UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8813001337

CO-ORDINATED SCIENCES **0654/32**

Paper 3 (Extended) **October/November 2010**

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	
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2	
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5	
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7	
8	
9	
10	
Total	

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

UNIVERSITY of CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 shows apparatus used in the electrolysis of copper chloride solution.

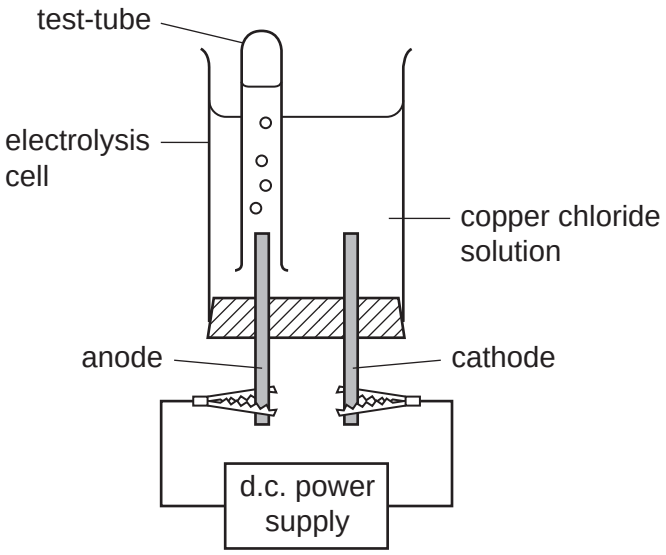


Fig. 1.1

(i) Describe what is observed at the cathode.

.....

[1]

(ii) Chloride ions have a single negative electrical charge, Cl^-.

For every copper ion in the solution, two chloride ions are present.

Deduce the electrical charge of a copper ion.

Show how you obtained your answer.

.....

[2]

(iii) Fig. 1.2 shows diagrams of two particles **L** and **M**. Each of these particles have 17 protons in their nucleus. Only the outer shell of each particle is shown.

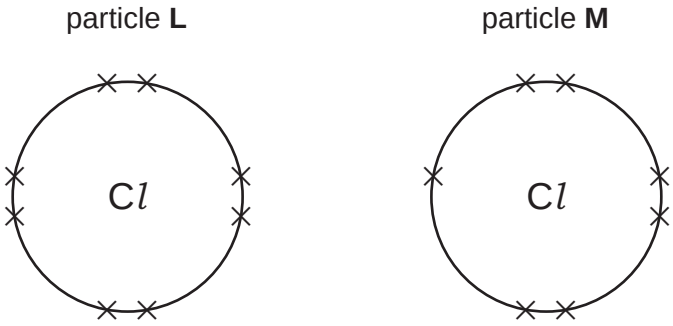


Fig. 1.2

State and explain which one of these particles, **L** or **M**, would move towards the anode during electrolysis.

particle .....

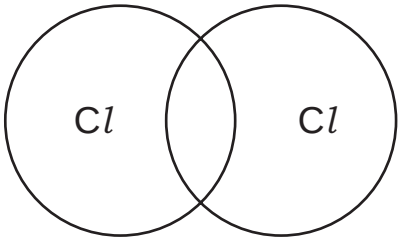
.....

.....

..... [2]

(iv) The bubbles of gas which rise from the anode contain diatomic molecules of chlorine.

Complete the bonding diagram below to show how the outer electrons are arranged in a chlorine molecule.



[2]

For Examiner's Use

(b) The apparatus shown in Fig. 1.3 can be used to investigate the reaction between lead oxide, PbO, and carbon.

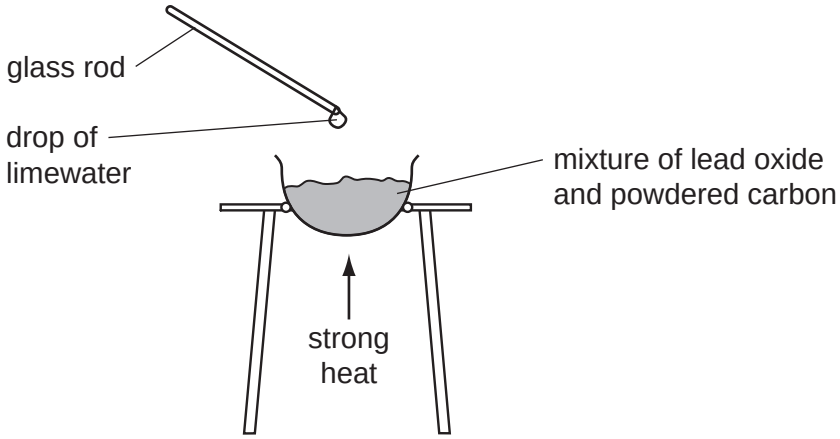


Fig. 1.3

When the mixture is heated, a redox reaction occurs in which lead oxide is reduced.

