UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9203180518

CO-ORDINATED SCIENCES **0654/02**

Paper 2 (Core) **October/November 2008**

2 hours

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.
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.
DO **NOT** WRITE IN ANY BARCODES

Answer **all** questions.
A copy of the Periodic Table is printed on page 28.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

This document consists of **25** printed pages and **3** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 A football match is taking place.

(a) When the ball is kicked it travels at 5 m / s.

(i) The ball has a mass of 0.6 kg.

Calculate the kinetic energy of the ball.

State the formula that you use and show your working.

formula

working

..... J [2]

(ii) Calculate the momentum of the ball.

State the formula that you use and show your working.

formula

working

..... kg m / s [2]

(b) Towards the end of the ball's journey it is slowing down.

Are the forces on the ball balanced or unbalanced?

Explain your answer.

.....

..... [1]

(c) The players need a lot of energy to play a game of football.
State the **two** main food types which supply the players with this energy.

1 .....

2 ..... [2]

For Examiner's Use

2 In the 1930s, farmers growing sugar cane in tropical parts of Australia had problems with insect pests, such as lacebugs, that ate the crop. Cane toads, *Bufo marinus*, were introduced from central America to try to solve the problem. Cane toads kill and eat insects and other small animals.

Fig. 2.1 shows a cane toad.

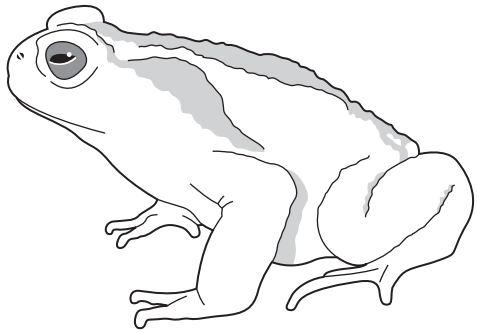


Fig. 2.1

(a) State **one** feature of a cane toad, visible in Fig. 2.1, which shows that it is an amphibian.

.....

[1]

(b) Name the genus to which cane toads belong.

.....

[1]

(c) Use the information above to write a food chain involving cane toads. For each organism, state whether it is a producer or a consumer.

.....

[2]

For Examiner's Use

(d) Biologists noticed that some cane toads had longer legs than others. They thought that perhaps toads with longer legs could travel faster than other toads.

They collected toads with different leg lengths, and measured the distance the toads travelled in 24 hours. The results are shown in Fig. 2.2.

