Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3599309503

COMBINED SCIENCE **5129/22**

Paper 2 **October/November 2016**

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 **24** printed pages.

CAMBRIDGE
International Examinations

1 A micrometer is used to measure the thickness of a piece of metal.

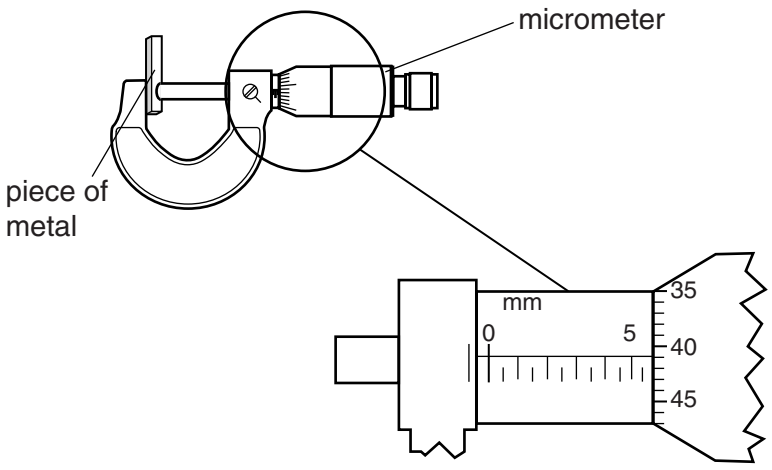

Fig. 1.1

(a) Determine the scale reading shown in Fig. 1.1.

reading = ... mm [1]

(b) The piece of metal has a volume of 2.5 cm^3 and a mass of 24 g.

Calculate the density of the metal.

density = ... g/cm^3 [2]

2 Fig. 2.1 shows a diagram of the human alimentary canal.

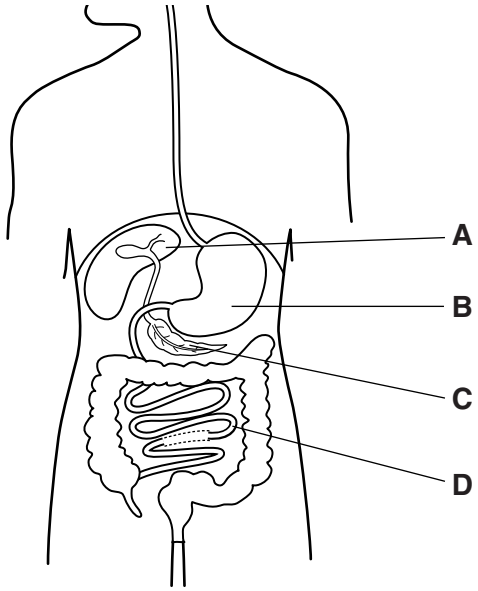

Fig. 2.1

(a) (i) Name the structures labelled **C** and **D** on Fig. 2.1.

C .....

D .....

[2]

(ii) Using the letters in Fig. 2.1, state which structure produces

acid, ...

bile. .....

[2]

(b) Amylase is produced in the mouth.

State and explain the function of amylase in digestion.

.....

.....

..... [2]

(c) Explain how bile helps digestion of fats.

.....

.....

..... [2]

3 The toy helicopter shown in Fig. 3.1 weighs 0.43 N.

Fig. 3.1

(a) Calculate the mass of the helicopter.
[gravitational field strength $g = 10\,\text{N/kg}$]

mass = ... kg [1]

(b) The speed-time graph for the motion of the helicopter is shown in Fig. 3.2.

