Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMBINED SCIENCE **5129/22**

Paper 2 **October/November 2017**

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.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

This document consists of **21** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

1 A diver uses fins to push himself through the water, as shown in Fig. 1.1.

The accelerating force on the diver produced by one kick of a fin is 15 N.

The mass of the diver is 70 kg.

Fig. 1.1

(a) Calculate the acceleration of the diver produced by one kick of a fin.

acceleration = ... m/s^2 [2]

(b) The diver can see a flag above the surface of the water, as shown in Fig. 1.2.

Complete Fig. 1.2 by drawing the path of **one** ray of light between the flag and the diver.

Draw an arrow on the ray to show its direction.

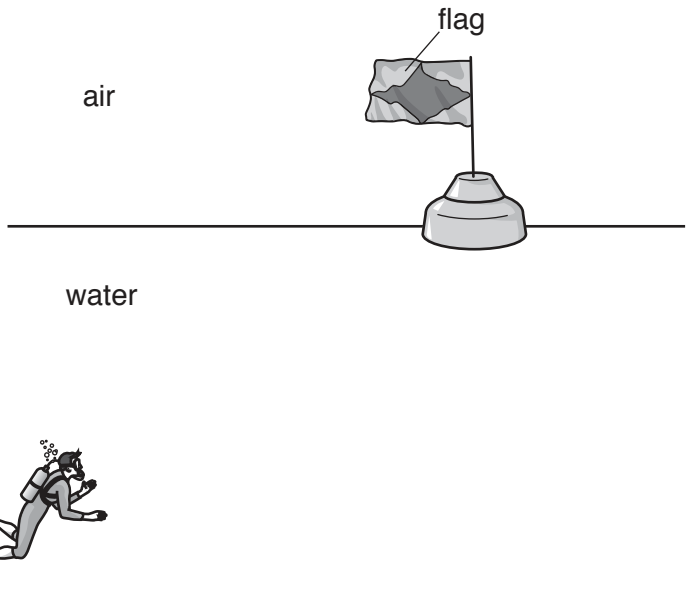

Fig. 1.2

[3]

2 Use words or phrases from the list to complete the sentences about blood vessels.

Each word or phrase may be used once, more than once, or not at all.

away from **carbon dioxide** **higher** **lower** **narrower**

oxygen **thicker** **thinner** **towards** **wider**

The lumen in an artery is ..... than the lumen in a vein.

The wall of an artery is ..... than the wall of a vein.

Arteries carry blood ..... the heart.

The blood in the arteries contains more ..... than the blood in veins.

The blood in veins is at a ..... pressure than the blood in arteries.

[5]

3 **(a)** Define *relative atomic mass*, A_r.

.....

.....[2]

(b) Calcium reacts with water to produce calcium hydroxide solution and hydrogen.

The equation for the reaction is

$$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$$

[A_r: O, 16; Ca, 40; H, 1]

(i) Calculate the relative molecular mass of calcium hydroxide

.....[1]

(ii) Complete the following sentences.

40 g of calcium reacts with ..... g of water and produces ..... g of hydrogen.

2 g of calcium reacts with ..... g of water. [3]

(c) Describe a test and the result that shows that calcium hydroxide solution is alkaline.

test .....

result .....

[2]

4 A glass ball rolls down a long curved track, as shown in Fig. 4.1.

At point **X**, the track becomes horizontal.

