Name

# UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS General Certificate of Education Ordinary Level

## **COMBINED SCIENCE**

5129/02

Paper 2

October/November 2005

2 hours 15 minutes

Candidates answer on the Question Paper. No Additional Materials are required.

#### **READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in. Write in dark blue or black pen in the spaces provided on the Question Paper. You may use a soft pencil for any diagrams, graphs, tables or rough working. Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

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 20.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use

This document consists of 18 printed pages and 2 blank pages.



| 1 Rubidium, Rb, is below potassium in Group 1 of the Periodic Table. |   |       | dic Table.              |                               |                      |     |
|--|---|-------|-------------------------|-------------------------------|----------------------|-----|
|  | (a)   | Stat  | e the formula of the i  | ubidium ion                   |                      | [1] |
|  | (b)   | (i)   | Rubidium and potas      | sium both react with cold wa  | ater.                |     |
|  |   |       | Suggest one differe     | nce in the way that they read | ot.                  |     |
|  |   |       |                         |                               |                      |     |
|  |   |       |                         |                               |                      | [1] |
|  |   | (ii)  | State the products of   | of the reaction between rubic | lium and cold water. |     |
|  |   |       |                         | and                           |                      | [2] |
| 2  | The   | follo | wing is a list of gases | S.                            |                      |     |
|  | amı   | moni  | a                       | carbon dioxide                | chlorine             |     |
|  | hyd   | roge  | en                      | nitrogen                      | oxygen               |     |
|  | Answer the following questions by selecting from the list. Each gas may be used once, more than once or not at all. |       |                         |                               |                      |     |
|  | Name  |       | e gas that              |                               |                      |     |
|  | (a)   | relig | hts a glowing splint,   |                               |                      |     |
|  | (b)   | is pa | ale green in colour,    |                               |                      |     |
|  | (c)   | is th | e most abundant in a    | air,                          |                      |     |
|  | (d)   | is us | sed in the manufactu    | re of margarine,              |                      |     |
|  | (e)   | turn  | s Universal Indicator   | solution blue                 |                      | [5] |

**3** Fig. 3.1 shows a plant cell.

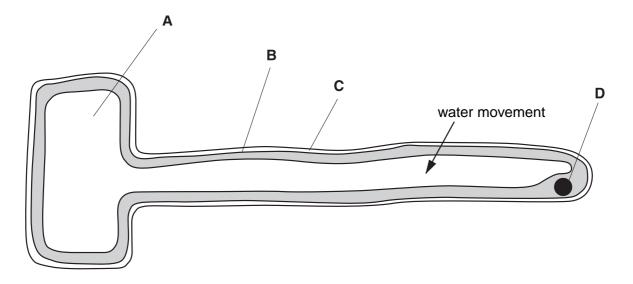


Fig. 3.1

| (a) Name the parts | <b>A</b> , <b>B</b> , <b>C</b> and <b>D</b> . |
|--------------------|---|
|--------------------|---|

(b)

| Α    |                                       |      |
|------|---------------------------------------|------|
| В    |                                       |      |
| С    |                                       |      |
| D    |                                       | .[4] |
| Stat | e the type of cell shown in Fig. 3.1. |      |
|      |                                       | [1]  |

| (c) | (i) | Name the process by which water moves into this cell. |
|-----|-----|---|

| ГА | ٦. |
|----|----|
| 11 | п  |
| ι. |    |

(ii) State three conditions for the process named in (c)(i) to occur.

|--|

2. .....

4 Fig. 4.1 shows a measuring cylinder containing liquid paraffin.

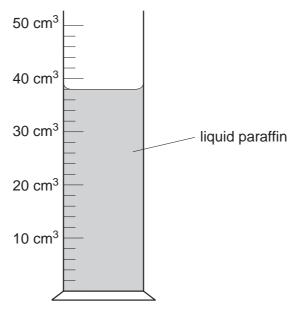


Fig. 4.1

(a) State the volume of the liquid paraffin shown in the measuring cylinder in Fig. 4.1.