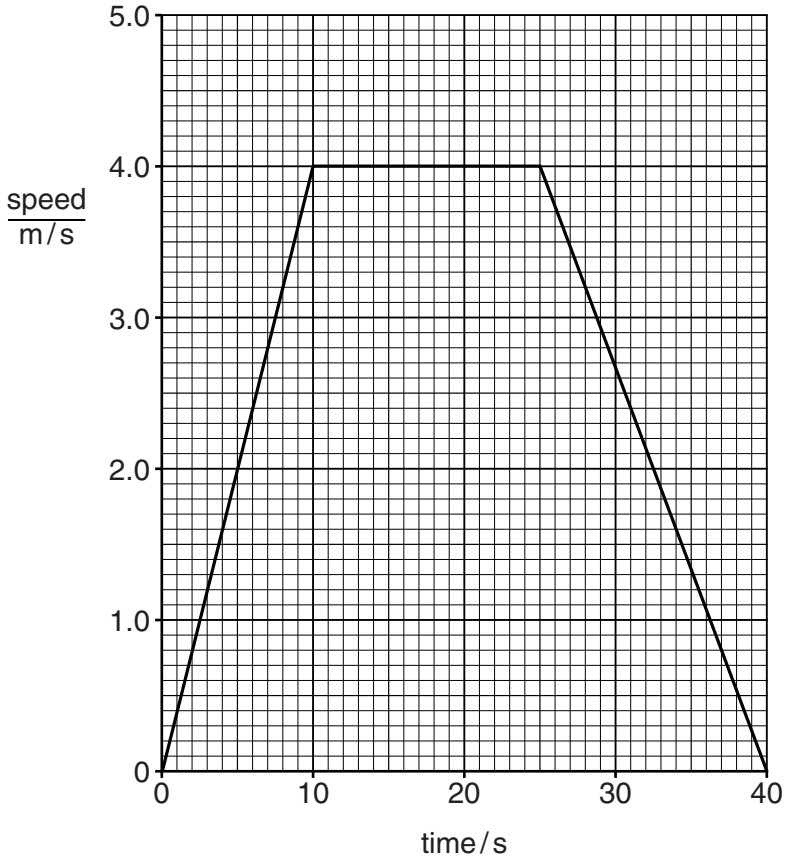

Fig. 3.2

(i) State the two times between which the acceleration is non-zero and constant.

from t = ... to t = ... [1]

(ii) The acceleration during the first 5 seconds is $0.4\,m/s^2$.

Calculate the force needed to cause this acceleration.

force = ... N [2]

(iii) Calculate the distance travelled by the helicopter during the time that it is moving at constant speed.

distance = ... m [2]

4 When potassium nitrate is heated, it decomposes to produce potassium nitrite and oxygen.

The equation for the reaction is shown.

$$2KNO_3 \longrightarrow 2KNO_2 + O_2$$

[A_r: O, 16; K, 39; N, 14]

The relative molecular mass of potassium nitrate is 101.

(a) (i) Calculate the relative molecular mass of potassium nitrite.

..... [1]

(ii) Complete the following sentences.

202 g of potassium nitrate produces .....g of potassium nitrite and

.....g of oxygen.

5.05 g of potassium nitrate produces .....g of potassium nitrite. [3]

(b) The electronic structure of an oxygen atom is shown in Fig. 4.1.

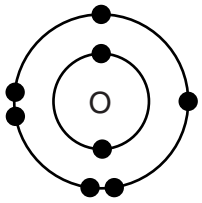

Fig. 4.1

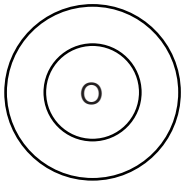

Fig. 4.2

(i) Complete Fig. 4.2 to show the electronic structure of an oxide **ion**. [1]

(ii) State the charge on the oxide ion. ..... [1]

(c) Oxygen is used in welding torches.

State the name of the gas which is mixed with oxygen in a welding torch.

..... [1]

5 Choose words or phrases from the list to complete the sentences.

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

aerobic respiration	**amino acids**	**anaerobic respiration**
carbon dioxide	**fats**	**kidneys**
liver	**lungs**	**nitrogen**	**toxic**

Excretion is defined as the removal of ..... materials and the waste products of metabolism.

Carbon dioxide is formed in humans during the process of ..... .

Urea is produced in the ..... and is excreted by the ..... .