The drop of limewater suspended on the glass rod turns cloudy.

(i) Name the gas which is produced in this redox reaction.

..... [1]

(ii) Suggest the balanced symbolic equation for the redox reaction between lead oxide and carbon.

..... [2]

(iii) A student suggested carrying out a similar redox reaction to that shown in Fig. 1.3, using potassium oxide instead of lead oxide.

Potassium is an alkali metal in Group 1 of the Periodic Table.

Predict and explain whether or not there would be a redox reaction between potassium oxide and carbon.

.....

.....

..... [2]

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Please turn over for Question 2.

For Examiner's Use

2 **(a)** Fig. 2.1 shows an electric circuit.

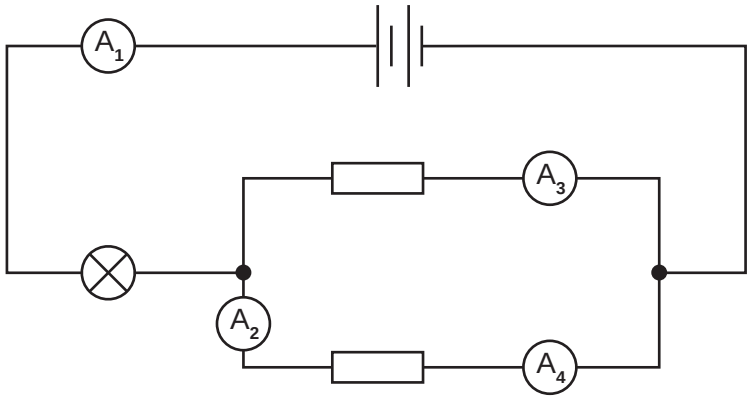

Fig. 2.1

Complete Table 2.1 to show the reading on each ammeter.

Table 2.1

ammeter	current / amps
A_1	0.7
A_2	
A_3	
A_4	0.3

[2]

(b) Fig. 2.2 shows how the current in a circuit varies with voltage.

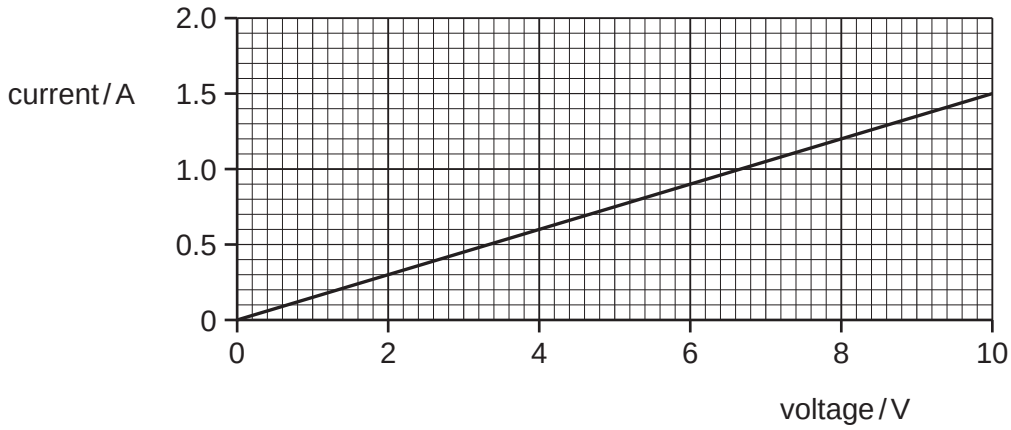

Fig. 2.2

(i) Is Ohm's Law obeyed in this circuit?

Explain your answer.

.....

.....

[1]

(ii) Predict the current in the circuit when the voltage is 13 V.

Explain your answer.

.....

..... [2]

(c) Fig. 2.3 shows a transformer.

