



Cambridge O Level

CANDIDATE
NAME

CENTRE
NUMBER

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COMBINED SCIENCE

5129/22

Paper 2

May/June 2022

2 hours 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 100.
- The number of marks for each question or part question is shown in brackets [].
- The Periodic Table is printed in the question paper.

This document has **24** pages.



- 1 Fig. 1.1 shows a magnified section through part of a leaf.

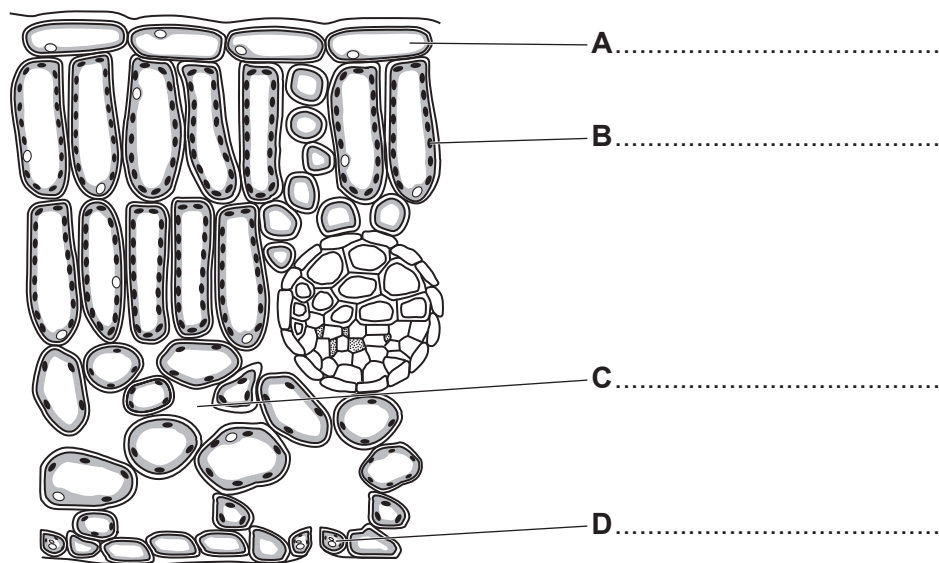


Fig. 1.1

- (a) Complete Fig. 1.1 by labelling the structures **A**, **B**, **C** and **D**.

Write your answers on the lines provided.

Choose your labels from the list.

air space	chloroplast	cuticle	epidermal cell
guard cell	mesophyll cell	nucleus	stoma

[4]

The vascular bundle contains xylem and phloem.

- (b) State the function of xylem and of phloem.

xylem

.....

phloem

.....

[2]

- (c) State the names of **two** gases which are produced by green leaves when there is no light.

1

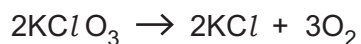
2

[2]

[Total: 8]

- 2 When potassium chlorate is heated, it decomposes to form potassium chloride and oxygen.

The equation for the reaction is:



The relative molecular mass of potassium chlorate is 122.5.

[A_r: Cl, 35.5; K, 39; O, 16]

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

..... [1]

- (ii) Complete the following sentences.

49g of potassium chlorate produces g of potassium chloride and g of oxygen.

14.9g of potassium chloride is produced from g of potassium chlorate.

[3]

- (b) State a test and the result of the test to show that oxygen is produced.

test

result [2]

[Total: 6]

- 3 A micrometer is used to measure the diameter d of a piece of wire as shown in Fig. 3.1.