Urea is formed from ..... that the body does not need.

[5]

6 Study the reaction scheme shown in Fig. 6.1.

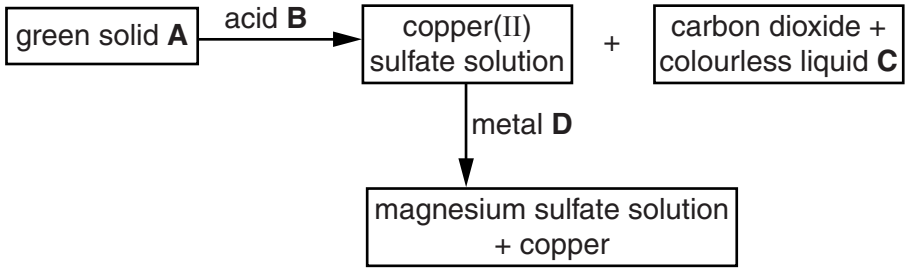

Fig. 6.1

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

green solid **A** .....

acid **B** .....

colourless liquid **C** .....

metal **D** ..... [4]

(b) Suggest how the copper may be removed from the magnesium sulfate solution.

..... [1]

(c) Describe the test and the result of the test for carbon dioxide.

test .....

result ..... [2]

7 A coiled spring is shown in Fig. 7.1.

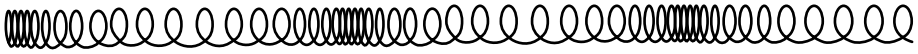

Fig. 7.1

A longitudinal wave passes along the spring.

(a) Explain what is meant by a *longitudinal* wave.

.....

..... [2]

(b) The frequency of the waves is 6.0 Hz and the wavelength is 0.90 m.

Calculate the speed of the wave.

speed = ... m/s [2]

8 A ray diagram for light passing into glass is shown in Fig. 8.1.

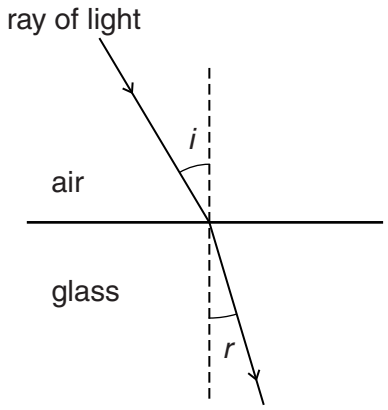

Fig. 8.1

(a) One pair of measurements for this experiment is

angle of incidence *i*	30.0°
angle of refraction *r*	19.0°

Show that the refractive index *n* of the glass is 1.54.

[2]

(b) The experiment is repeated for light entering water.
The refractive index of water is 1.33. The angle of incidence is 30°.

On Fig. 8.2, draw a line to show how the path of the refracted ray in water differs from the path of the refracted ray in glass. Label your line with the letter **W**.

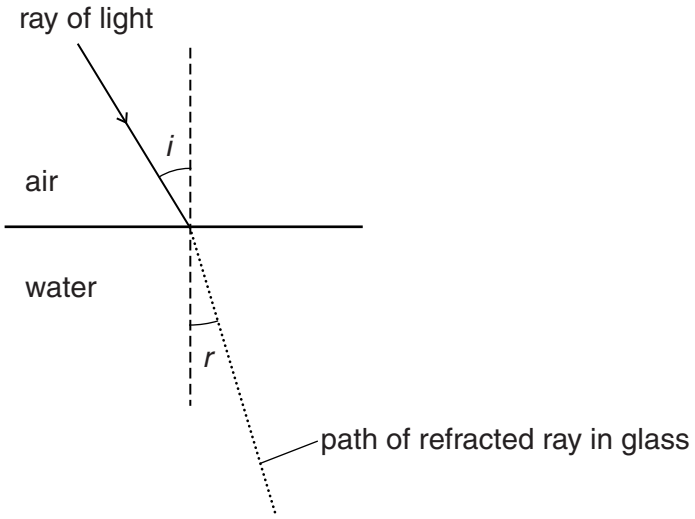

Fig. 8.2

[1]