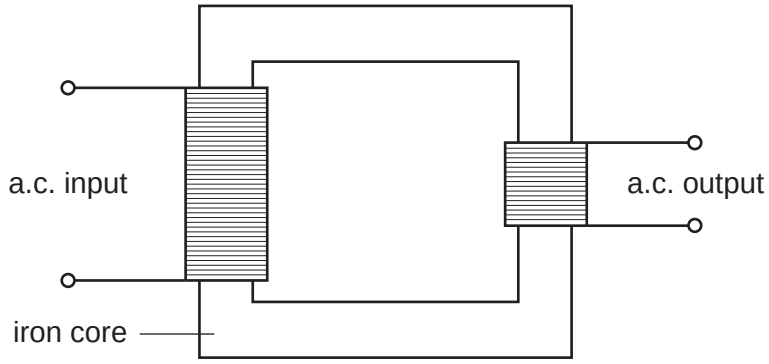

Fig. 2.3

(i) Explain why the core of the transformer is made of iron.

.....

.....

..... [2]

(ii) The transformer has 10 000 turns on the primary coil and 1000 turns on the secondary coil.

The voltage across the primary coil is 200 V.

Use the formula

$$V_p / V_s = N_p / N_s$$

to calculate the voltage across the secondary coil.

Show your working.

..... [1]

For Examiner's Use

3 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 3.1.

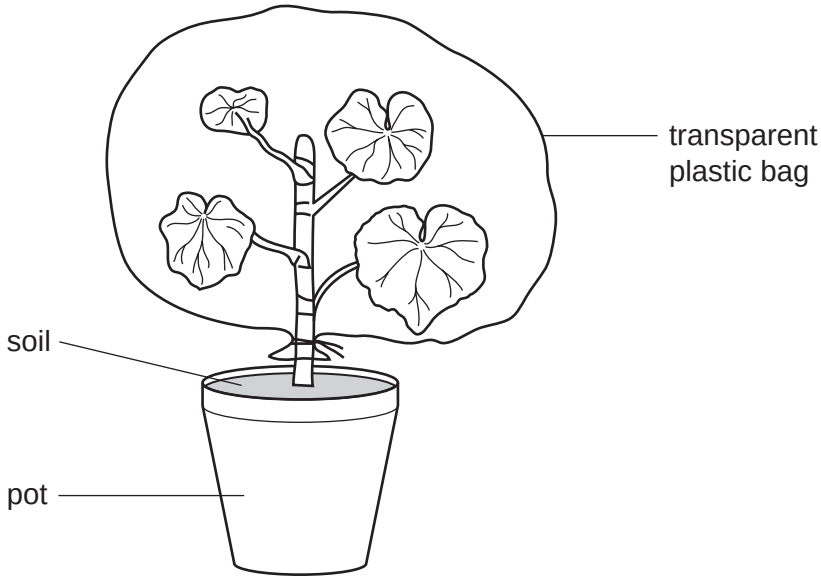

Fig. 3.1

(a) The temperature near the window fell overnight. The next morning, small droplets of water were visible on the inside of the plastic bag.

Explain why the droplets of water appeared on the inside of the plastic bag.

.....

.....

.....

.....

..... [4]

(b) The plastic bag was then removed from the plant. The next day was warm and sunny, and by the end of the day the plant had wilted. Fig. 3.2 shows the wilted plant.

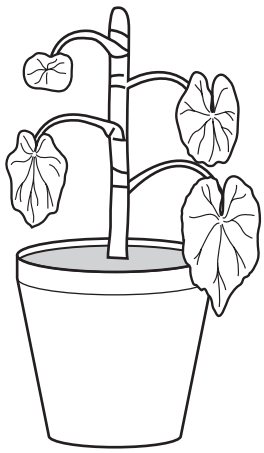

Fig. 3.2

(i) Explain why the plant wilted.

.....

.....

..... [2]

(ii) Explain why the main stem of the plant remained upright, even when the rest of the plant wilted.

.....

..... [1]

[Turn over

(iii) Fig. 3.3 shows a cell from the plant leaf before it wilted.

For Examiner's Use

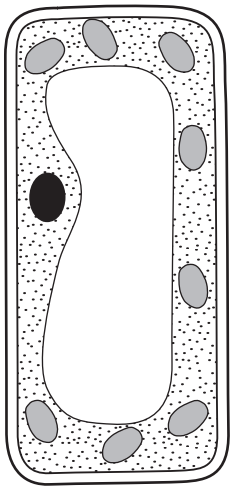

Fig. 3.3

In the space below, draw the same cell to show its appearance after the plant had wilted.

[3]

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Please turn over for Question 4.

For Examiner's Use

4 **(a)** Below is a list of some types of waves.

gamma **infra-red** **microwave** **sound**

ultrasound **ultraviolet** **visible light**

State **one** wave from the list that is

(i) a longitudinal wave, ... [1]

(ii) emitted by hot objects but cannot be seen by the human eye,

..... [1]

(iii) the transverse wave with the highest frequency.