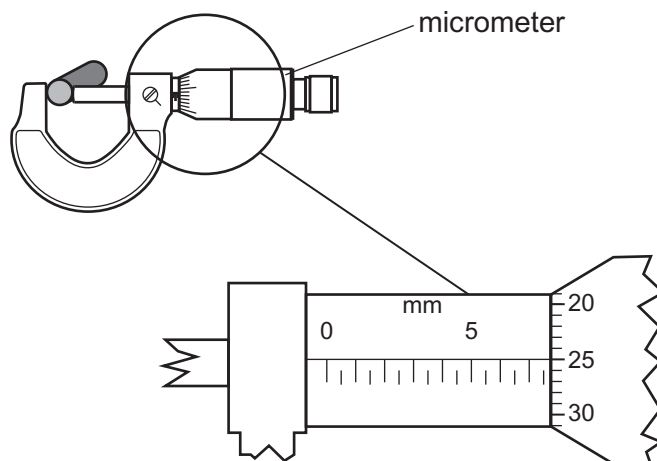


Fig. 3.1

- (a) Determine the reading shown on the micrometer scale in Fig. 3.1.

$d = \dots\dots\dots$ mm [1]

- (b) The length l of the piece of wire is 850 mm.

- (i) Calculate the volume V of the wire using the equation:

$$V = 0.25 \pi l d^2$$

where $\pi = 3.14$ and d is your answer to (a).

$V = \dots\dots\dots$ mm³ [2]

- (ii) Name a piece of apparatus suitable for measuring the length of the piece of wire.

Describe **one** feature of this piece of apparatus that enables the length to be measured accurately.

apparatus

feature

.....

[2]

[Total: 5]

4 Fig. 4.1 shows a plant cell.

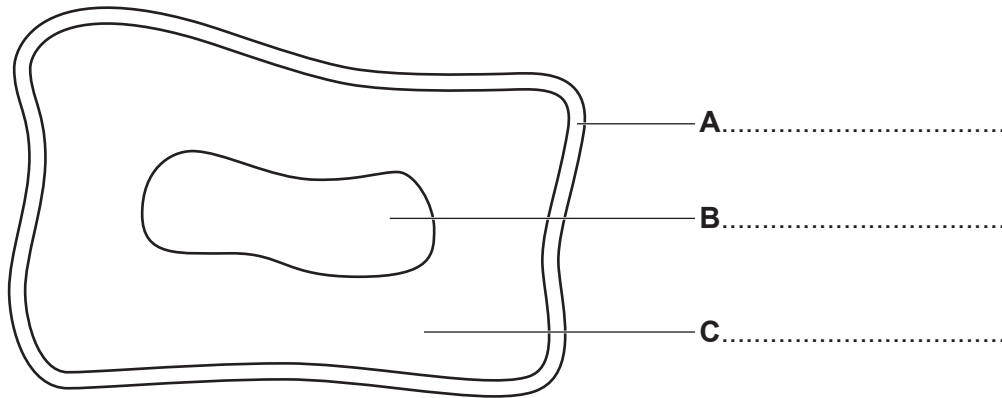


Fig. 4.1

(a) Complete Fig. 4.1 by labelling the structures **A**, **B** and **C**.

Write your answers on the lines provided. [3]

(b) Draw the nucleus in the cell on Fig. 4.1. [1]

(c) When a plant cell is placed in distilled water for 15 minutes, it increases in size.

State the name of the process that makes the cell increase in size.

..... [1]

(d) When an animal cell is placed in distilled water for fifteen minutes, it bursts. A plant cell placed in distilled water for fifteen minutes does **not** burst.

Suggest why a plant cell does **not** burst.

.....
 [1]

[Total: 6]

- 5 The alkali metals are a group of elements in the Periodic Table.

Table 5.1 shows the melting points of some alkali metals.

Table 5.1

element	proton number	melting point / °C
lithium	3	180
sodium	11	98
potassium	19	
rubidium	37	39

- (a) Use the information in Table 5.1 to predict the melting point of potassium.

Complete the table by writing your answer in the box.

[1]

- (b) Use the words in the list to complete the sentences about alkali metals.

decreases hard hydrogen increases
one oxygen seven soft unreactive

The words can be used once, more than once or not at all.

The number of electrons in the outer shell of an alkali metal atom

is

Alkali metals are relatively metals.

