

CANDIDATE
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COMBINED SCIENCE

Paper 2

5129/21

October/November 2014

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.

1 Use words from the list to complete the sentences.

acid alkali duodenum
excretion oesophagus pancreatic peristalsis
protein salivary starch

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

The gland produces the enzyme amylase in the mouth.

In the mouth, amylase acts on and breaks it down into sugars.

Chewed food is swallowed and passes down the into the stomach.

Bacteria in the food are killed by in the stomach secretions.

Material is passed along the alimentary canal by the process of

[5]

- 2 A mixture of chromium(III) oxide and aluminium is ignited with a magnesium fuse, as shown in Fig. 2.1.

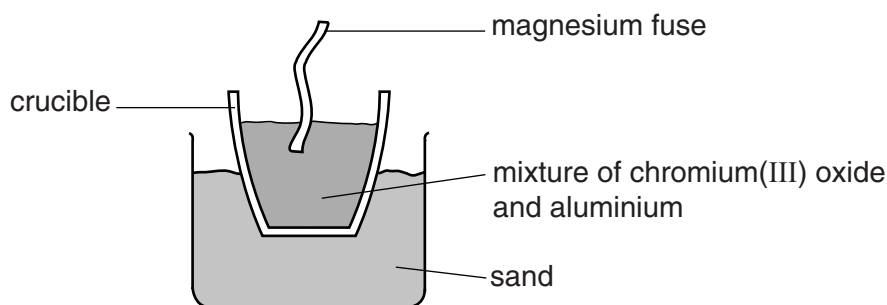


Fig. 2.1

A violent reaction occurs.

The equation for the reaction is



- (a) (i) Calculate the relative molecular mass of aluminium oxide.

(A_r : Cr, 52; Al, 27; O, 16)

relative molecular mass =[1]

- (ii) The relative molecular mass of chromium(III) oxide is 152.

Use the equation to complete the following sentences.

152 g of chromium(III) oxide produces g of chromium.

38 g of chromium(III) oxide produces g of chromium. [2]

- (b) State the type of reaction that aluminium has undergone.

.....[1]

- (c) Aluminium is more reactive than iron.

Suggest why aluminium is resistant to corrosion but iron corrodes easily.

.....
[2]

- 3 A series circuit containing two resistors **P** and **Q** is shown in Fig. 3.1.

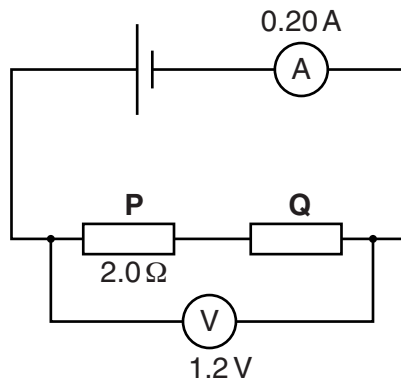


Fig. 3.1

Resistor **P** has a resistance of $2.0\ \Omega$.

The voltmeter reads 1.2V . The ammeter reads 0.20A .

(a) Calculate

- (i) the combined resistance of resistors **P** and **Q**,

resistance = Ω [2]

- (ii) the resistance of resistor **Q**.

resistance = Ω [1]

(b) Calculate the time taken for a charge of 10C to pass through the ammeter.

time = s [2]

(c) The resistors in Fig. 3.1 have fixed values.

In the space below, draw the symbol for a variable resistor.

[1]

4 (a) Fig. 4.1 shows five methods of birth control and examples of each method.

Complete Fig. 4.1 by drawing a line between the method of birth control and its example.

One line has been drawn for you.