..... [1]

(b) A sound wave has a frequency of 50 000 Hz.

(i) Explain the meaning of the term *frequency*.

.....

..... [1]

(ii) Explain whether a person would be able to hear this sound.

.....

..... [1]

(iii) Sound waves travel through the air at 330 m / s.

Calculate the wavelength of the sound wave.

State the formula that you use and show your working.

formula used

working

..... [3]

5 In many countries, river water is collected and treated to make it safe for humans to drink.

(a) Explain which **one** of the treatments shown below might **not** remove all the harmful bacteria from water which is to be used for drinking.

chlorination **distillation** **filtration**

treatment .....

.....

..... [1]

(b) Sometimes large numbers of tiny pieces of insoluble solid material become dispersed in river water, forming a colloid.

Fig. 5.1 shows a simplified diagram of a colloid.

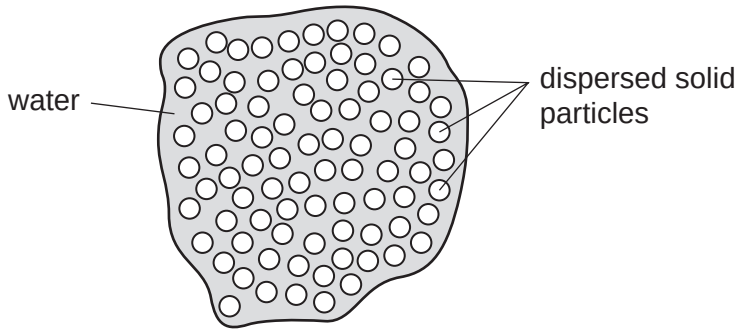

Fig. 5.1

Explain in terms of light rays, why colloids are **not** transparent.

You may draw some light rays on Fig. 5.1 to help you to answer this question.

.....

.....

..... [2]

(c) A chemist wanted to find the concentration in mol / dm^3 of sulfuric acid in a sample of acidic lake water.

Fig. 5.2 shows the apparatus and materials that he used.

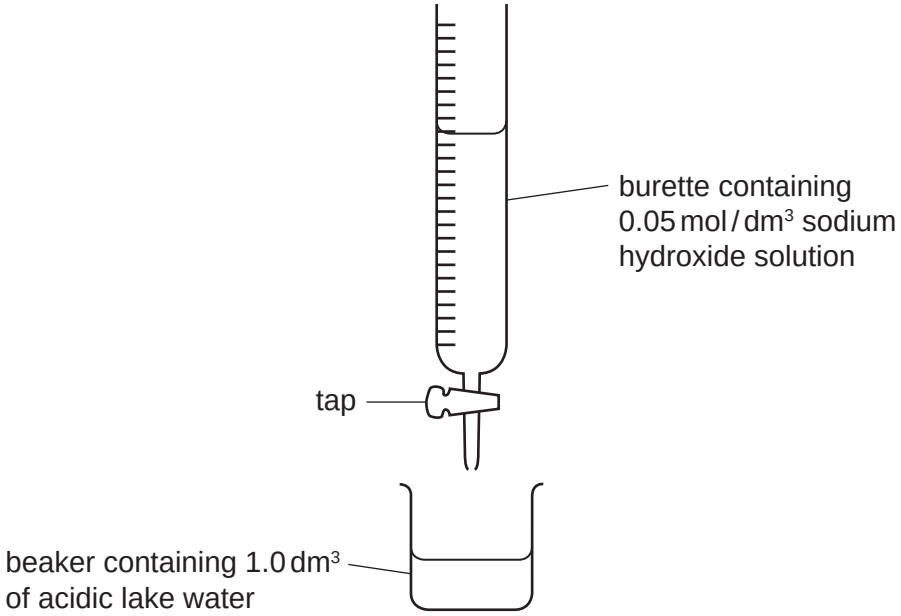

Fig. 5.2

The chemist slowly added 0.05 mol / dm^3 sodium hydroxide solution to 1.0 dm^3 of acidic lake water contained in a beaker until the acid had just been neutralised.

The chemist found that it required 12.5 cm^3 of 0.05 mol / dm^3 sodium hydroxide solution to neutralise the acid.

(i) State the number of moles of sodium hydroxide which are dissolved in 1.0 dm^3 of the sodium hydroxide solution.