.....cm<sup>3</sup> [1]

**(b)** A student measures the mass of the empty measuring cylinder and then containing the liquid paraffin. His results are shown in Fig. 4.2.

| mass of empty measuring cylinder                          | 20.2 g |
|---|--------|
| mass of measuring cylinder containing the liquid paraffin | 50.6 g |

Fig. 4.2

Calculate

(i) the mass of the paraffin,

.....[1]

(ii) the density of the paraffin.

[3]

| 5 | (a) | Sug    | gest a property of aluminium that makes it useful in the manufacture of  |
|---|-----|--------|--|
|   |     | (i)    | aircraft,  |
|   |     |        |  |
|   |     | (ii)   | food containers.   |
|   |     |        | [2]  |
|   | (b) | Fig.   | 5.1 shows an electric cable.   |
|   |     |        | plastic coating metal core   |
|   |     |        |  |
|   |     |        | Fig. 5.1   |
|   |     | Nar    | ne the metal most commonly used for the core[1]  |
| 6 | One | e isot | ope of nitrogen is represented as  |
|   |     |        | <sup>15</sup> <sub>7</sub> N   |
|   | (a) | Sta    | te the number of protons, neutrons and electrons in an atom of this isotope.   |
|   |     | nun    | nber of protons  |
|   |     | nun    | nber of neutrons   |
|   |     | nun    | nber of electrons  |
|   | (b) | Exp    | plain why nitrogen forms the ion N <sup>3-</sup> rather than the ion N <sup>2-</sup> .   |
|   |     |        |  |
|   |     |        | [2]  |
|   | (c) |        | ogen reacts with lithium to form lithium nitride. The lithium ion is Li <sup>+</sup> .  struct the formula of lithium nitride. |
|   |     |        | [1]  |

7 (a) Fig. 7.1 shows one type of plant growing in a garden.

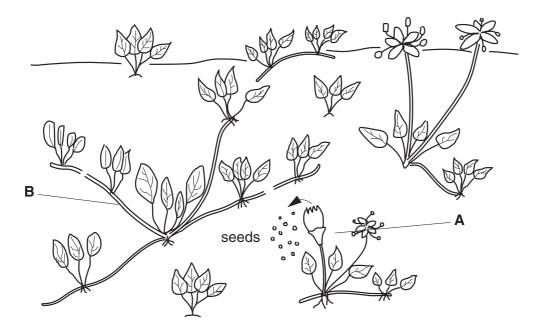


Fig. 7.1

**A** and **B** show two different types of reproduction carried out by this plant. State the type of reproduction shown at

|     | (i)  | <b>A</b> ,  |     |  |  |  |
|-----|------|---|-----|--|--|--|
|     |      | B   |     |  |  |  |
|     | (ii) | State the difference between the offspring resulting from these two types reproduction.   | of  |  |  |  |
|     |      |   |     |  |  |  |
|     |      |   |     |  |  |  |
|     |      |   | [2] |  |  |  |
| (b) |      | other type of plant produces fruits that are bright red and soft.  Plain how this adaptation helps the plant to colonise new areas. |     |  |  |  |
|     |      |   |     |  |  |  |
|     |      |   |     |  |  |  |
|     |      |   | [2] |  |  |  |

(c) Some plants are growing on the banks of a river.

Over a period of years, an island forms in the middle of the river.

Plants grow on the island as shown in Fig. 7.2.

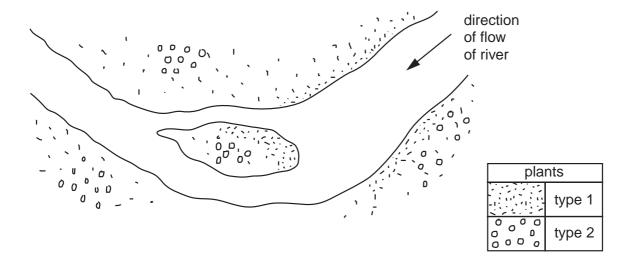


Fig. 7.2

| Suggest two wa   | با ما د د د د ما د م د د |                 |               |              |               | :-       |
|------------------|--------------------------|-----------------|---------------|--------------|---------------|----------|
| >110000t two w/s | ave nv wnier             | 1 CDDAC TrAM    | niante on the | rivar nanke  | reached the   | ISIANA   |
| Juducsi iwo wa   |                          | 1 300003 110111 | Dianio On the | TIVEL Daling | Todoliou lilo | iolaliu. |
|                  |                          |                 |               |              |               |          |