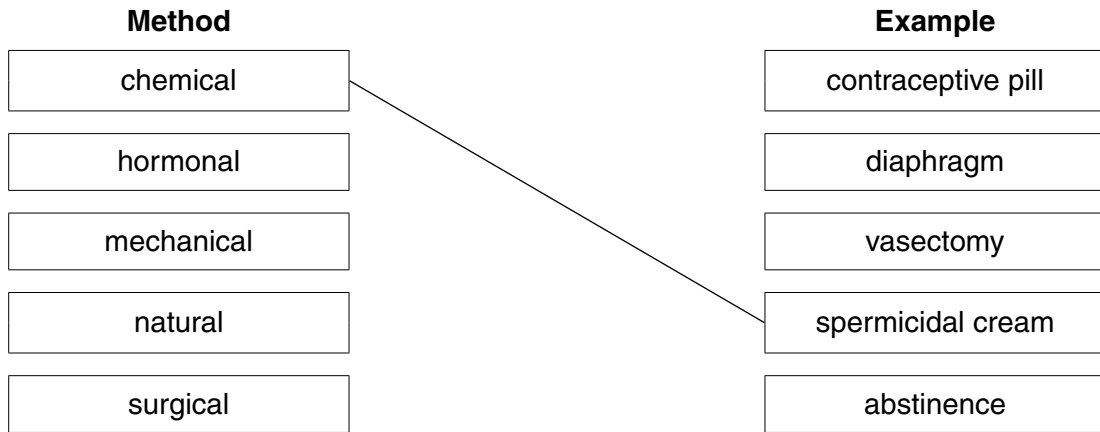


Fig. 4.1

[4]

(b) State the name of an example of birth control other than abstinence that helps prevent the spread of HIV.

Explain why it is effective.

name

explanation

.....

.....

.....[3]

5 Fig. 5.1 shows the arrangement of the electrons in atoms of five different elements **A–E**.

The letters are **not** the chemical symbols of the elements.

element	A	B	C	D	E
electron structure	2,4	2,8,8	2,8,6	2,8,4	2,8,2

Fig. 5.1

Use the letters in Fig. 5.1 to answer the questions.

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

- (a) Which element has proton number 12? [1]
- (b) Which element has nucleon number 32 and an isotope that
contains 16 neutrons? [1]
- (c) Which two elements are in the same group of the Periodic Table?
..... and [1]
- (d) Which element forms a basic oxide? [1]

6 A moon buggy is a type of car used on the Moon.

The buggy has a mass of 200 kg.

On the Moon, the gravitational field strength is 1.6 N/kg.

(a) Calculate the weight of the buggy when it is on the Moon. State the unit.

weight = unit [2]

(b) State whether the mass of the buggy on Earth is greater than, equal to or less than its mass when on the Moon.

..... [1]

(c) The buggy is driven on the Moon.

Calculate the acceleration when the accelerating force is 550 N.

acceleration = unit [3]

7 A measuring cylinder containing a liquid is shown in Fig. 7.1.

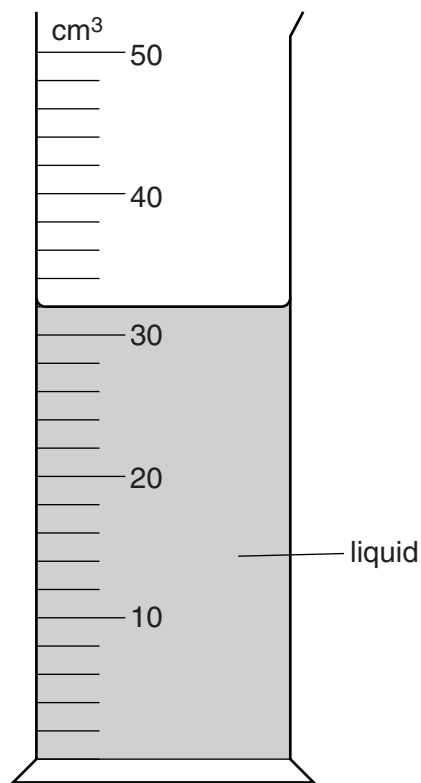


Fig. 7.1

(a) (i) State the volume of the liquid in the cylinder.

volume = cm³ [1]

(ii) The mass of the liquid is 35.2 g.