..... [1]

(ii) Calculate the number of moles of sodium hydroxide which are dissolved in 12.5 cm^3 of the sodium hydroxide solution.

Show your working.

..... [2]

(iii) The balanced equation for the neutralisation reaction is

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the number of moles of sulfuric acid which were contained in 1.0 dm^3 of acidic lake water.

Show your working.

.....

[2]

6 Fig. 6.1 shows the speed-time graph for a car for the first 24 seconds of a journey.

For Examiner's Use

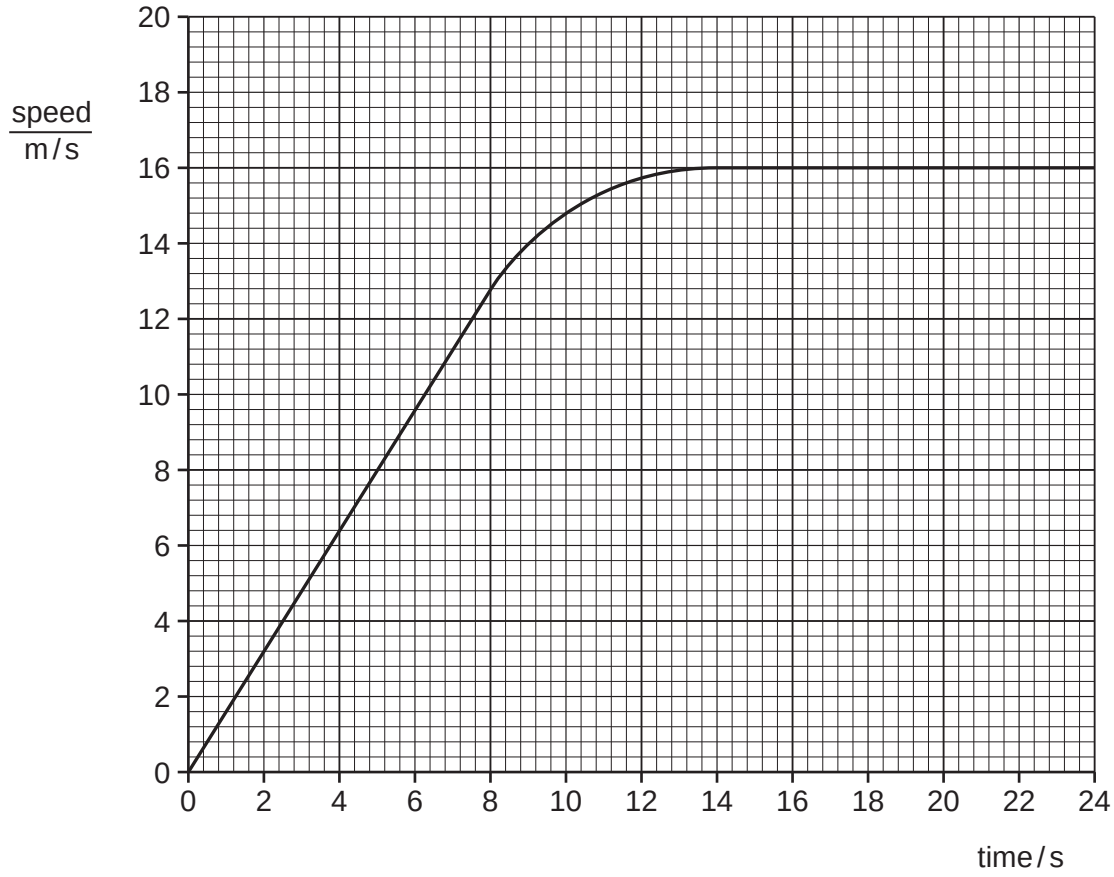

Fig. 6.1

(a) On the graph, label with an **A** a section when the car is accelerating. [1]

(b) Calculate the distance covered in the first 8 seconds.

Show your working.

..... [2]

(c) The mass of the car is 800 kg.

Calculate the kinetic energy of the car when travelling at its maximum speed on this journey.

State the formula that you use and show your working.

formula used

working

..... [3]

(d) When the speed of a car doubles, its momentum also doubles but its kinetic energy is four times greater.

Explain why.

.....

.....

.....

..... [2]

For Examiner's Use

7 **(a)** Mammals are vertebrates. State **two** characteristic visible features of mammals that distinguish them from all other classes of vertebrates.

1 .....

2 ..... [2]

(b) Mammals are able to maintain a constant internal body temperature.

Describe how vasodilation helps to cool the body when it gets too hot.