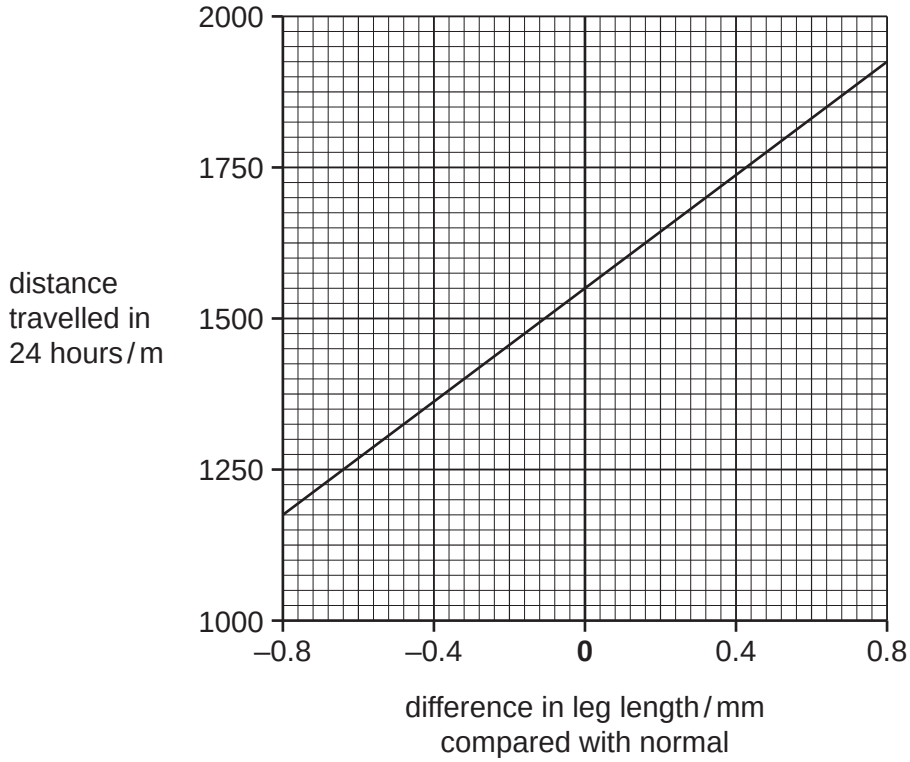


Fig. 2.2

(i) The number **0** on the x axis indicates toads that had normal leg lengths.

Calculate the speed at which a toad with normal leg length travelled. Show your working.

..... m per hour [2]

(ii) Describe the relationship between the length of the toad's legs and the speed at which it travelled.

.....

..... [1]

(iii) State **two** variables that the researchers should have kept the same in their investigation.

1 .....

2 ..... [2]

(e) The digestive system of a cane toad is very similar to the human digestive system. The diet of a cane toad is high in protein.

For Examiner's Use

(i) Name the kind of enzyme that digests proteins to amino acids.

..... [1]

(ii) Suggest the part of a cane toad's digestive system where the amino acids are absorbed into the blood.

..... [1]

For Examiner's Use

3 A student investigates the reaction between magnesium and dilute acid **Y**.
Fig. 3.1 shows the metal being added to the acid contained in a test-tube, and also the same tube some time later.

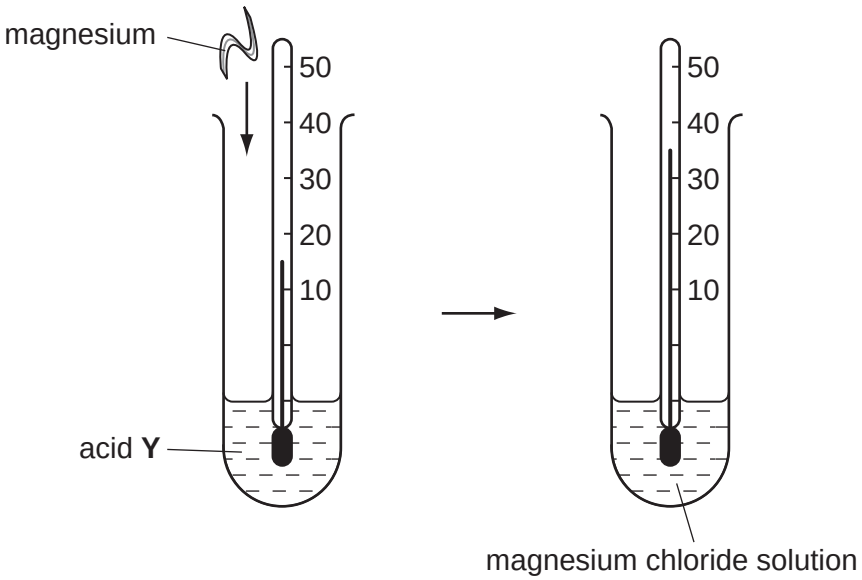


Fig. 3.1

(a) (i) Name the compound present after the reaction that was not present before.

.....

[1]

(ii) Name acid **Y**.

.....

[1]

(iii) The student observed bubbles of gas escaping from the mixture. She collected samples of this gas and tested them with limewater, a glowing wooden splint and a lit wooden splint.

Explain which **one** of these tests produced a positive result.

.....

.....

.....

[2]

(iv) Explain how it is possible to tell from Fig. 3.1 that the reaction was exothermic.

.....

.....

[2]

For Examiner's Use

(b) Magnesium alloys are widely used in making parts for aircraft and racing car engines.

(i) One type of magnesium alloy contains the elements zinc and zirconium.

Suggest how this magnesium alloy is made.

.....

..... [1]

(ii) Suggest and explain why a magnesium alloy, rather than a transition metal such as iron, is used to make parts for aircraft and racing cars.

.....

.....

..... [2]

For Examiner's Use

4 **(a)** Some countries use nuclear fission reactors to generate electricity.

(i) What is meant by the term *nuclear fission*?

.....