| 1. |     |
|----|-----|
| 2. | [2] |

| 8 | (a) | Ear   | Earth, a spacecraft has a weight of 50 000 N. The gravitational field strength at the th's surface is 10 N / kg. culate the mass of the spacecraft. |
|---|-----|-------|---|
|   | (b) |       | [1] the Moon, the weight of the spacecraft is less than 50 000 N. plain why it weighs less on the Moon.   |
|   | (c) | (i)   | State the relation between force <i>F</i> , mass <i>m</i> and acceleration <i>a</i> .  [1]  |
|   |     | (ii)  | The rockets on the spacecraft produce a force of 20 000 N. Calculate the acceleration of the spacecraft.  |
| 9 | (a) | A Ia  | [2] aboratory thermometer contains mercury. The thermometer is taken from hot water   |
|   | (ω) | and   | I placed in cold water.  te what happens to  the volume of the mercury,   |
|   | (h) | (ii)  | the mass of the mercury[2]  nical thermometers may also contain mercury.  |
|   | (5) | Sta 1 | te two ways in which clinical thermometers differ from laboratory thermometers.   |
|   |     | 2     | [2]   |
|   |     |       |   |

**10** Fig. 10.1 shows the reduction of copper(II) oxide by hydrogen.

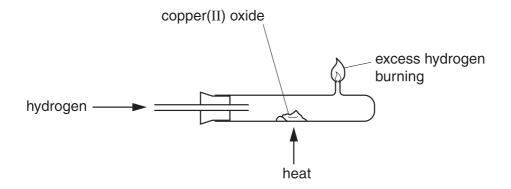


Fig. 10.1

The equation for the reaction is

(a) State what is meant by the term reduction.

$$\mathrm{CuO} \ + \ \mathrm{H_2} \ \rightarrow \ \mathrm{Cu} \ + \ \mathrm{H_2O}$$

|  | [4 |
|--|----|

| /L- \ | /:\ | Oplands to the male than made and a manager of a manager III) and de- |
|-------|-----|---|

| <ul><li>(b) (i) Calculate the relative molecular mass of copper</li></ul> | (II) oxide. |
|---|-------------|
|---|-------------|

| (ii) | Calculate the relative molecular mass of water. |
|------|---|
|      |   |

| (111) | Calculate the mass of water produced from 4 g of copper(II) oxide. |
|-------|--|
|       |  |
|       |  |
|       |  |

11 Fig. 11.1 shows the liver, part of the small intestine and associated blood vessels.

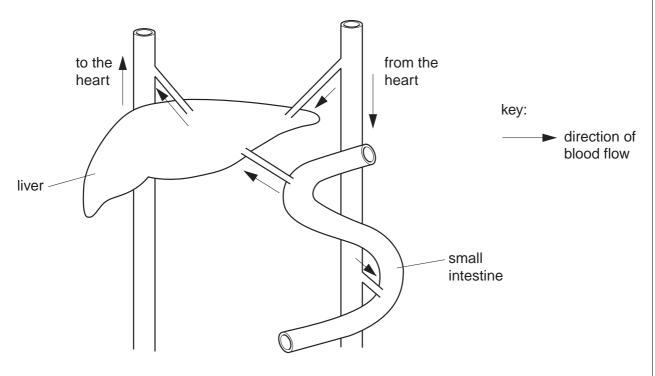


Fig. 11.1

| (a) | Glucose and amino acids are absorbed into the blood from the small intestine. |
|-----|---|
|     | Describe how the liver changes each of these nutrients.                       |
|     | glucose   |
|     | [2]   |
|     | amino acids   |
|     | [2]   |
| (b) | State two <b>other</b> functions of the liver.                                |
|     | 1   |
|     | 2[2]  |

**12** Fig. 12.1 shows an electrical heater being used to heat water in a beaker.

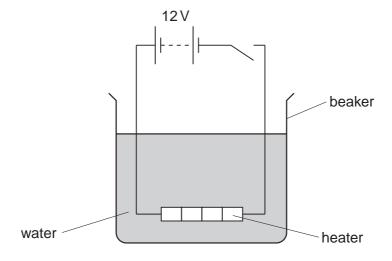


Fig. 12.1

(a) When a 12 V supply is connected across the heater, the power of the heater is 30 W. Calculate the current in the heater.

