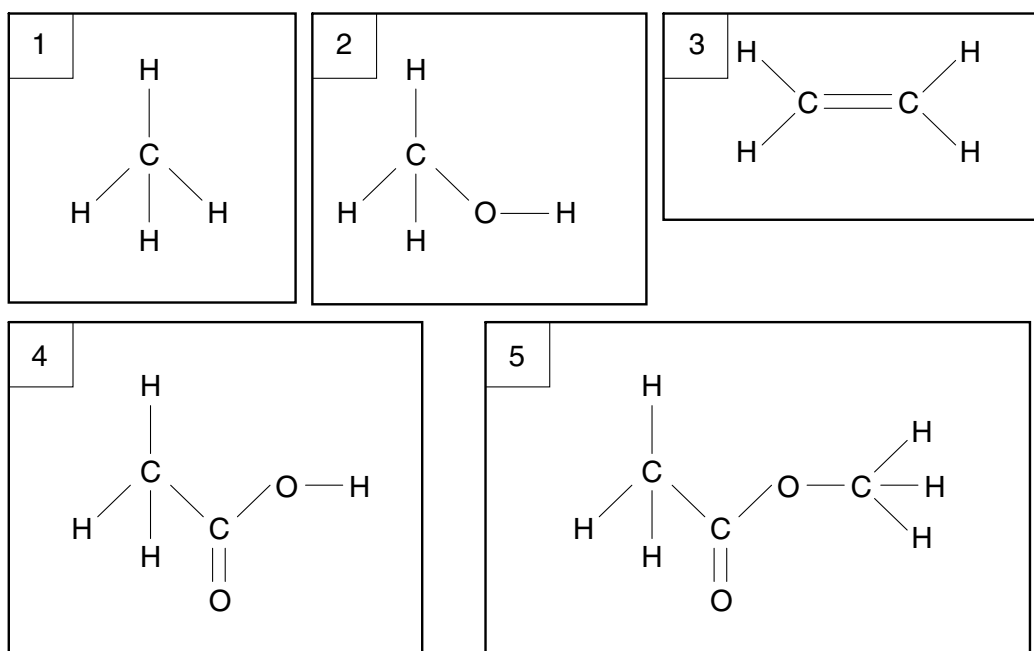


Fig. 9.1

Answer the questions below by stating the numbers of the diagrams.

(a) Which diagram shows

- (i) methane,[1]
- (ii) a compound which is acidic,[1]
- (iii) a compound which decolourises aqueous bromine,[1]
- (iv) an alcohol?[1]

(b) Which **two** compounds react together to form the compound shown in diagram 5?

..... and[1]

Section B

Answer any **two** questions.

Write your answers on the lined pages provided, and, if necessary, continue on separate answer paper.

- 10 (a)** Describe, using **one** suitable example, the formation of covalent bonds between two non-metals. [4]
- (b)** Describe how ionic and covalent compounds differ in solubility and electrical conductivity. Use suitable examples to illustrate your answer. [6]
- 11 (a)** A solid and a liquid react to form a gas which is insoluble in water. Design and draw a labelled diagram of an apparatus that could be used to collect this gas. [3]
- (b)** Explain how your apparatus can be used to measure the **rate of reaction** between the solid and the liquid. [3]
- (c)** How can your results from **(b)** be displayed to show how the rate of reaction gradually slows down and eventually stops? [4]
- 12 (a)** Describe how iron can be manufactured from a named ore using coke, C, and limestone, CaCO_3 . Write equations for the decomposition of limestone and for the reduction of the ore. [6]
- (b)** Calculate the maximum mass of carbon dioxide that will be formed by decomposing 25 tonnes of limestone.
- [Relative atomic masses: A_r : C, 12; O, 16; Ca, 40] [4]

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DATA SHEET
The Periodic Table of the Elements