9 Some definitions and names of biological processes are shown in Fig. 9.1.

definition	process
the production of genetically identical offspring from one parent	sexual reproduction
	diffusion
the movement of molecules from a region of higher concentration to a region of lower concentration	
	asexual reproduction
an externally administered substance which modifies or affects chemical reactions in the body	hormone
	photosynthesis
a chemical substance produced by a gland, carried by the blood, which alters the activity of one or more target organs	
	drug
a process by which plants manufacture carbohydrates from raw materials	
	transpiration

Fig. 9.1

Draw a straight line from each definition to the correct biological process. [5]

10 Metals and non-metals have different physical and chemical properties.

(a) Complete Table 10.1 to describe the general properties of metals and non-metals.

Table 10.1

property	metals	non-metals
melting point		
malleability		
electrical conductivity		
type of oxide		

[4]

(b) Aluminium is a metal.

Complete the following sentence about aluminium.

Aluminium is used to make some aircraft parts because of its

..... and used to make food containers

because of its ..... . [2]

11 The apparatus shown in Fig. 11.1 is used to investigate the strength of an electromagnet. The diagram is not to scale.

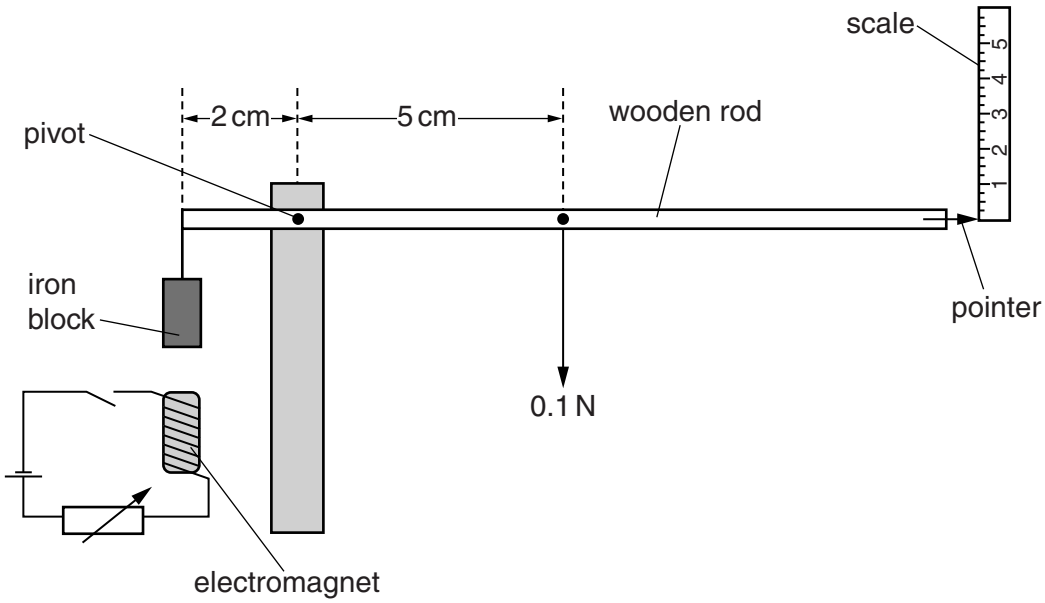

Fig. 11.1

A pointer is attached to one end of a uniform wooden rod of weight 0.1 N.

An iron block is suspended from the other end.

When the electromagnet is switched off, the rod is horizontal.

(a) (i) Calculate the moment of the weight of the rod about the pivot in N cm.

moment = ... N cm [1]

(ii) Use your answer from **(a)(i)** to calculate the weight of the iron block.

weight = ... N [1]

(b) The electromagnet in Fig. 11.1 is part of a circuit. The circuit is designed so that the strength of the electromagnet can be varied.

Suggest **two** ways in which the strength of the electromagnet may be increased.