..... [2]

(ii) State **one** advantage and **one** disadvantage of generating electricity using nuclear reactors.

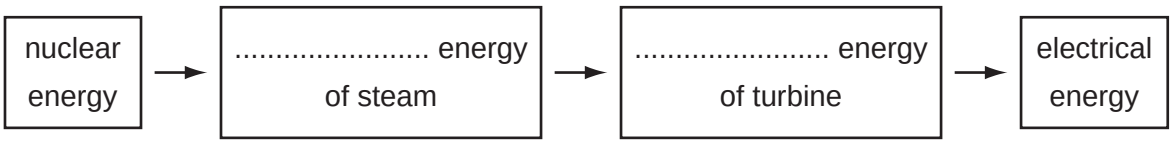
advantage .....

.....

disadvantage .....

..... [2]

(iii) Complete the boxes to show how nuclear power stations transfer energy.



[2]

(b) When nuclear fuel is used in a power station, ionising radiation is released.

Table 4.1 shows some information about three types of ionising radiation.

Table 4.1

radiation	ionising power	deflection by electric field
alpha	very strong	small
beta	moderate	large
gamma	weak	none

(i) Explain why alpha and beta radiations are deflected by an electric field but gamma radiation is not.

.....

..... [1]

(ii) Explain why beta radiation is deflected more than alpha radiation by an electric field.

.....

..... [1]

(iii) Explain why alpha radiation is the most ionising.

.....

..... [1]

(iv) State **one** effect of ionising radiation on living things.

.....

..... [1]

(v) Why are radioactive sources stored in lead containers?

..... [1]

[Turn over

5 Fig. 5.1 shows the female reproductive system.

For Examiner's Use

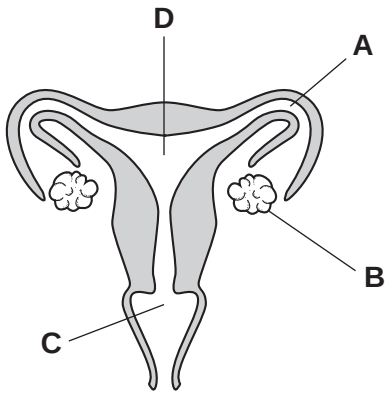


Fig.5.1

(a) Give the **letter** on the diagram which represents each of the following structures.

vagina .....

ovary .....

uterus .....

oviduct ..... [2]

(b) Fig. 5.2 shows how the thickness of the uterus lining changes during one month of the menstrual cycle.

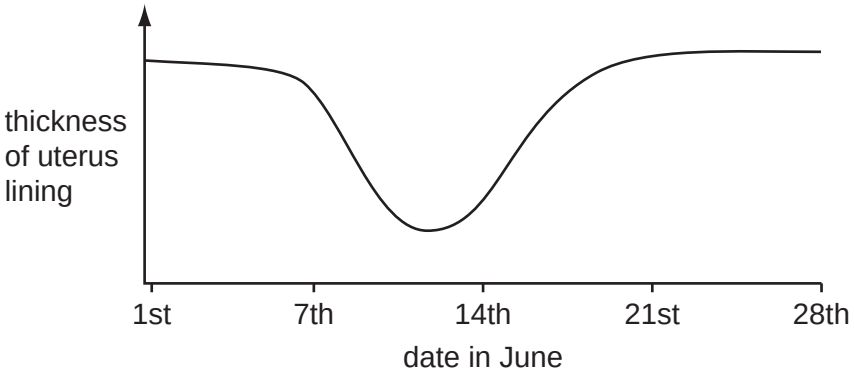


Fig. 5.2

(i) Explain how the graph shows that menstruation began on June 7th.

.....

..... [1]

(ii) Suggest the date on which ovulation (the release of an egg from an ovary) occurred.

..... [1]

(c) During fertilisation, a sperm fuses with an egg.

(i) Name the part of the reproductive system where fertilisation takes place.

..... [1]

(ii) A sperm contains 23 chromosomes.

How many chromosomes does an egg contain?

..... [1]

(iii) Name the part of a sperm or an egg which contains the chromosomes.

..... [1]

(d) (i) AIDS can be transmitted from one person to another during sexual intercourse.

Explain how this transmission can take place.

.....

.....