[2]

- **(b)** Thermal energy can be transferred by conduction, convection or radiation. State the main method by which thermal energy is transferred
  - (i) through the walls of the beaker,

.....

(ii) from the water near the bottom of the beaker to the water at the top.

.....[2]

**13** Fig. 13.1 shows changes of state.

solid 
$$\xrightarrow{W}$$
 liquid  $\xrightarrow{Y}$  gas

Fig. 13.1

| (a) | State the letter, <b>w</b> , <b>x</b> , <b>y</b> or <b>z</b> , that represents |               |     |  |  |  |
|-----|--|---------------|-----|--|--|--|
|     | (i)  | condensation, |     |  |  |  |
|     | (ii)   | melting       | [2] |  |  |  |

**(b)** Draw a diagram to show the arrangement of the particles in a gas.



[1]

| (c) | Describe differences in the arrangement and the movement of the particles who solid changes to a liquid. | n a |
|-----|--|-----|
|     |  |     |
|     |  |     |
|     |  |     |
|     |  | [2] |

| 14 | athlete is walking to the start of a race. |       |   |  |  |  |  |  |
|----|--|-------|---|--|--|--|--|--|
|    |  | (i)   | Name the type of respiration in her muscles as she walks.   |  |  |  |  |  |
|    |  | (ii)  | Write a word equation for this type of respiration.   |  |  |  |  |  |
|    |  | (iii) | State the advantage to the body of this type of respiration. [1]  |  |  |  |  |  |
|    | (b)  | A di  | race starts and she runs.  fferent type of respiration takes place in her muscles when she is running as fast as can. |  |  |  |  |  |
|    |  | (i)   | Write a word equation for this type of respiration.   |  |  |  |  |  |
|    |  |       | [2]   |  |  |  |  |  |
|    |  | (ii)  | State the advantage to the body of this type of respiration.  |  |  |  |  |  |
|    | (c)  | One   | re is a greater amount of two gases in expired air than in inspired air. e of these gases is water vapour.            |  |  |  |  |  |
|    |  | Nan   | ne the other gas[1]   |  |  |  |  |  |
|    | (d)  | Incr  | eased physical activity causes an increase in the rate and the depth of breathing.                                    |  |  |  |  |  |
|    |  | Sug   | gest two ways in which these increases are helpful to the body.   |  |  |  |  |  |
|    |  | 1     |   |  |  |  |  |  |
|    |  | 2     | [2]   |  |  |  |  |  |

15 Fig. 15.1 shows a ray of light passing through a parallel-sided glass block. Some of the light is reflected at the surface of the block. Normals to the glass surface are shown.

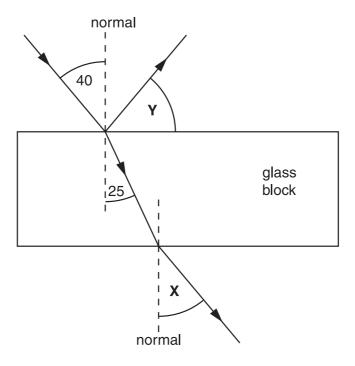


Fig. 15.1

- (a) State the value of the angle X.....[1](b) Calculate the value of the angle Y.
  - , .....[1]
- (c) Calculate the refractive index of the glass.

[3]

**16** Fig. 16.1 shows an electric circuit.

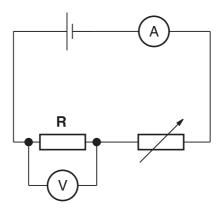


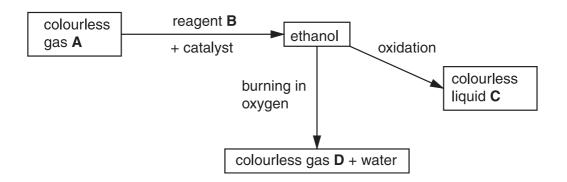
Fig. 16.1

(a) For one setting of the variable resistor, the ammeter reading is 0.20 A and the voltmeter reading is 0.80 V. Calculate the resistance of the fixed resistor R.