.....

.....

.....

..... [3]

(c) The maintenance of a constant internal body temperature is part of homeostasis.

Homeostasis also includes the regulation of blood glucose concentration and the removal of toxic waste products, such as urea, from the body.

(i) Describe how blood glucose concentration is brought back to normal if it rises too high.

.....

.....

.....

..... [3]

(ii) Urea is removed from the body dissolved in water, forming urine. Fig. 7.1 is an incomplete diagram of the kidneys and other organs involved in the removal of urea from the body.

For Examiner's Use

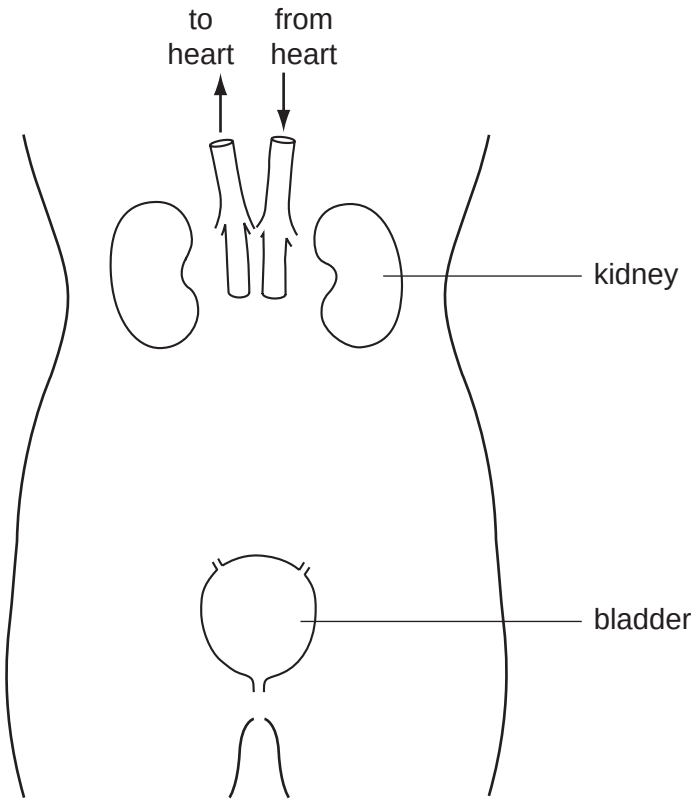

Fig. 7.1

Complete Fig. 7.1 by drawing and labelling:

- the renal arteries
- the renal veins
- the ureters
- the urethra [4]

8 **(a)** A scientist uses a Geiger counter to measure radiation from a radioactive source.

For Examiner's Use

Fig. 8.1 shows the graph of her results.