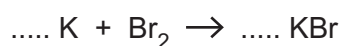
The reactivity of the alkali metals down the group.

Alkali metals and water produce when they react.

[4]

- (c) Potassium reacts with bromine to form potassium bromide.

Balance the equation for the reaction.



[1]

[Total: 6]

- 6 Two forces act on a beam attached to a pivot, as shown in Fig. 6.1.

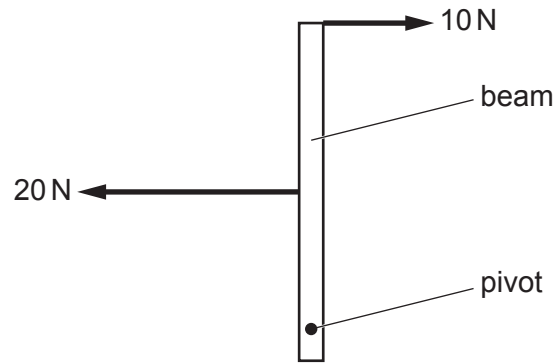


Fig. 6.1

- (a) The beam is free to rotate about the pivot.

The two forces shown in Fig. 6.1 have different magnitudes.

Explain why the two forces do **not** cause the beam to rotate.

.....

 [2]

- (b) The beam is removed from the pivot and lifted by a machine.

The beam has a weight of 8 N.

The machine develops a power of 4 W as it lifts the beam.

Calculate the time taken to lift the beam through a height of 0.2 m.

time = s [4]

[Total: 6]

7 (a) State the **three** environmental conditions that seeds need to germinate.

1

2

3

[3]

(b) Fig. 7.1 shows how the percentage germination of one type of seed is affected by the pH of the soil in which it is planted.