1. .....

2. .....

[2]

12 A food web is shown in Fig. 12.1.

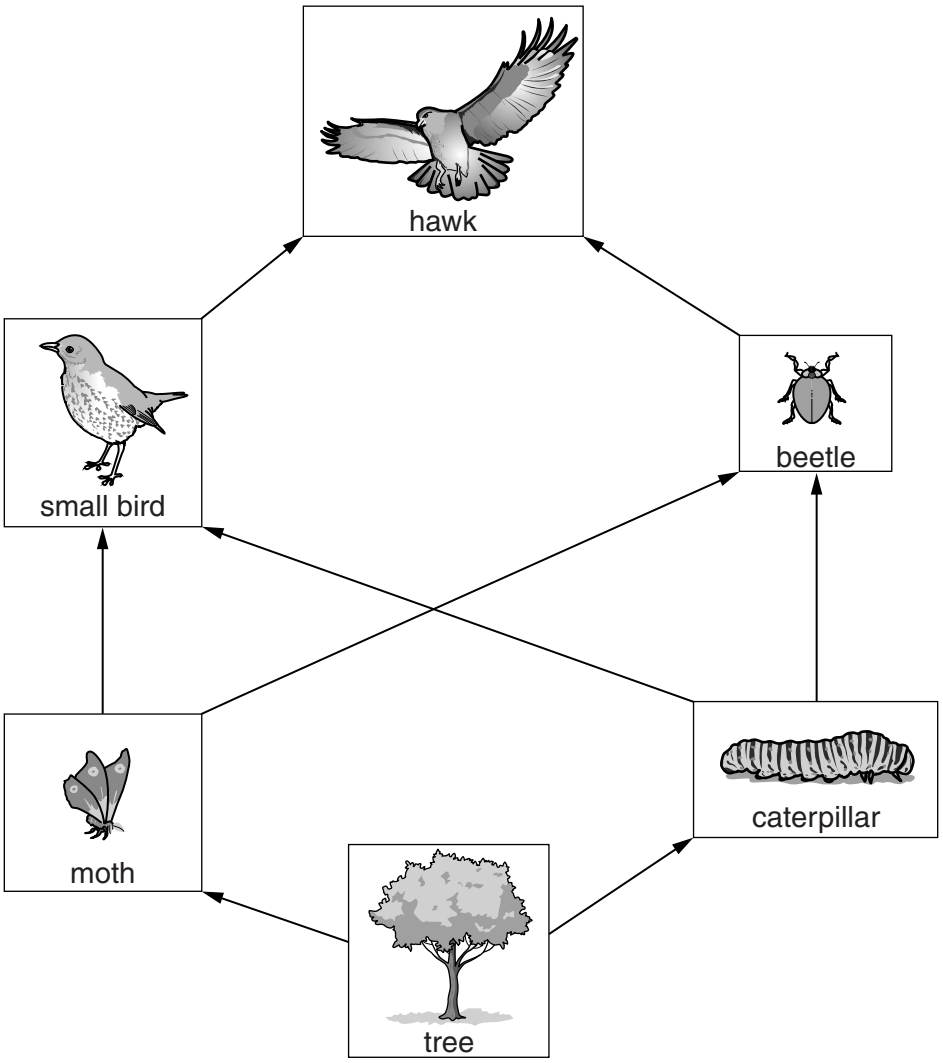

Fig. 12.1

(a) Name the source of energy for the food web shown in Fig. 12.1.

..... [1]

(b) Use the information in Fig. 12.1 to name

the producer, ...

an organism that feeds on consumers, ...

a herbivore. .....

[3]

(c) Explain why food chains are usually short.

.....

.....

.....

..... [3]

13 Pentane and ethene are hydrocarbons.

(a) Explain the meaning of the term *hydrocarbon*.

.....

.....

..... [2]

(b) Hydrocarbons burn in oxygen to form carbon dioxide and water.

(i) Balance the equation for the combustion of pentane.