..... [2]

(ii) Outline **two** ways by which the spread of AIDS by this method can be limited.

.....

.....

..... [2]

[Turn over

6 Fig. 6.1 shows crude oil (petroleum) being extracted from sedimentary rock under the sea.

For Examiner's Use

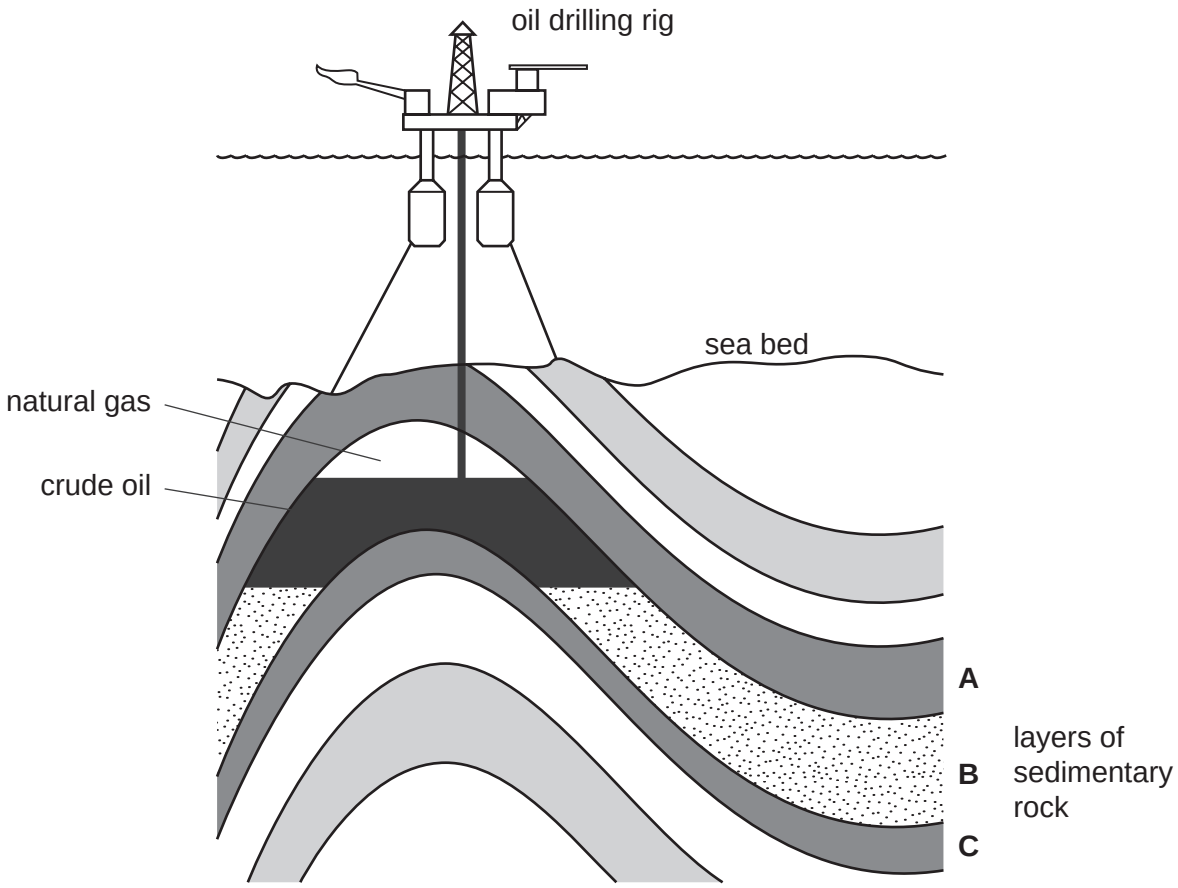


Fig. 6.1

(a) The oil shown in Fig. 6.1 is contained in the layer of sedimentary rock labelled **B**.

(i) Name the two other main types of rock, in addition to sedimentary rocks, which make up the Earth's crust.

1 .....

2 .....

[2]

(ii) The oil in Fig. 6.1 is found only in rock layer **B** and not in layers **A** or **C**.

Suggest the property of rock **B** which is different from rocks **A** and **C**, and which allows it to contain oil.

.....