[3]

- **(b)** The resistance of the variable resistor is increased. State what happens to the reading on
  - (i) the ammeter,.....
  - (ii) the voltmeter. .....[2]

**17** Study the following series of reactions.



(a) Identify substances A, B, C and D.

| Α |         |
|---|---------|
| В |         |
| С |         |
| D | <br>[4] |

**(b)** Draw a diagram to show the structure of a molecule of ethanol.

[1]

(c) Colourless liquid **C** turns damp Universal Indicator paper red. State what this shows about colourless liquid **C**.

......[1]

**18** Fig. 18.1 shows a simple transformer.

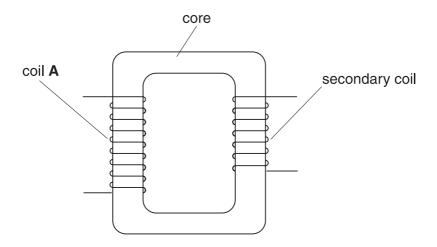


Fig. 18.1

(a) The secondary coil is labelled.

|     | Stat | te the name of coil <b>A</b> ,   |     |
|-----|------|--|-----|
|     | (ii) | the material used for the core.  | [2] |
| (b) | Exp  | plain why the input to the transformer must be an alternating current, <b>not</b> a direction. | et  |
|     |      |  |     |
|     |      |  | [3] |

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DATA SHEET
The Periodic Table of the Elements