C_5H_{12} + ...O_2 ⟶ .....CO_2 + ...H_2O [1]

(ii) State the conditions under which the combustion of hydrocarbons produces carbon monoxide and water rather than carbon dioxide and water.

.....

..... [1]

(c) Ethene reacts with hydrogen but pentane does not react with hydrogen.

(i) In terms of molecular structure, explain why ethene reacts with hydrogen.

.....

..... [1]

(ii) State the type of reaction when ethene reacts with hydrogen and name the product of the reaction.

type of reaction .....

product .....

[1]

14 A plastic ball rests on a horizontal sheet, as shown in Fig. 14.1.

The ball has positive charge.

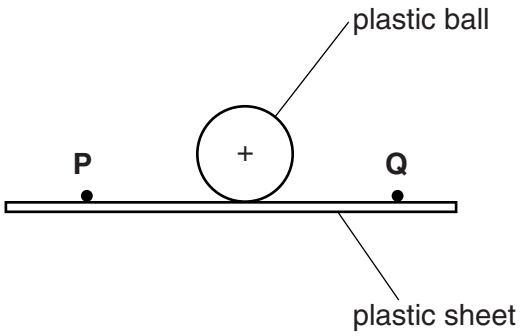

Fig. 14.1

The ball and the sheet are made of the same plastic material.

A charged object is placed at point **P**.

The ball moves towards point **Q**.

Explain why the ball moves towards point **Q**.

.....

..... [2]

15 A student carries out an investigation into the rate of transpiration in plants.

Three identical shoots are placed in water and their leaves are treated as shown in Fig. 15.1. All three shoots are left for an hour in the same environment.

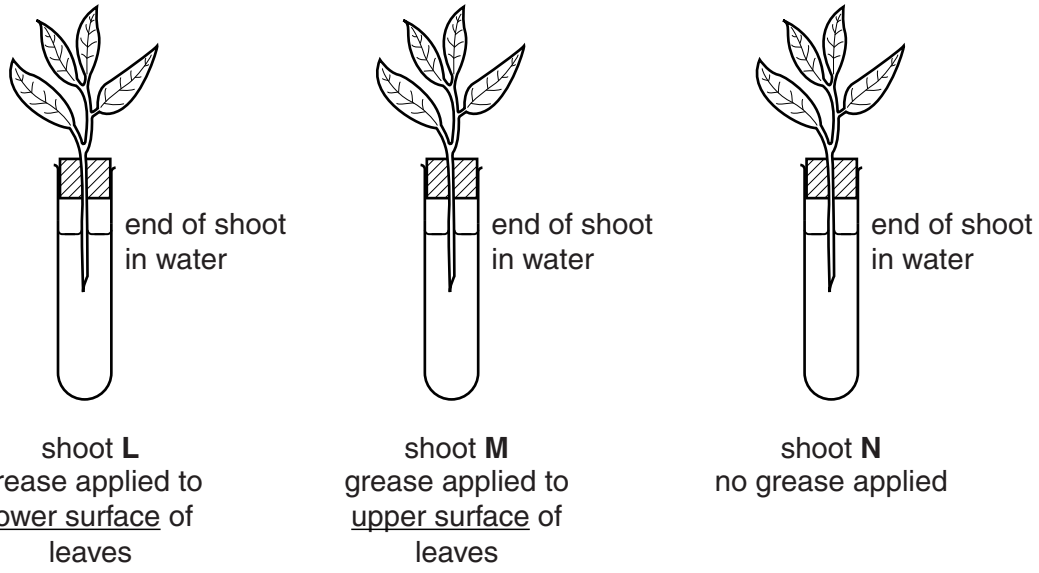

Fig. 15.1

Table 15.1 shows the results of this investigation.

Table 15.1

shoot	rate of transpiration / arbitrary units per hour
L	2
M	14
N	16

(a) Explain why shoot **L** transpires more slowly than shoot **N**.

.....

.....

.....