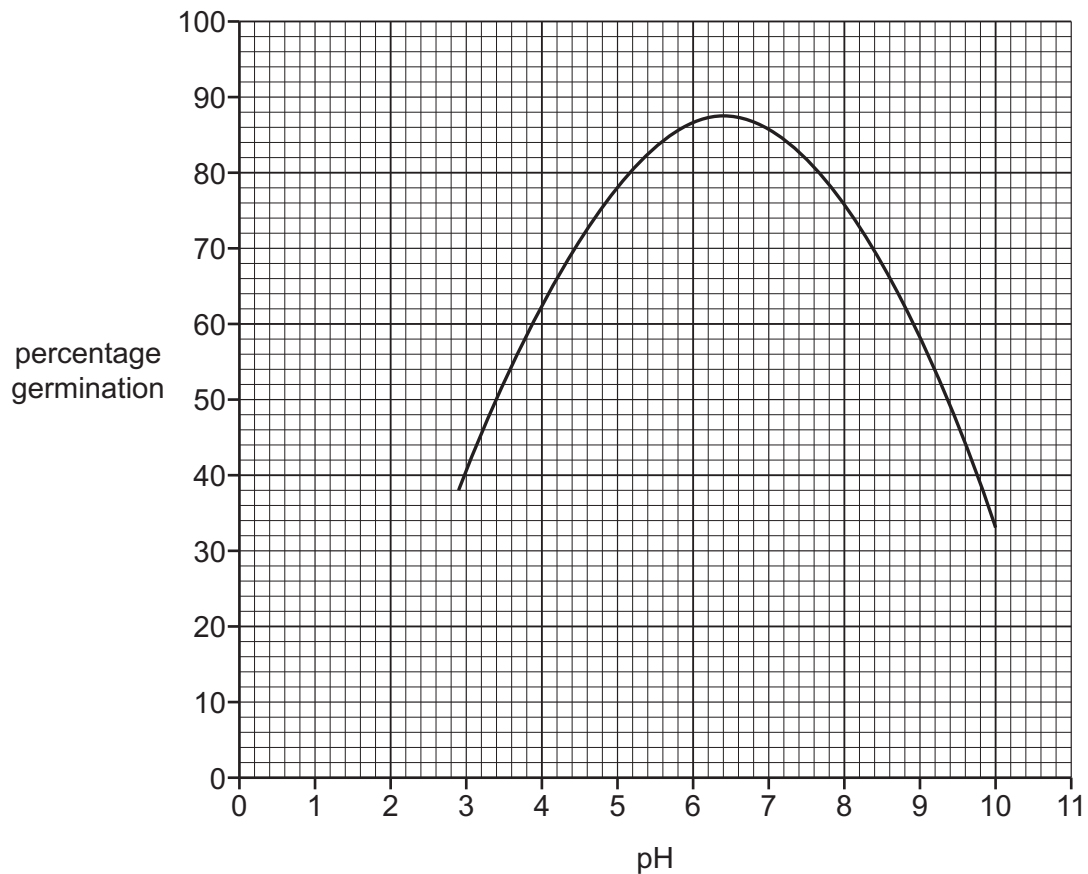


Fig. 7.1

Describe how the percentage germination of these seeds is affected by the pH of the soil.

Use data from the graph in your description.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 7]

8 Fig. 8.1 shows a beaker of water being heated.

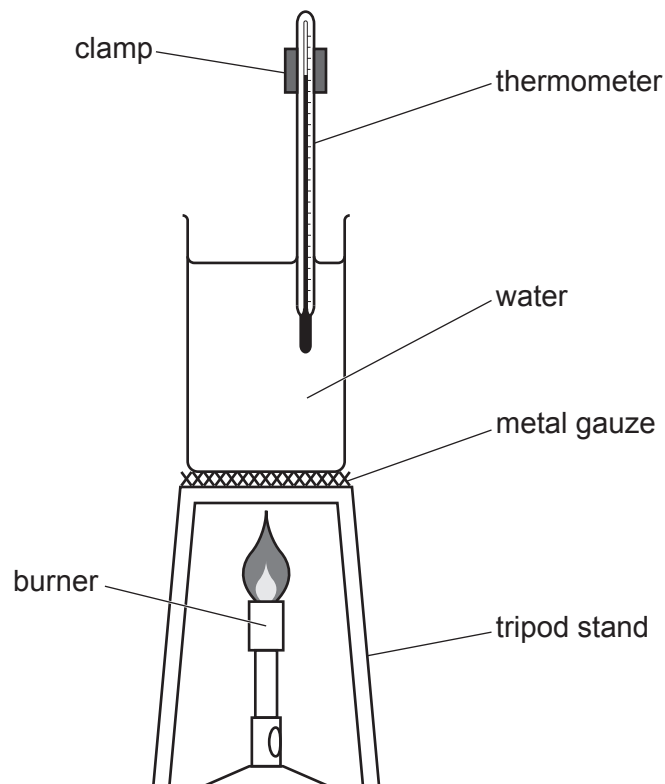


Fig. 8.1

(a) Name the main process by which thermal energy is transferred through:

- the metal gauze

.....

- the water.

.....

[2]

(b) The burner heats the water at the bottom of the beaker. Describe the process by which the water at the top of the beaker becomes hotter.

.....

.....

.....

.....

[2]

(c) Fig. 8.2 shows the liquid inside a thermometer.

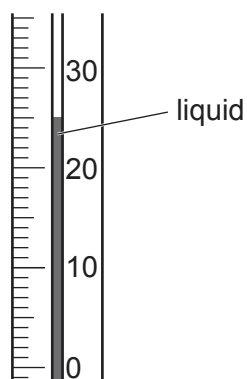


Fig. 8.2

Use ideas about particles to explain how thermal energy causes the liquid to expand up the thermometer.

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

[Total: 6]

9 Fig. 9.1 shows the alimentary canal and associated organs.

Four structures are labelled, **A**, **B**, **C** and **D**.