..... [1]

(b) Crude oil is a mixture of different hydrocarbon molecules. A typical hydrocarbon molecule is shown in Fig. 6.2.

For Examiner's Use

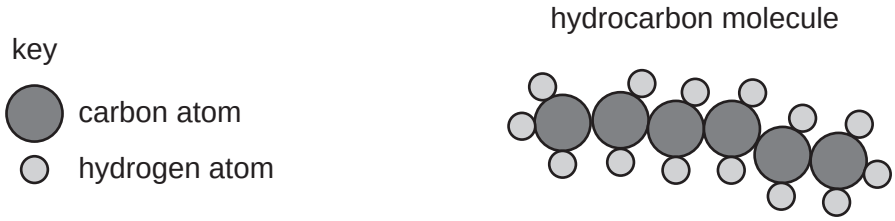


Fig. 6.2

Some hydrocarbon molecules are different from others in crude oil because their carbon atoms form a branched chain as shown in Fig. 6.3.

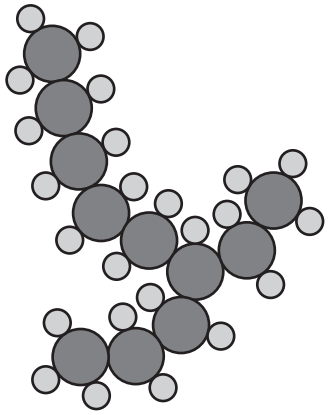


Fig. 6.3

Describe **two** other ways in which hydrocarbon molecules can be different from one another.

1 .....

.....

2 .....

..... [2]

(c) Some hydrocarbons are changed by chemical reactions into a very wide range of materials including plastics. Plastics are made of polymer molecules.

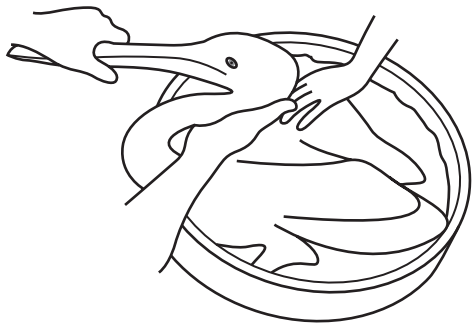
For Examiner's Use

Some of the reactions and processes which are required to produce a typical plastic are shown below. Draw lines linking the statements. One line has already been drawn.

extraction	unsaturated hydrocarbon molecules bond together
fractional distillation	saturated hydrocarbons are heated to form unsaturated hydrocarbons
cracking	oil is obtained from rocks in the Earth
polymerisation	hydrocarbons are separated according to their boiling points

[2]

(d) If an oil tanker is involved in an accident, oil may spill into the sea. If sea birds become covered in crude oil they will die unless the oil can be removed.



(i) Why is water alone not able to wash the oil from the birds?

.....

..... [1]

(ii) Suggest what could be added to the water in order to remove the oil from the birds.

..... [1]

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Please turn over for Question 7

For Examiner's Use

7 An airline passenger enters an airport.

(a) He buys some hot food at the restaurant and carries it away in a polystyrene container.

Explain why a polystyrene container is used to keep food hot.

.....

..... [1]

(b) He then moves up an escalator (moving staircase) as shown in Fig. 7.1.

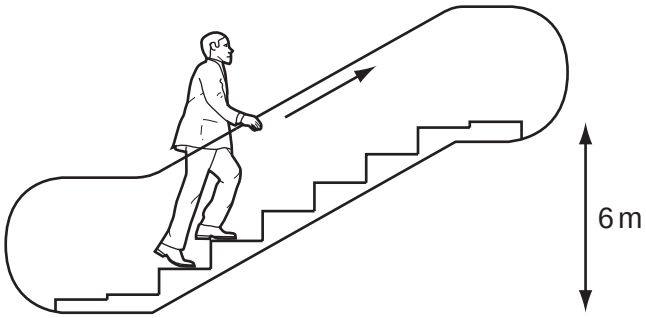


Fig. 7.1

The passenger weighs 900N.

(i) Calculate the work done lifting the passenger a vertical distance of 6 metres.

State the formula that you use and show your working.

formula

working

..... J [2]

(ii) State the potential energy the passenger has gained when he reaches the top of the escalator.