..... [3]

(b) Explain why the transpiration rates for shoots **M** and **N** are almost the same.

.....

.....

.....

..... [2]

16 Complete the following sentences about the elements in Group I of the Periodic Table.

Elements in Group I of the Periodic Table are known as the ..... metals.

The elements are placed in Group I because they have .....

in the outermost shell.

The elements react with water to produce the metal ..... and

..... gas.

This reaction becomes ..... vigorous as the group is descended.

[4]

17 Fig. 17.1 shows a circuit containing two strips of aluminium foil and a lamp.

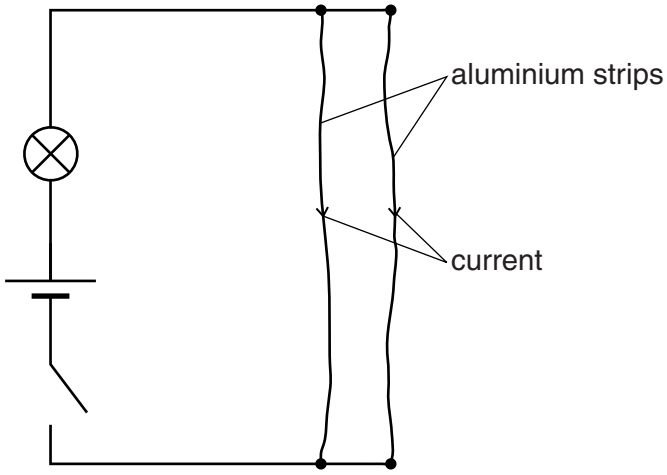

Fig. 17.1

The switch is closed and there is a current in the same direction through each of the strips. The foil strips move towards each other.

(a) Complete the sentences below about energy changes in the circuit.

Chemical energy in the cell is transferred to thermal energy and

..... energy in the bulb, and also to

..... energy as the aluminium

foil strips move towards each other. [2]

(b) The connections to the cell are reversed.

(i) State what happens to the brightness of the lamp.

..... [1]

(ii) Suggest what happens to the movement of the aluminium foil strips.

..... [1]

(c) The lamp has a resistance of 3.0 Ω and the potential difference across the lamp is 1.5 V.

Calculate the current in the lamp. State the unit.

current = ... unit ..... [3]

18 Parts of a flower are shown in Fig. 18.1.

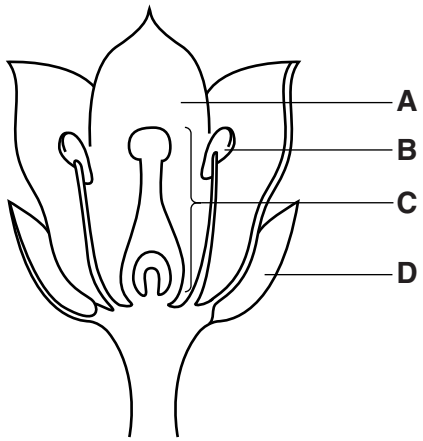

Fig. 18.1

Use the letters to identify the part which

contains seeds, ...

produces pollen, ...

protects the developing flower. .....

[3]

19 Ammonia is a gas that dissolves in water to produce an alkaline solution.

(a) **(i)** State the name of the ion which makes the solution alkaline.

..... [1]

(ii) When Universal Indicator paper is dipped into the solution, it goes blue.

Suggest the pH value of the solution. ..... [1]

(b) Ammonia is used to manufacture fertilisers such as ammonium nitrate.

Name the acid that reacts with ammonia to make ammonium nitrate.

..... [1]

(c) Fertilisers are used to increase plant growth because they contain nitrogen.

Name one other element needed for plant growth.

..... [1]

20 The three types of emission from the decay of radioactive materials can be stopped by different barriers.

(a) State which emission or emissions are stopped by

lead, ...

paper. ..... [2]

(b) Part of the equation for the decay of radon to polonium is shown.

Complete the equation.

$$^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + ...$$

[2]

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.)