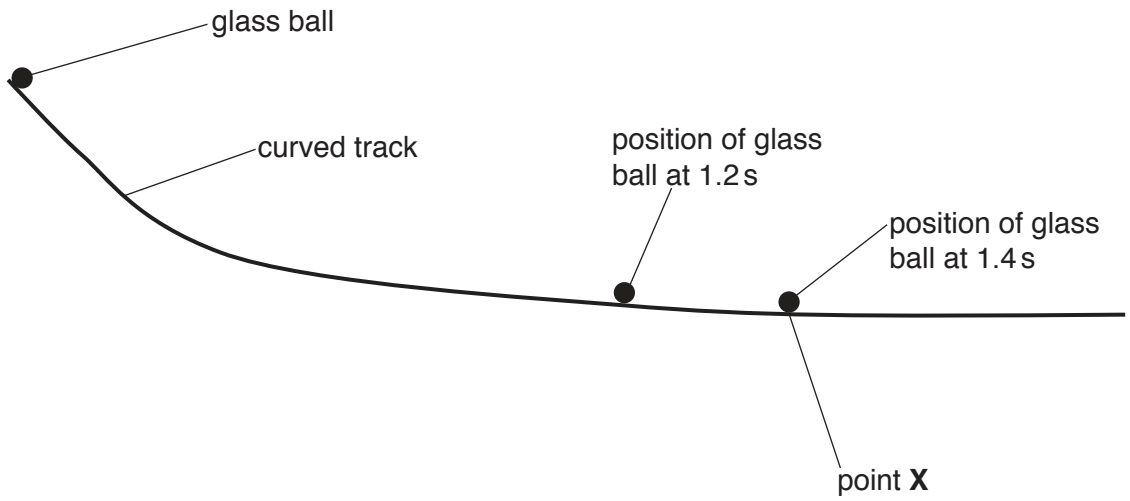

Fig. 4.1

The speed of the ball is recorded between time $t = 0.2$ s and time $t = 1.2$ s, as shown in Table 4.1.

Table 4.1

time / s	0.2	0.4	0.6	0.8	1.0	1.2
$\frac{\text{speed}}{\text{cm/s}}$	0.7	1.4	1.9	2.4	2.8	3.1

(a) (i) Explain why the speed of the ball is recorded, rather than the velocity of the ball.

.....[1]

(ii) Describe the type of motion shown by the readings in Table 4.1.

.....[2]

(iii) Predict the speed of the glass ball at time $t = 1.4$ s.

.....[1]

(b) State and explain how the motion of the ball changes after point **X**, as it rolls further along the track.

.....

.....[2]

5 The front of the eye is shown in Fig. 5.1.

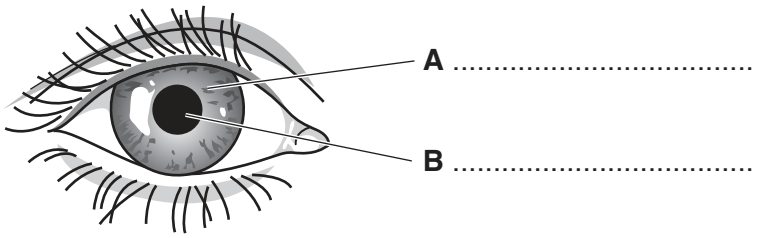

Fig. 5.1

(a) Complete Fig. 5.1 by labelling the parts **A** and **B**. [2]

(b) Bright light is shone into the eye shown in Fig 5.1.

(i) Describe the change in the appearance of the eye.

.....[1]

(ii) Suggest how this change protects the eye.

.....

.....

.....

.....[2]

[Turn over

6 Copper is a metal.

Sodium chloride is an ionic compound.

(a) Describe the arrangement **and** the movement of the atoms in solid copper.

arrangement of atoms .....

.....

movement of atoms .....

.....

[2]

(b) State **two** ways in which the physical properties of copper differ from the physical properties of sodium chloride.

1 .....

.....

2 .....

.....

[2]

(c) The electronic structure of a sodium atom is 2,8,1.

Fig. 6.1 shows the electronic structure of a sodium ion.

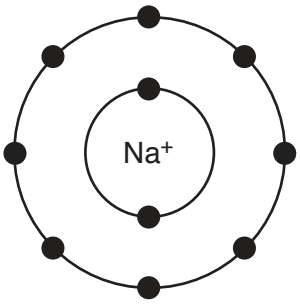

Fig. 6.1

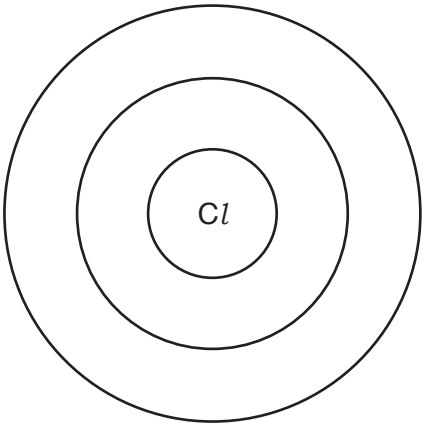

Fig. 6.2

(i) Complete Fig. 6.2 to show the electronic structure of a chloride **ion**. [1]

(ii) Explain the significance of the electronic structure of the sodium **ion**.