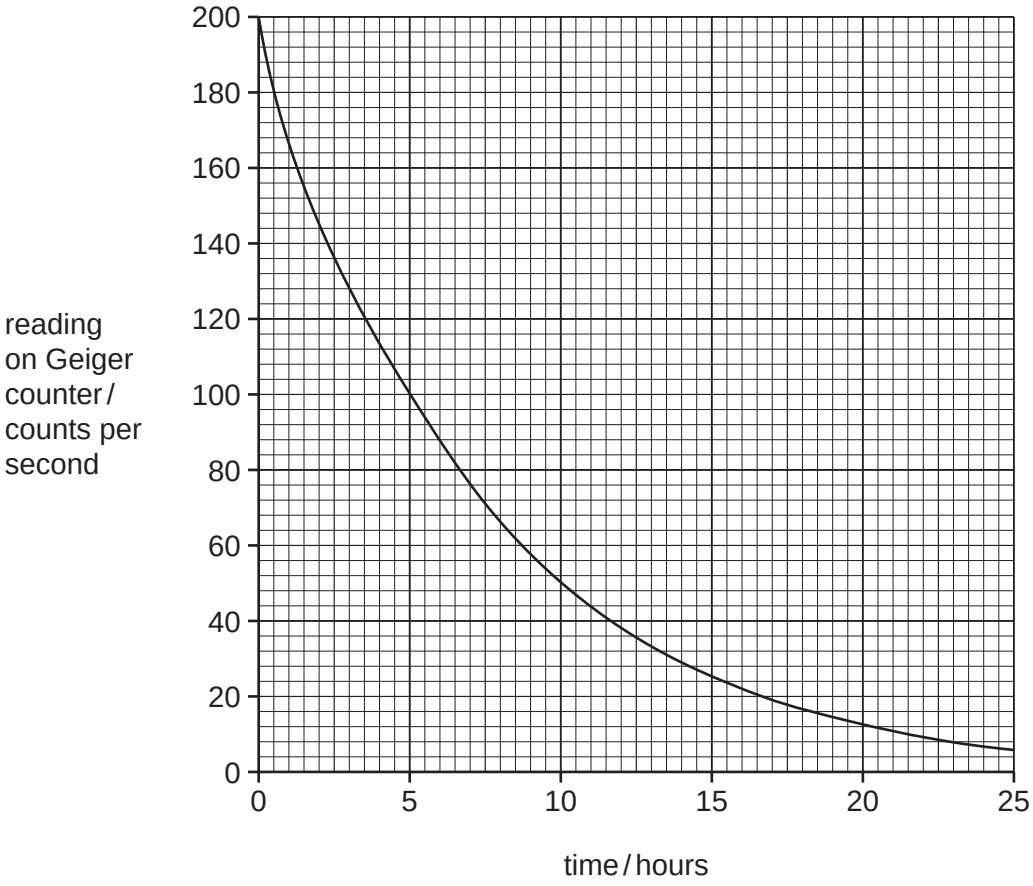

Fig. 8.1

Calculate the half-life of the radioactive source.

Show your working.

..... [2]

For Examiner's Use

(b) Alpha radiation is a form of ionising radiation.

(i) Explain the meaning of the term *ionising radiation*.

.....

..... [1]

(ii) An alpha radiation source is **less** harmful to humans than a gamma radiation source if it is **outside** the body.

An alpha radiation source is **more** harmful than to humans than a gamma radiation source if it is **inside** the body.

Explain why.

.....

.....

..... [2]

(c) Nuclear fission and nuclear fusion are both sources of energy.

(i) Describe how these two processes differ.

.....

.....

..... [2]

(ii) There are safety concerns about the use of nuclear fission as an energy resource.

Describe and explain **one** of these safety concerns.

.....

.....

.....

..... [2]

For Examiner's Use

9 **(a)** The chemical symbols for the atoms shown below include proton (atomic) numbers and nucleon (mass) numbers.

$$^{16}_{8}O \quad ^{31}_{15}P \quad ^{32}_{16}S \quad ^{70}_{31}Ga$$

Complete Table 9.1 which shows the names and the numbers of protons and neutrons in two of the atoms shown above.

Table 9.1

element name	protons	neutrons
oxygen		
	15	16

[2]

(b) Fig. 9.1 shows part of a chart of the melting points in kelvins (K) of some elements.