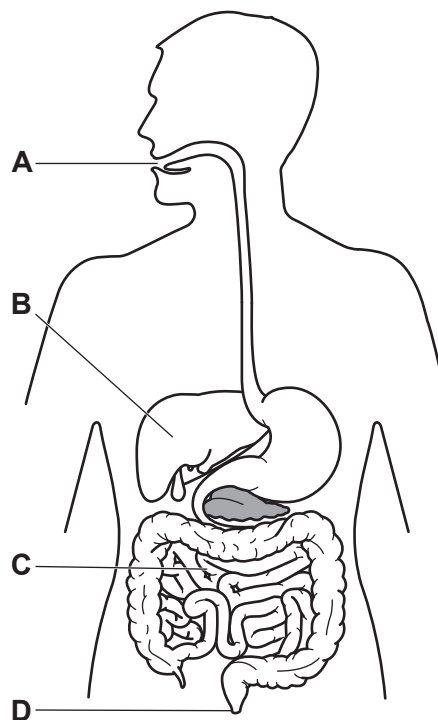


Fig. 9.1

(a) Complete Fig. 9.2 by drawing **one** straight line from **each** label to the name of the structure.

label	structure
A	anus
B	ileum
C	liver
D	mouth

Fig. 9.2

[3]

- (b) Complete Fig. 9.3 by drawing **one** straight line from **each** structure to the process it carries out.

structure	process
anus	ingestion
ileum	absorption
liver	assimilation
mouth	egestion

Fig. 9.3

[3]

[Total: 6]

10 Different gases have different properties.

On Fig. 10.1, draw **one** straight line from **each** property to a gas with that property.

property	gas
the gas used in the purification of water supplies	ammonia
the gas that reacts with acids to make fertilisers	argon
the gas that is 21% of the atmosphere	chlorine
a noble gas	ethane
the main compound in natural gas	methane
	nitrogen
	oxygen

Fig. 10.1

[5]

11 Ethene C_2H_4 is a covalent molecule.

(a) Draw the structure of ethene.

[1]

(b) Study the reaction scheme shown in Fig. 11.1.

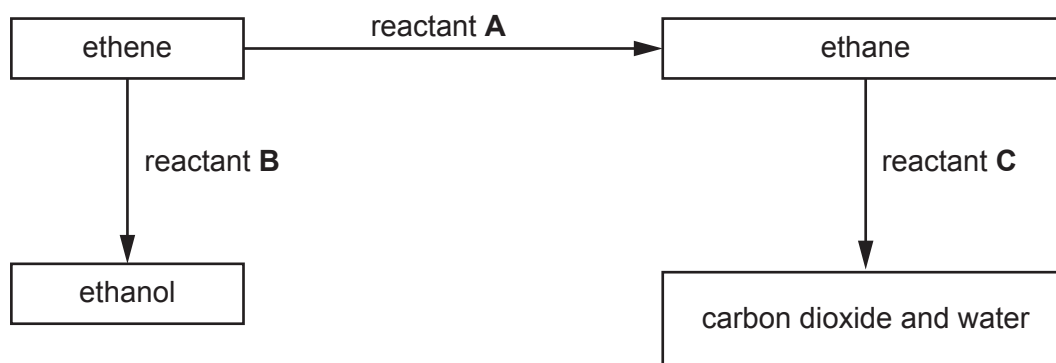


Fig. 11.1

Identify the reactants **A**, **B** and **C**.

reactant **A**

reactant **B**

reactant **C**

[3]

(c) Define reduction in terms of what happens to the hydrogen in a reaction.

.....

..... [1]

[Total: 5]

- 12 Two rays of light from an object at **O** are incident on a plane mirror as shown in Fig. 12.1.

The image of the object is formed at **I**.