.....

.....[2]

Question 7 begins on the next page.

7 A boat has a winch powered by an electric motor that is used to raise an anchor, as shown in Fig. 7.1.

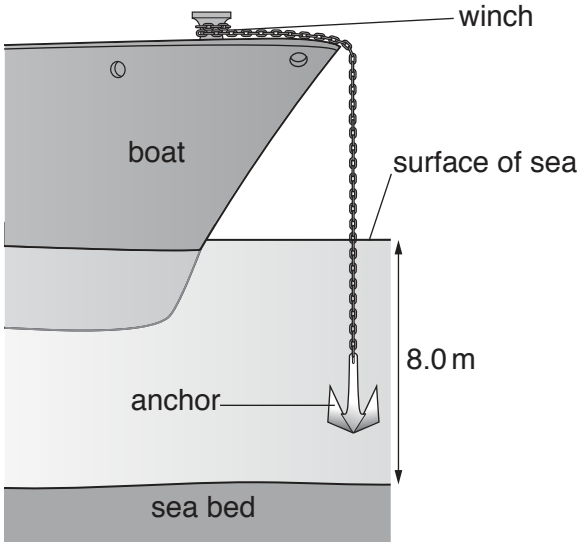

Fig. 7.1

(a) (i) A force of 300 N is needed to raise the anchor.

The distance from the sea bed to the surface of the sea is 8.0 m.

Calculate the useful work done to raise the anchor from the sea bed to the surface of the sea.

work done = ... J [2]

(ii) The potential difference across the electric motor is 12 V and the current in the motor is 10 A.

The time taken to raise the anchor through 8.0 m is 25 s.

Calculate the energy transferred to the motor to raise the anchor from the sea bed to the surface of the sea.

energy transferred = ... J [2]

(iii) Use your answers to **(a)(i)** and **(a)(ii)** to determine the energy loss in raising the anchor from the seabed to the surface of the sea.

energy loss = ...J [1]

(b) State **one** hazard associated with large amounts of energy transferred as heat in electric motors.

.....[1]