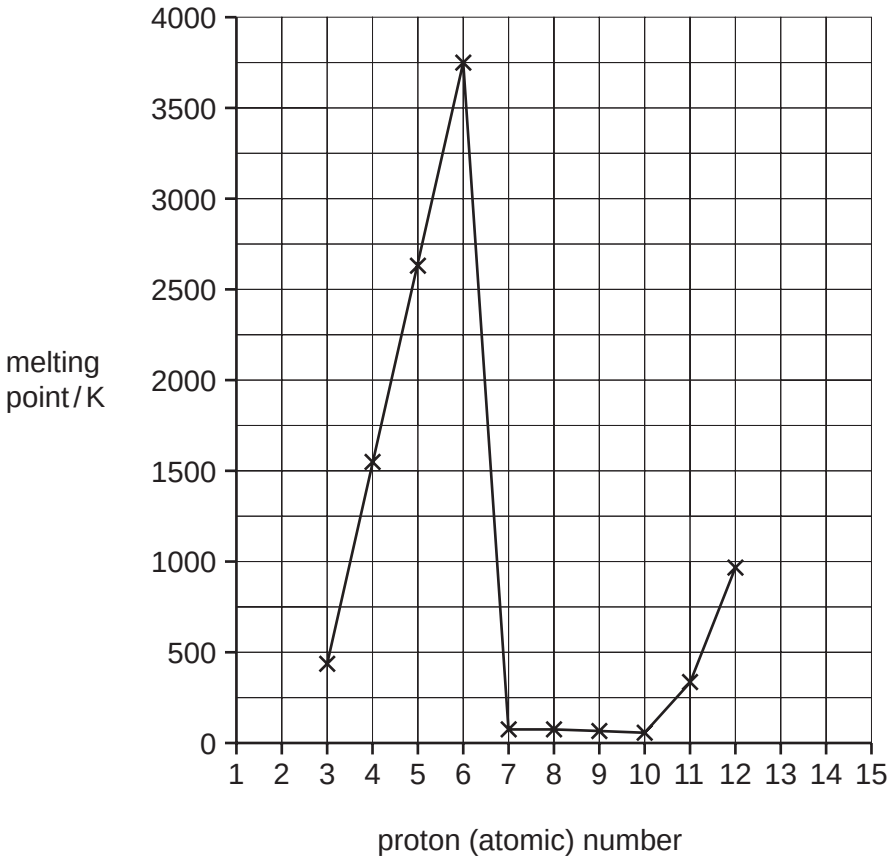

Fig. 9.1

The melting points of the elements in Period 2 and Period 3 of the Periodic Table show a periodic pattern.

For Examiner's Use

(i) Use Fig. 9.1 and your understanding of the term *periodic pattern* to predict the element which has the highest melting point in Period 3.

Explain your choice briefly.

element .....

explanation .....

.....

..... [2]

(ii) Carbon, proton number 6, and nitrogen, proton number 7, have very different melting points.

Explain the difference in terms of the structures of these elements.

In your answer you should include the phrases, *giant structure* and *simple molecular structure*.

You may wish to draw diagrams as part of your answer.

.....

.....

.....

.....

..... [3]

(c) Carbon and hydrogen combine to form a very large number of hydrocarbons.

Ethene, C_2H_4, is a gaseous, unsaturated hydrocarbon, which is of industrial importance.

(i) Complete the displayed formula of the ethene molecule below.

[2]

(ii) Unsaturated hydrocarbons are made in industry from fractions obtained by the fractional distillation of oil (petroleum).

Name the process which is used to make unsaturated hydrocarbons and describe briefly how it is done.

name of process .....

description .....

.....

.....

..... [3]

(iii) Describe, in terms of changes to chemical bonds, what happens when ethene molecules react to form molecules of poly(ethene).

.....

.....

..... [2]

10 Fig. 10.1 shows some stages in the formation of a human fetus.

For Examiner's Use

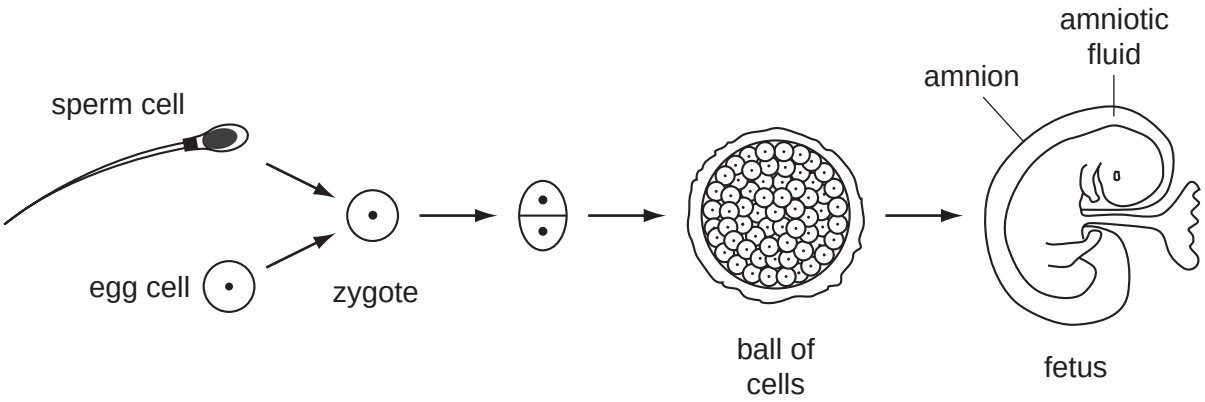

Fig. 10.1

(a) Most human cells contain 46 chromosomes.

(i) State the number of chromosomes in a sperm cell. ..... [1]

(ii) State the number of chromosomes in a zygote. ..... [1]

(iii) Name the part of the cell in which chromosomes are found. ..... [1]

(b) Name the part of the female reproductive system in which each of these events occurs.

(i) The zygote is produced. ..... [1]

(ii) The fetus develops. ..... [1]

(c) Describe the function of the amnion.

.....

.....

..... [2]

(d) Mutations sometimes occur in the chromosomes of a cell.

For Examiner's Use

Mutations are generally harmful, but sometimes a mutation may increase an organism's ability to survive in its environment.

Explain how this could lead to a change, over time, in the characteristics of a population of organisms.

.....

.....

.....

.....

.....

..... [4]

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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** Sulfur 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 **X** 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.).