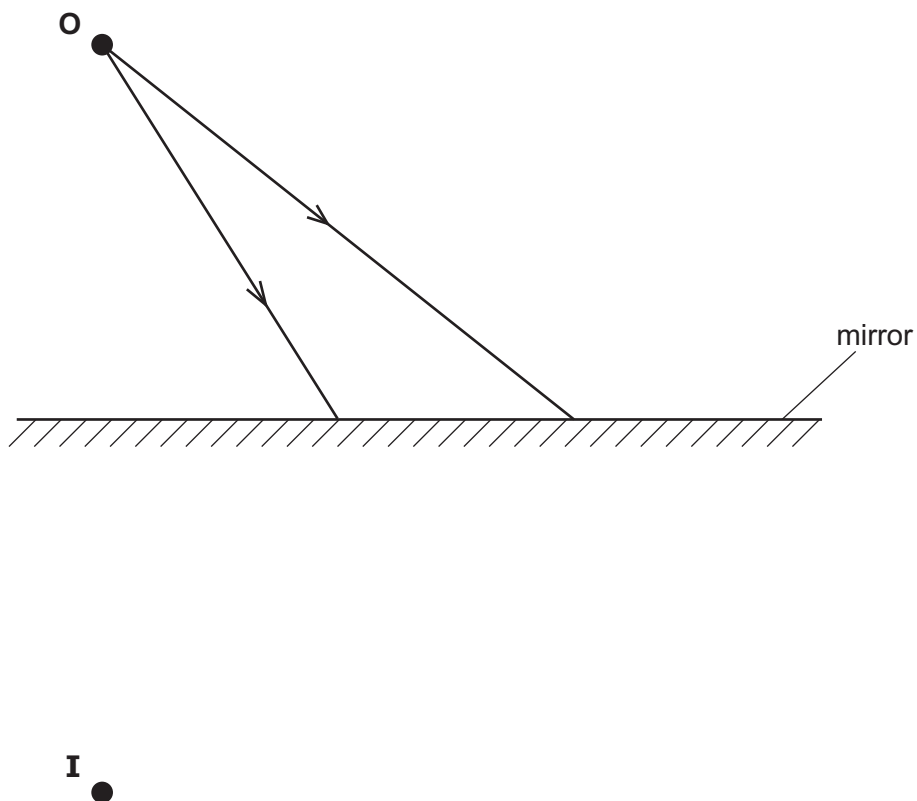


Fig. 12.1

- (a) Describe how to determine the angle of incidence for **one** of these rays.

You may draw on Fig. 12.1 if you wish.

.....

.....

..... [2]

- (b) Complete Fig. 12.1 to show how the image is formed.

[2]

[Total: 4]

- 13** Complete the sentences about excretion by inserting words or phrases from the list.

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

carbon dioxide fibrous kidney liver
lungs nitrogen pancreas toxic

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

The lungs excrete

Urea is produced in the and then excreted by the

.....

[4]

15 Fig. 15.1 shows a simple circuit.

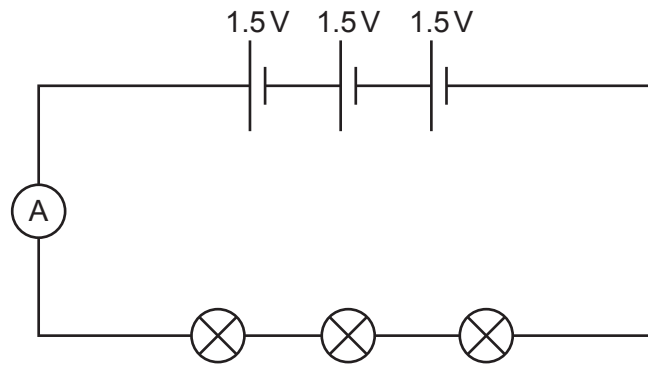


Fig. 15.1

- (a) (i) The resistance of each lamp is $9.0\ \Omega$.

Calculate the total resistance of the lamps.

resistance = Ω [1]

- (ii) Determine the total voltage of the battery.

voltage = V [1]

- (b) Calculate the current in the circuit.