[Turn over

8 A section through a leaf is shown in Fig. 8.1.

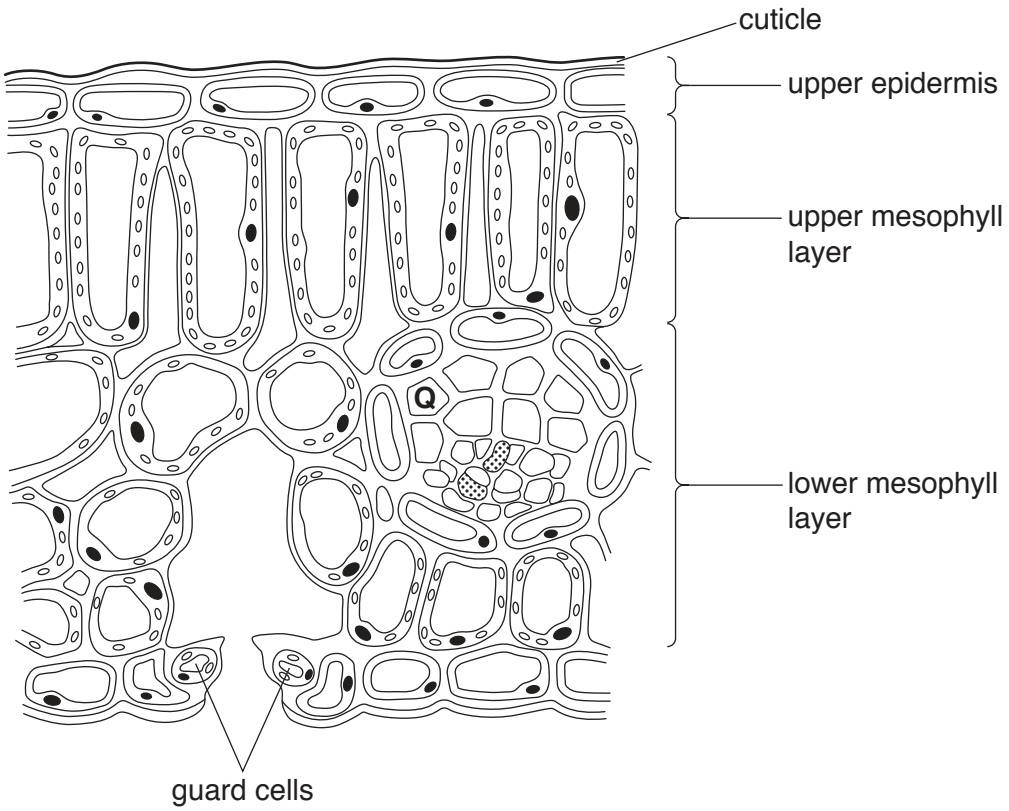

Fig. 8.1

The average number of chloroplasts for four types of leaf cells is shown in Fig. 8.2.

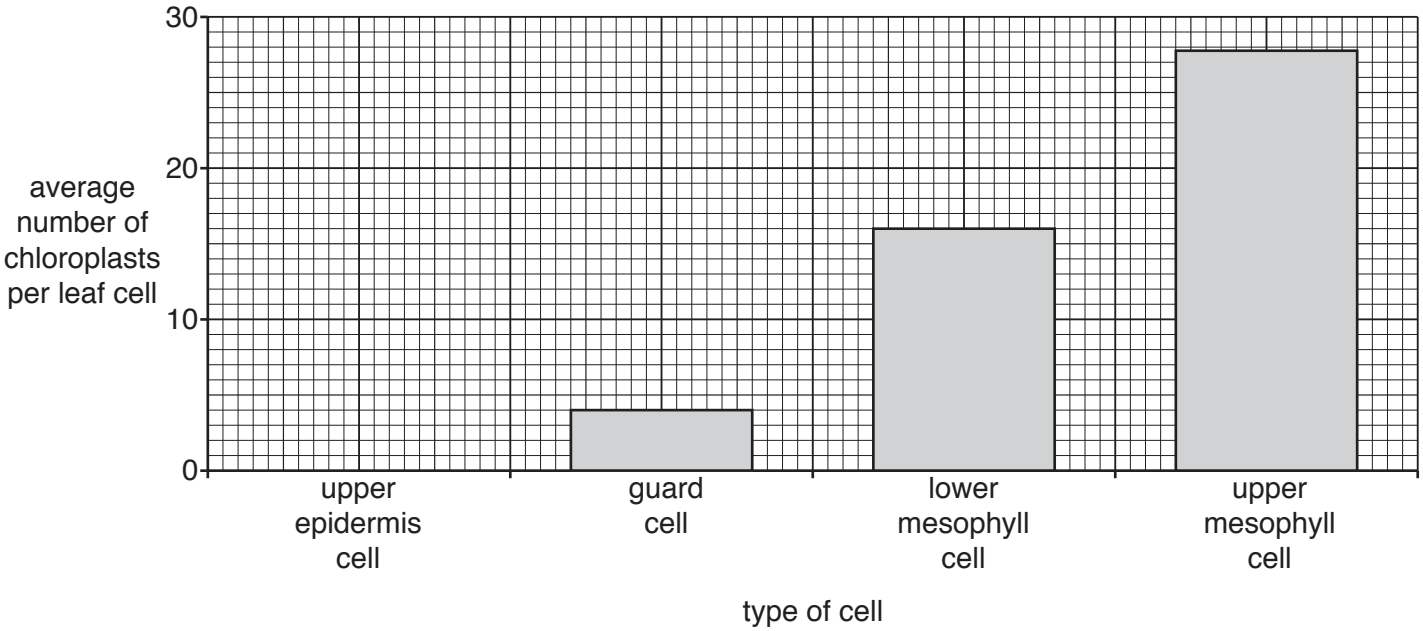

Fig. 8.2

(a) (i) Complete the following sentence.

The average number of chloroplasts in a lower mesophyll cell is .....

and in an upper mesophyll cell is ..... . [1]

(ii) Calculate the number of chloroplasts in a lower mesophyll cell as a percentage of the number in an upper mesophyll cell.