|                                    |       |     |                                |                               |                                    |                                   | _•                                  |                                    |                                    |
|------------------------------------|-------|-----|--------------------------------|-------------------------------|------------------------------------|-----------------------------------|-------------------------------------|------------------------------------|------------------------------------|
|                                    |       | 0   | 4 <b>He</b> Helium             | 20 <b>Ne</b> Neon 10          | 40<br><b>Ar</b><br>Argon           | 84 <b>Kr</b><br>Krypton<br>36     | 131<br><b>Xe</b><br>Xenon<br>54     | Radon<br>86                        |                                    |
|                                    |       | IIA |                                | 19 <b>F</b> Fluorine          | 35.5 <b>C1</b> Chlorine            | 80<br><b>Br</b><br>Bromine<br>35  | 127 <b>I</b> lodine 53              | At<br>Astatine<br>85               |                                    |
|                                    |       | VI  |                                | 16<br><b>O</b><br>Oxygen<br>8 | 32<br><b>Sulphur</b><br>16         | 79<br><b>Se</b><br>Selenium<br>34 | 128 <b>Te</b> Tellurium 52          | <b>Po</b> Polonium 84              |                                    |
|                                    |       | >   |                                | 14 <b>N</b> itrogen 7         | 31<br>Phosphorus<br>15             | 75<br><b>AS</b><br>Arsenic<br>33  | 122<br><b>Sb</b><br>Antimony<br>51  | 209 <b>Bi</b> Bismuth 83           |                                    |
|                                    |       | 2   |                                | 12<br><b>C</b><br>Carbon<br>6 | 28<br><b>Si</b><br>Silion<br>14    | 73 <b>Ge</b> Germanium            | 119<br><b>Sn</b><br>Tin             | 207 <b>Pb</b> Lead 82              |                                    |
|                                    |       | ≡   |                                | 11<br>Boron<br>5              | 27<br><b>A1</b><br>Aluminium<br>13 | 70 <b>Ga</b> Gallium              | 115<br><b>In</b><br>Indium          | 204 <b>Tt</b> Thallium             |                                    |
| ts                                 |       |     |                                |                               |                                    | 65<br><b>Zinc</b><br>30           | 112<br><b>Cd</b><br>Cadmium<br>48   | 201<br><b>Hg</b><br>Mercury<br>80  |                                    |
| Elemen                             |       |     |                                |                               |                                    | 64 <b>Cu</b> Copper               | 108 <b>Ag</b> Silver 47             | 197<br><b>Au</b><br>Gold<br>79     |                                    |
| The Periodic Lable of the Elements | Group |     |                                |                               |                                    | Nickel Nickel 28                  | 106<br><b>Pd</b><br>Palladium<br>46 | 195 <b>Pt</b> Platinum 78          |                                    |
| dic labi                           | Gre   |     |                                |                               |                                    | 59<br><b>Co</b><br>Cobalt<br>27   | 103 <b>Rh</b> Rhodium 45            | 192 <b>Ir</b><br>Iridium           |                                    |
| ne Perio                           |       |     | 1<br><b>H</b><br>Hydrogen<br>1 |                               |                                    | 56<br><b>Fe</b><br>Iron<br>26     | Ruthenium 44                        | 190<br><b>OS</b><br>Osmium<br>76   |                                    |
|                                    |       |     |                                |                               |                                    | 55<br>Wn<br>Manganese<br>25       | Tc Technetium                       | 186<br><b>Re</b><br>Rhenium<br>75  |                                    |
|                                    |       |     |                                |                               |                                    | 52<br><b>Cr</b><br>Chromium<br>24 | 96<br><b>Mo</b><br>Molybdenum<br>42 | 184 <b>W</b> Tungsten 74           |                                    |
|                                    |       |     |                                |                               |                                    | 51<br>V<br>Vanadium<br>23         | Niobium 41                          | 181 <b>Ta</b> Tantalum 73          |                                    |
|                                    |       |     |                                |                               |                                    | 48 <b>Ti</b> Titanium 22          | 91 Zr Zirconium 40                  | 178 <b>Hf</b><br>Hafnium<br>72     |                                    |
|                                    |       |     |                                |                               |                                    | 45<br><b>Sc</b><br>Scandium<br>21 | 89 <b>×</b> Yttrium 39              | 139 <b>La</b><br>Lanthanum<br>57 * | 227<br><b>Ac</b><br>Actinium<br>89 |
|                                    |       |     |                                | 9 <b>Be</b> Beryllium         | 24 Mg Magnesium                    | 40 <b>Ca</b> Calcium 20           | Sr<br>Strontium                     | 137 <b>Ba</b> Barium 56            | 226 <b>Ra</b> Radium 88            |
|                                    |       | _   |                                | 7 <b>Li</b> Lithium           | 23 <b>Na</b> Sodium                | 39 <b>K</b> Potassium             | Rubidium 37                         | 133<br>CS<br>Caesium<br>55         | <b>Fr</b><br>Francium<br>87        |

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

|        | 140        | <sup>14</sup> | 44 7     | 5      | 150       | 152       | 157        | 159<br><b>F</b> | 162                | 165         | 167                                      | 169<br><b>H</b> | 173      |
|--------|------------|---------------|----------|--------|-----------|-----------|------------|-----------------|--------------------|-------------|--|-----------------|----------|
|        | <b>9</b> [ | Ĭ             |          |        |           |           | ָב<br>פֿיי | <b>2</b> - L    | ָבַ בַּ            | 2           | ֡֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֓֓֓֓֓֓֓֞֞֜֞֓֓֓֓֓֓֓֓֓֓֞֟ |                 | 2        |
|        | 28         | 59            | 60       | 61     |           |           | 64         | 65              | Dyspiosidiii<br>66 |             | 68<br>68                                 | 69              | 70       |
| ass    | 232        |               | 238      |        |           |           |            |                 |                    |             |  |                 |          |
|        | T          | Pa            | <b>-</b> | о<br>М | Pu        | Am        | CB         | 쓢               | ర                  | Es          | Fm                                       | Md              | 8        |
| rodani | Thorium    | Protactinium  | Uranium  |        | Plutonium | Americium | Curium     | Berkelium       |                    | Einsteinium | Fermium                                  | Mendelevium     | Nobelium |
|        | 06         | 91            | 95       |        | 94        | 98        | 96         | 26              |                    | 66          | 100                                      | 101             | 102      |
|        |            |               |          |        |           |           |            |                 |                    |             |  |                 |          |

**Lr** Lawrencium 103

Lu Lutetium 71

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).