..... J [1]

(c) The aeroplane that the passenger travels on is able to navigate using radar.

This involves the use of microwaves. These are part of the electromagnetic spectrum.

For Examiner's Use

(i) Name **one** other wave which is part of the electromagnetic spectrum.

..... [1]

(ii) State the speed at which these waves travel in a vacuum.

..... m/s [1]

For Examiner's Use

8 Fig. 8.1 shows an alveolus and a blood capillary in the lungs.

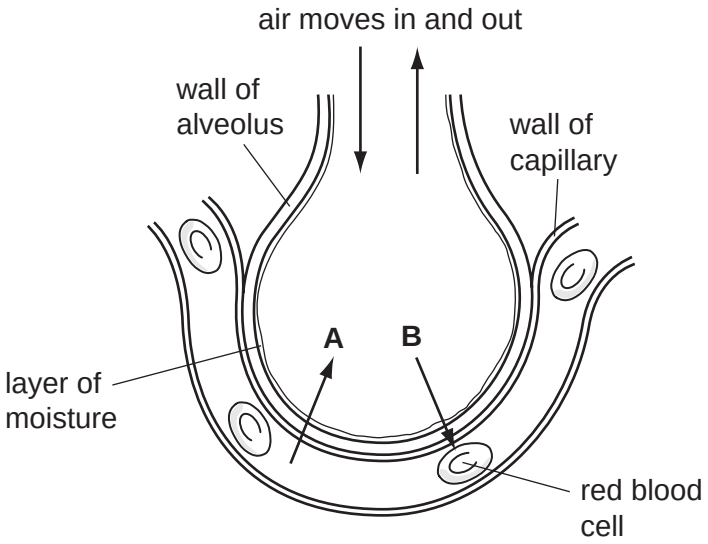


Fig. 8.1

(a) (i) Name the gases that move as indicated by arrows **A** and **B**.

A .....

B ..... [2]

(ii) Name the process by which the gases move.

..... [1]

(b) Describe what happens in the red blood cells as they pass through the lungs.

.....

.....

..... [2]

(c) Fig. 8.2 shows the structure of a leaf.

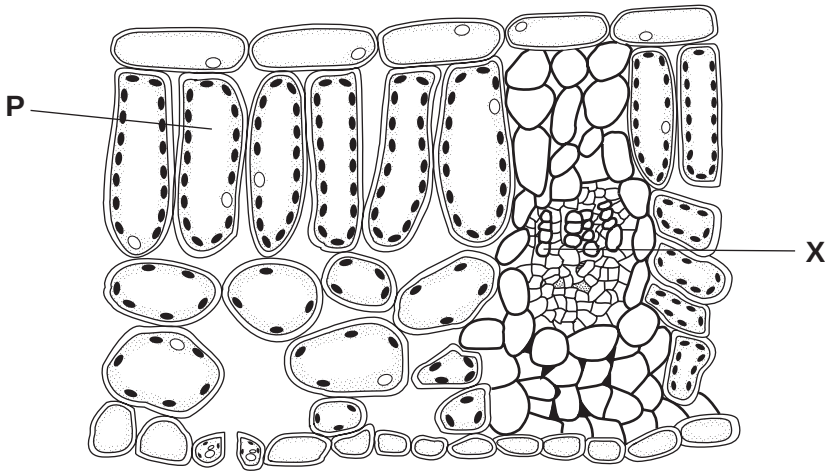


Fig. 8.2

(i) Cell **P** contains many chloroplasts and can photosynthesise.

At night, cell **P** takes in oxygen and gives out carbon dioxide.

In the daytime, cell **P** takes in carbon dioxide and gives out oxygen.

Explain why this happens.

at night .....

.....

in daytime .....

.....

..... [3]

(ii) On Fig. 8.2, draw an arrow to show how gases travel to cell **P** from the air. [1]

(iii) Cell **X** is a xylem vessel.

Give **two** functions of a xylem vessel in a leaf.

1 .....