Give your answer to the **nearest whole number**.

percentage number of chloroplasts = ...% [1]

(iii) State which type of leaf cell forms the most glucose during a sunny day.

Explain your answer.

cell .....

explanation .....

.....

.....

.....

[3]

(b) Cells in the upper epidermis contain no chloroplasts but produce the waxy substance called the cuticle.

Suggest a function for the cuticle.

.....

.....[1]

9 Ethanol, C_2H_5OH, is made by the fermentation of glucose.

(a) Complete the sentences about fermentation.

Glucose is dissolved in water and ..... is added to the solution.

The mixture is left for a few days at a temperature of .....°C.

Air is not allowed to enter the fermentation container in order to prevent

..... of ethanol to ethanoic acid.

When the reaction is complete the ethanol is separated from the water

by ..... . [4]

(b) Balance the equation for the fermentation reaction.

$$C_6H_{12}O_6 \longrightarrow \text{.....}\ C_2H_5OH + \text{.....}\ CO_2$$

[1]

(c) Draw the structure of ethanol.

[1]

10 A spanner is shown next to a rule in Fig. 10.1.

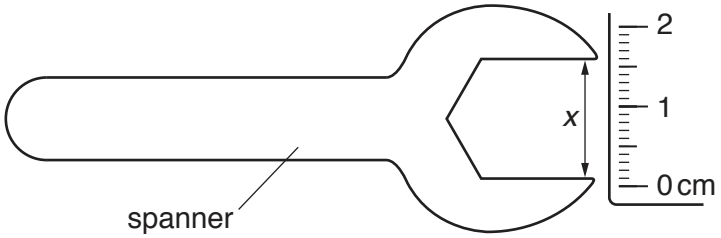

Fig. 10.1

(a) Use Fig 10.1 to determine the width *x* of the jaws of the spanner.

x = ...mm [1]

(b) The spanner is used to loosen a bolt.

The bolt becomes loose when a force of 25 N is applied at a distance of 5.0 cm from the centre of the bolt, as shown in Fig. 10.2.

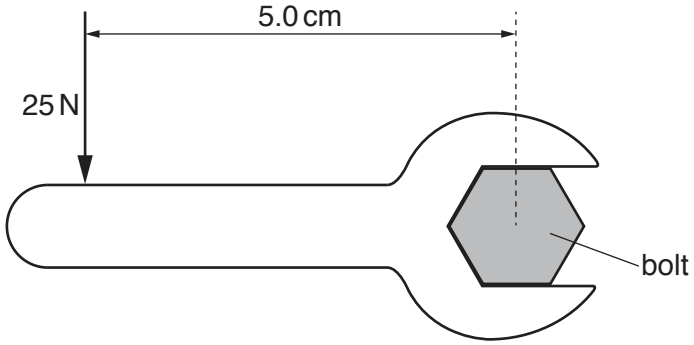

Fig. 10.2

Calculate the moment of the force about the centre of the bolt.

State the unit.

moment = ... unit ..... [3]

(c) The mass of the spanner is 120 g and it has a density of 7.9 g / cm^3.

Calculate the volume of the spanner.

volume = ...cm^3 [2]