Give your answer to 2 significant figures.

current = A [2]

[Total: 4]

16 A student makes some observations of the scene shown in Fig. 16.1.



Fig. 16.1

The student's observations are shown in Fig. 16.2.

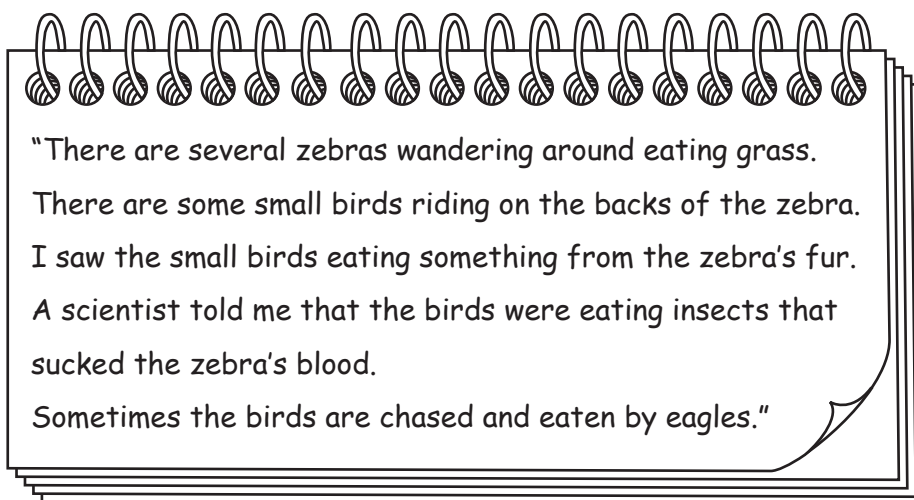


Fig. 16.2

Use the information in Fig. 16.1 and Fig. 16.2 to construct a food chain.

- 17 (a) Lead is in Group IV of the Periodic Table.

State the number of electrons in the outer shell of an atom of lead.

..... [1]

- (b) Lead nitrate is an ionic substance.

It contains lead ions, Pb^{2+} , and nitrate ions, NO_3^- .

Deduce the formula of lead nitrate.

..... [1]

- (c) State **two** ways in which lead nitrate can be made to conduct electricity.

1

2 [2]

- (d) When a solution of lead nitrate is mixed with dilute sulfuric acid, it forms insoluble lead sulfate, PbSO_4 .

Deduce the ionic charge on the sulfate ion. [1]

[Total: 5]

- 18 (a) An iron bar is used as the core of a simple electromagnet.

On Fig. 18.1, draw a circuit to show how the bar is made into an electromagnet.

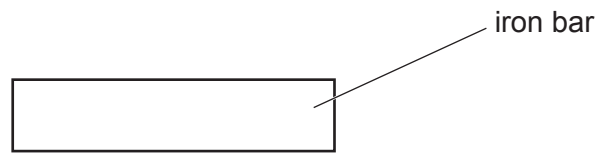


Fig. 18.1

[2]

- (b) Explain why iron is a suitable material for the core of an electromagnet.

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

- (c) State **one** difference between a permanent magnet and an induced magnet.

.....
..... [1]

[Total: 5]

19 Uranium-238 is radioactive.

The nucleus of uranium-238 decays to an isotope of thorium with the emission of radiation.

The graph in Fig. 19.1 shows the changes in the nucleus as a result of this emission.