2 ..... [2]

For Examiner's Use

9 Litmus and alizarin yellow are substances which can be used to indicate the pH of a solution. The colours of these substances in solutions of different pH ranges are shown below.

	pH 4.5 and lower	pH 8.3 and higher
litmus	red	blue

	pH 10.1 and lower	pH 12.0 and higher
alizarin yellow	yellow	brown

(a) A student wishes to find out if a colourless solution is an acid or an alkali by using one of the substances named above.

Explain why she should use litmus and not alizarin yellow.

.....

.....

..... [2]

(b) Litmus is obtained from plant material and alizarin yellow is a synthetic dye. The chemical formula of alizarin yellow is $C_{13}H_8N_3NaO_5$.

(i) Explain the meaning of the term *synthetic dye*.

.....

.....

..... [2]

(ii) How many metallic elements are shown in the formula of alizarin yellow?

..... [1]

(iii) Name a method which could be used to find out whether a mixture contained both litmus and alizarin yellow.

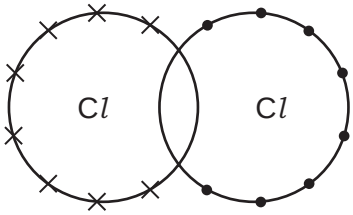
..... [1]

(c) The atoms in molecules are joined by covalent chemical bonds.

For Examiner's Use

Explain which **one** of the diagrams, **1** to **4**, shows a covalent bond between the atoms in a chlorine molecule.

1



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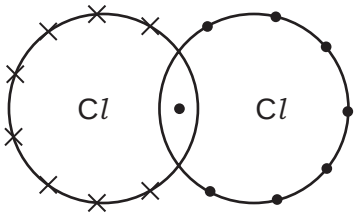

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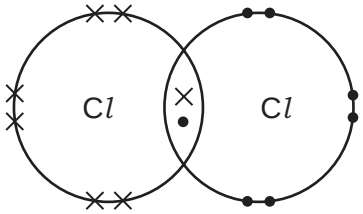

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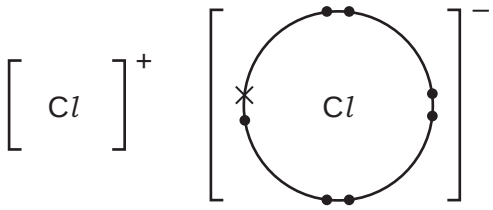

.....

.....

..... [2]

10 **(a)** A simple circuit is shown in Fig. 10.1.

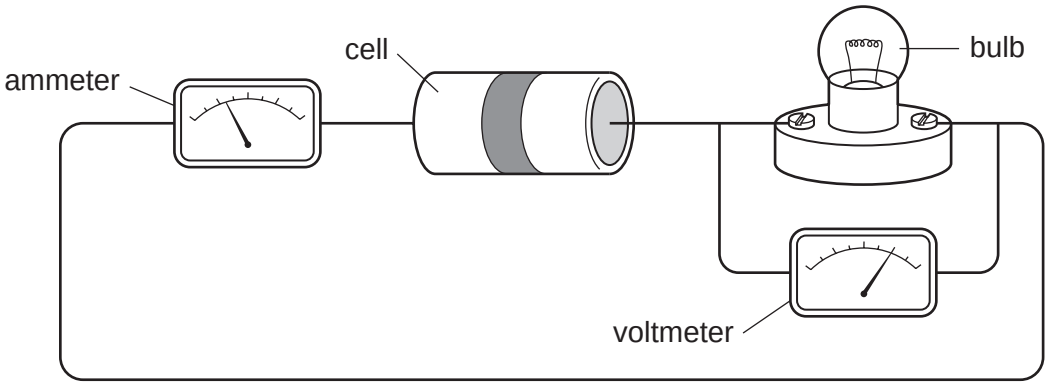

Fig. 10.1

In the space below, draw the circuit diagram for this circuit using the correct symbols.

[3]

(b) Fig. 10.2 shows a d.c. electric motor.