11 Fig. 11.1 shows the names of different processes carried out by a healthy body and the names of some structures.

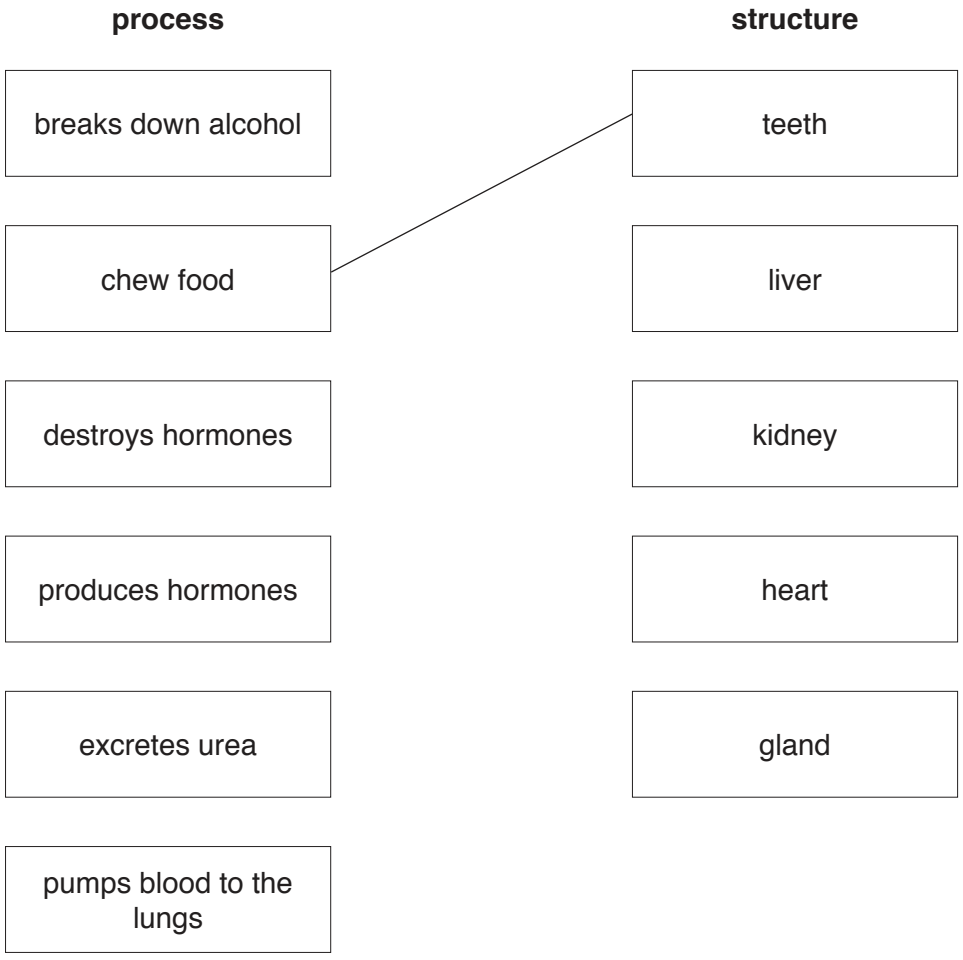

Fig. 11.1

Complete Fig. 11.1 by drawing **one** line from each process to the structure where the process occurs.

One has been done for you. [5]

12 At high temperatures, potassium can react with carbon dioxide to produce a white solid **V** and a black solid **W.**

(a) Name the white solid **V** and the black solid **W**.

white solid **V** .....

black solid **W** .....

[2]

(b) Complete the sentence.

During the reaction the potassium is ..... and the carbon dioxide is

..... . [1]

(c) When the products of the reaction are added to water, the white solid **V** dissolves but the black solid **W** does not dissolve.

Name the process that can be used to separate the black solid from the solution.

.....[1]

(d) A solution of white solid **V** turns Universal Indicator purple.

(i) Suggest the pH of the solution. ..... [1]

(ii) Describe the change to the pH of the solution when dilute hydrochloric acid is added to the solution.

.....[1]

[Turn over

13 Ultraviolet radiation is part of the electromagnetic spectrum.

(a) Name **one** electromagnetic wave with a **shorter** wavelength than ultraviolet radiation.

.....[1]

(b) The range of wavelengths of ultraviolet radiation is 1.0×10^{-7} m to 4.0×10^{-7} m.

(i) State the speed of light in a vacuum.

speed = ... m/s [1]

(ii) Calculate the highest frequency of ultraviolet radiation.

frequency = ... Hz [2]

14 **(a)** State **one** important feature of an enzyme.

.....

.....

.....[1]

(b) Part of the alimentary canal and associated organs are shown in Fig. 14.1.