| | | Group | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|-------------------------------------|---|-------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|--------------------------------------|--|--------------------------------------|---------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|------------------------------------|--|-------------------------------------|--------------------------------------|-------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-----------------------------------|----------------------------------|-----------------------------------|-------------------------------------|------------------------------------|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 5%;"></td> <td style="width: 5%;"></td> <td style="width: 10%;">1 H Hydrogen 1</td> <td colspan="9"></td> </tr> </table> | | | | | | | | | | | | 1 H Hydrogen 1 | | | | | | | | | | | | | | | | | |
| | | 1 H Hydrogen 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 7 Li Lithium 3 | 9 Be Beryllium 4 | 11 Na Sodium 11 | 12 Mg Magnesium 12 | 13 Al Aluminium 13 | 14 N Nitrogen 7 | 15 P Phosphorus 15 | 16 S Sulphur 16 | 17 Cl Chlorine 17 | 18 Ar Argon 18 | 20 Ne Neon 10 | | | | | | | | | | | | | | | | | | | |
| | | 19 K Potassium 19 | 20 Ca Calcium 20 | 23 V Vanadium 23 | 24 Cr Chromium 24 | 25 Mn Manganese 25 | 26 Fe Iron 26 | 27 Co Cobalt 27 | 28 Ni Nickel 28 | 29 Cu Copper 29 | 30 Zn Zinc 30 | 31 Ga Gallium 31 | 32 Ge Germanium 32 | 33 As Arsenic 33 | 34 Se Selenium 34 | 35 Br Bromine 35 | 36 Kr Krypton 36 | | | | | | | | | | | | | | |
| | | 37 Rb Rubidium 37 | 38 Sr Strontium 38 | 41 Nb Niobium 41 | 42 Mo Molybdenum 42 | 43 Tc Technetium 43 | 44 Ru Ruthenium 44 | 45 Rh Rhodium 45 | 46 Pd Palladium 46 | 47 Ag Silver 47 | 48 Cd Cadmium 48 | 49 In Indium 49 | 50 Sn Tin 50 | 51 Sb Antimony 51 | 52 Te Tellurium 52 | 53 I Iodine 53 | 54 Xe Xenon 54 | | | | | | | | | | | | | | |
| | | 55 Cs Caesium 55 | 56 Ba Barium 56 | 73 Ta Tantalum 73 | 74 W Tungsten 74 | 75 Re Rhenium 75 | 76 Os Osmium 76 | 77 Ir Iridium 77 | 78 Pt Platinum 78 | 79 Au Gold 79 | 80 Hg Mercury 80 | 81 Tl Thallium 81 | 82 Pb Lead 82 | 83 Bi Bismuth 83 | 84 Po Polonium 84 | 85 At Astatine 85 | 86 Rn Radon 86 | | | | | | | | | | | | | | |
| | | 87 Fr Francium 87 | 88 Ra Radium 88 | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 5%;"></td> <td style="width: 5%;"></td> <td style="width: 10%;">139 La Lanthanum 57</td> <td style="width: 10%;">140 Ce Cerium 58</td> <td style="width: 10%;">141 Pr Praseodymium 59</td> <td style="width: 10%;">142 Nd Neodymium 60</td> <td style="width: 10%;">143 Pm Promethium 61</td> <td style="width: 10%;">144 Nd Neodymium 60</td> <td style="width: 10%;">145 Sm Samarium 62</td> <td style="width: 10%;">146 Eu Europium 63</td> <td style="width: 10%;">147 Gd Gadolinium 64</td> <td style="width: 10%;">148 Tb Terbium 65</td> <td style="width: 10%;">149 Dy Dysprosium 66</td> <td style="width: 10%;">150 Ho Holmium 67</td> <td style="width: 10%;">151 Er Erbium 68</td> <td style="width: 10%;">152 Tm Thulium 69</td> <td style="width: 10%;">153 Yb Ytterbium 70</td> <td style="width: 10%;">154 Lu Lutetium 71</td> </tr> </table> | | | | | | | | | | | | 139 La Lanthanum 57 | 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 142 Nd Neodymium 60 | 143 Pm Promethium 61 | 144 Nd Neodymium 60 | 145 Sm Samarium 62 | 146 Eu Europium 63 | 147 Gd Gadolinium 64 | 148 Tb Terbium 65 | 149 Dy Dysprosium 66 | 150 Ho Holmium 67 | 151 Er Erbium 68 | 152 Tm Thulium 69 | 153 Yb Ytterbium 70 | 154 Lu Lutetium 71 |
| | | 139 La Lanthanum 57 | 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 142 Nd Neodymium 60 | 143 Pm Promethium 61 | 144 Nd Neodymium 60 | 145 Sm Samarium 62 | 146 Eu Europium 63 | 147 Gd Gadolinium 64 | 148 Tb Terbium 65 | 149 Dy Dysprosium 66 | 150 Ho Holmium 67 | 151 Er Erbium 68 | 152 Tm Thulium 69 | 153 Yb Ytterbium 70 | 154 Lu Lutetium 71 | | | | | | | | | | | | | | |
| | | 89 Y Yttrium 39 | 90 Zr Zirconium 40 | 91 Nb Niobium 41 | 92 Mo Molybdenum 42 | 93 Tc Technetium 43 | 94 Ru Ruthenium 44 | 95 Rh Rhodium 45 | 96 Pd Palladium 46 | 97 Ag Silver 47 | 98 Cd Cadmium 48 | 99 In Indium 49 | 100 Sn Tin 50 | 101 Sb Antimony 51 | 102 Te Tellurium 52 | 103 I Iodine 53 | 104 Xe Xenon 54 | | | | | | | | | | | | | | |
| | | 105 At Astatine 85 | 106 Rn Radon 86 | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 5%;"></td> <td style="width: 5%;"></td> <td style="width: 10%;">227 Ac Actinium 89</td> <td colspan="15"></td> </tr> </table> | | | | | | | | | | | | 227 Ac Actinium 89 | | | | | | | | | | | | | | | |
| | | 227 Ac Actinium 89 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 107 U Uranium 92 | 108 Np Neptunium 93 | 109 Pu Plutonium 94 | 110 Am Americium 95 | 111 Cm Curium 96 | 112 Bk Berkelium 97 | 113 Cf Californium 98 | 114 Es Einsteinium 99 | 115 Fm Fermium 100 | 116 Md Mendelevium 101 | 117 No Nobelium 102 | 118 Lr Lawrencium 103 | | | | | | | | | | | | | | | | | | |

*58-71 Lanthanoid series
†90-103 Actinoid series

| | | | | |
|--|--|---|---|---|
| | | a | X | b |
|--|--|---|---|---|

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).