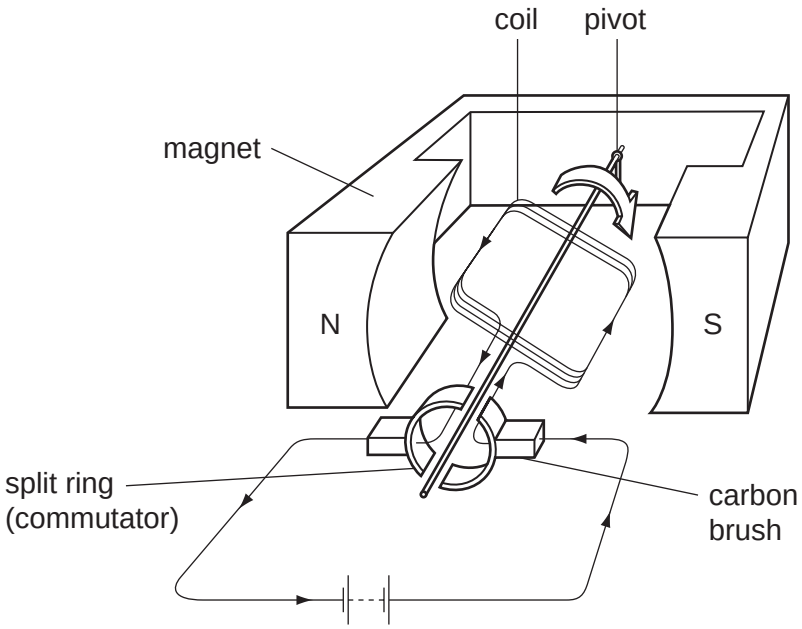

Fig. 10.2

(i) Suggest **two** ways of making the coil spin more quickly.

1 .....

.....

2 .....

..... [2]

(ii) Apart from changing the direction of the current in the coil, how could you reverse the motion of the coil?

..... [1]

(c) An electric motor is connected to a 240 V supply.

The maximum current used by the motor is 4 A.

(i) Use the formula **power = voltage x current** to calculate the maximum power put into the motor.

Show your working.

..... W [1]

(ii) Explain why the electrical input power will be greater than the useful mechanical output power.

.....

..... [2]

11 Fig. 11.1 shows the apparatus and substances used by a student to make an electrical cell.

For Examiner's Use

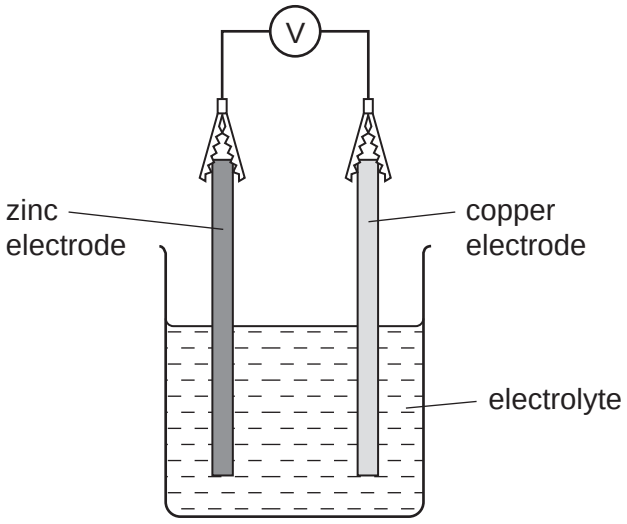

Fig. 11.1

(a) (i) What type of compound must be dissolved in water to produce an electrolyte?

.....

[1]

(ii) The student finds that the voltmeter reads 1.1 V.

He then replaces the copper electrode with another electrode made of zinc.

Predict and explain briefly the new voltmeter reading.

.....

.....

.....

[2]

For Examiner's Use

(b) In the electrical cell in Fig. 11.1 zinc atoms are converted into positively charged zinc ions, Zn^{2+}.

(i) State the number of electrons in one atom of zinc. Use your copy of the Periodic Table on page 28 to help you to answer this question.

..... [1]

(ii) Describe what happens to a zinc atom when it changes into a zinc ion.

.....

..... [2]

(c) Fig. 11.2 shows an electrical cell used in a personal stereo.

Fig. 11.2

The following chemical reaction occurs inside the cell when the stereo is switched on.

$$Zn + 2MnO_2 \rightarrow ZnO + Mn_2O_3$$

Name the substance which is oxidised in this reaction.

Explain your answer.

substance oxidised

.....

explanation

.....

..... [2]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 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
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
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	64 **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
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**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
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **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	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															
				140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
				232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

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

Key: a above **X** above b

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

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