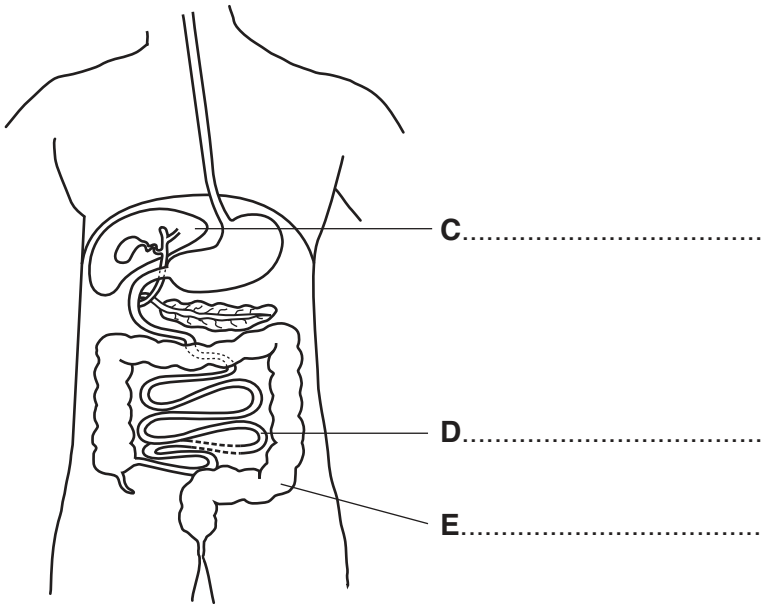

Fig. 14.1

On Fig. 14.1, name the structures **C**, **D** and **E**. [3]

(c) Name an organ in the body where

hydrochloric acid is made, ...

bile is made, ...

amylase is made. .....

[3]

(d) After digested food has been absorbed, it is assimilated.

Describe how the liver assimilates glucose.

.....

.....

.....

.....[2]

15 **(a)** Describe **two** ways in which respiration and the combustion of a hydrocarbon are the same.

1 .....

.....

2 .....

.....

[2]

(b) Hydrocarbon fuels are saturated hydrocarbons.

(i) State the source of hydrocarbon fuels.

.....[1]

(ii) State the meaning of the term *saturated*.

.....

.....[1]

16 A radioactive source is stored in a lead-lined box, as shown in Fig. 16.1.

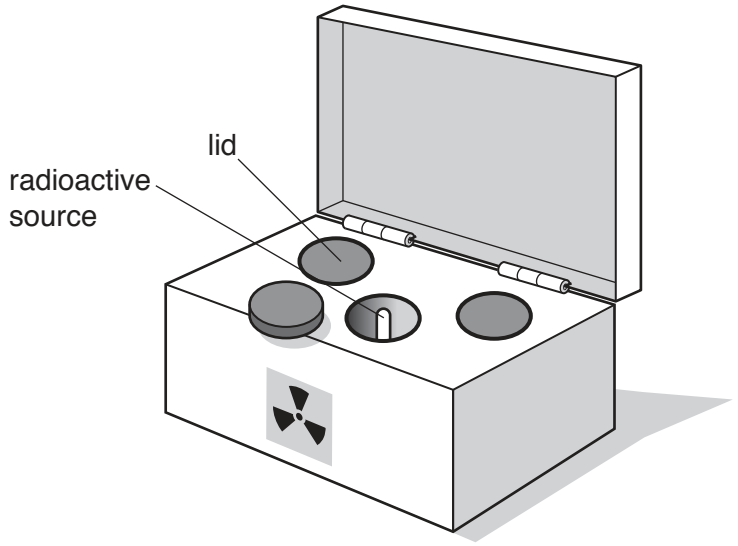

Fig. 16.1

(a) (i) Name the piece of equipment used to remove safely the radioactive source from the box.

.....[1]

(ii) Describe **one** other safety precaution that must be taken when removing the radioactive source from the box.

.....[1]

(iii) State the name of the most ionising type of radiation.

.....[1]

(b) A teacher uses a source of radiation, a detector and some absorbers to show that there are three different types of emission from the radioactive source.

Describe how the teacher uses the equipment.

.....

.....

.....

.....[3]

[Turn over

17 Three components of a balanced diet are carbohydrates, fats and proteins.

State three **other** components of a balanced diet.

1 .....

2 .....

3 ..... [3]

18 Copper reacts with silver nitrate to produce a blue solution and a solid.

(a) Name the products of the reaction.

..... and ..... [2]

(b) Zinc reacts with copper(II) sulfate.

Zinc is extracted from its ore by heating with carbon.

Aluminium cannot be extracted from its ore by heating with carbon.

Place the elements aluminium, copper, silver and zinc in order of reactivity (most reactive first).

most reactive .....

.....

.....

least reactive ..... [1]

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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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