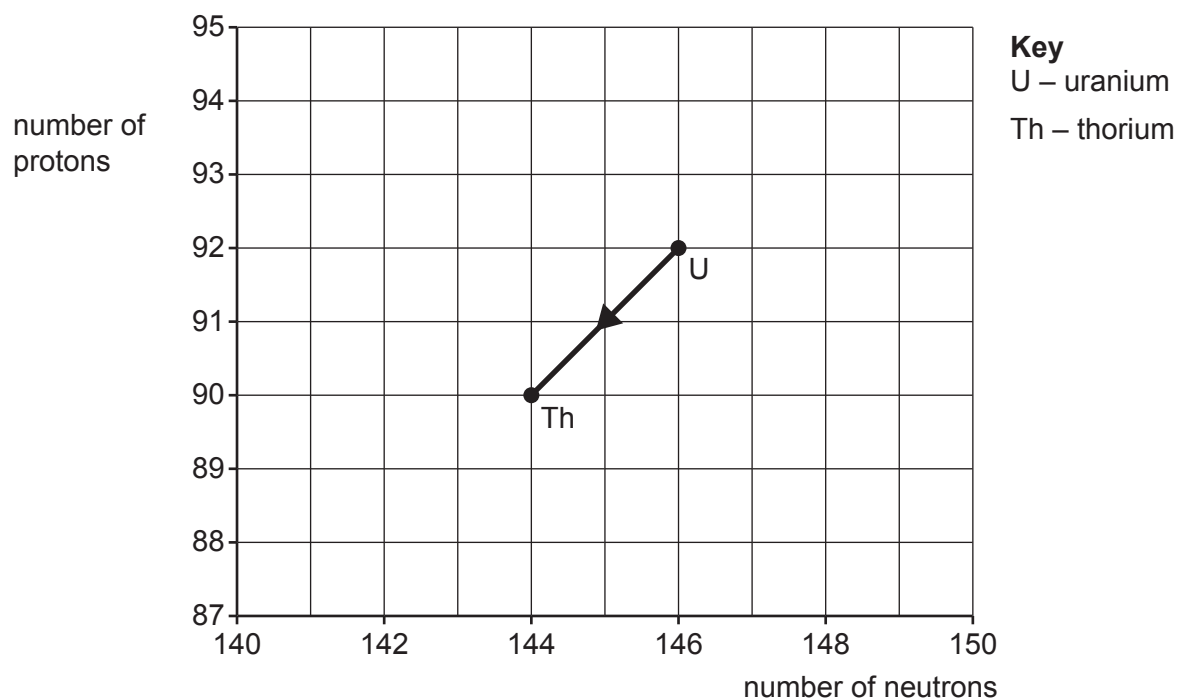


Fig. 19.1

- (a)** Determine the nucleon number and proton number of the particle emitted from the uranium nucleus.

nucleon number of emitted particle

proton number of emitted particle

[2]

- (b)** Thorium is also radioactive. It decays to an isotope of protactinium by the emission of a beta-particle.

On Fig. 19.1 plot the position of this protactinium isotope. Label this point Pa.

[1]

[Total: 3]

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The Periodic Table of Elements

Group																	
I	II							III	IV	V	VI	VII	VIII				
		1Hhydrogen1															
		Key atomic number atomic symbol name relative atomic mass															
3Li lithium 7	4Be beryllium 9																
11Na sodium 23	12Mg magnesium 24																
13Al	14Si	15P	16S	17Cl	18Ar												
19K	20Ca	21Sc	22Ti	23V	24Cr	25Mn	26Fe	27Co	28Ni	29Cu	30Zn	31Ga	32Ge	33As	34Se	35Br	36Kr
37Rb	38Sr	39Y	40Zr	41Nb	42Mo	43Tc	44Ru	45Rh	46Pd	47Ag	48Cd	49In	50Sn	51Sb	52Te	53I	54Xe
55Cs	56Ba	57–71lanthanoids	72Hf	73Ta	74W	75Re	76Os	77Ir	78Pt	79Au	80Hg	81Tl	82Pb	83Bi	84Po	85At	86Rn
87Fr	88Ra	89–103actinoids	104Rf	105Db	106Sg	107Bh	108Hs	109Mt	110Ds	111Rg	112Cn	113Nh	114Fl	115Lv	116Ts	117Uu	118Ug