Calculate the density of the liquid.

density = unit [3]

(b) A stone is placed in the liquid as shown in Fig. 7.2.

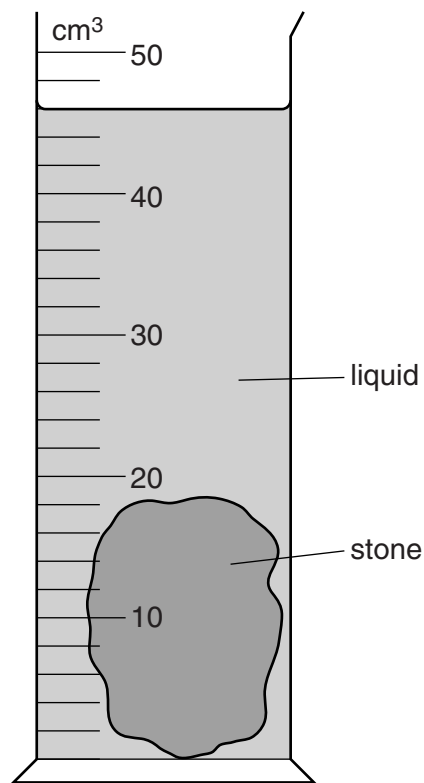


Fig. 7.2

Calculate the volume of the stone.

volume = cm^3 [1]

8 (a) State the function of the heart.

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

(b) Fig. 8.1 shows a section through the heart as viewed from the front.

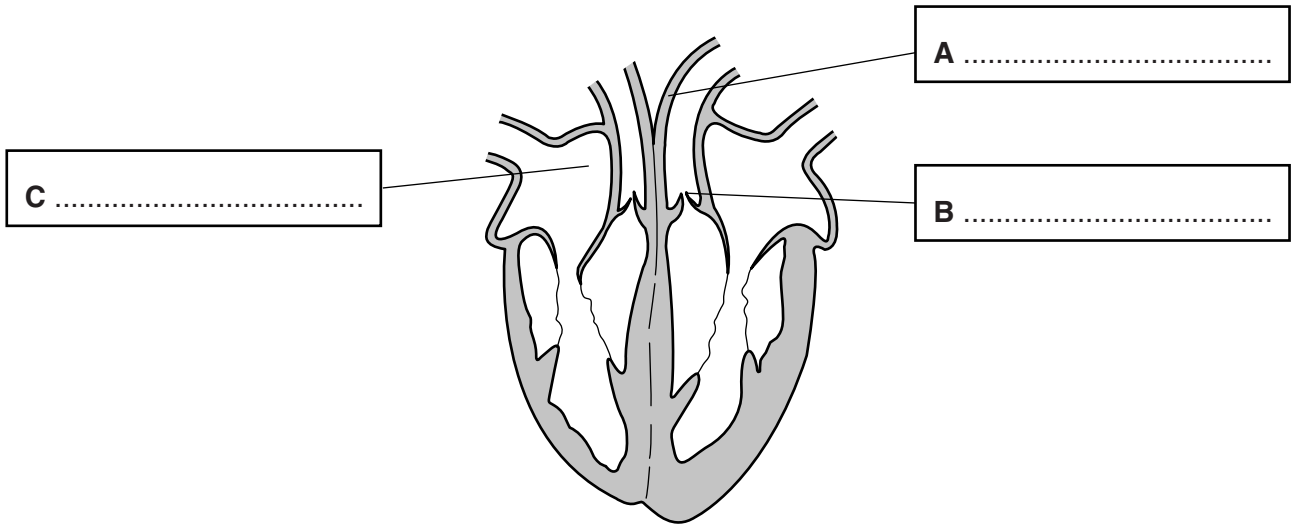


Fig. 8.1

On Fig. 8.1, complete the labels **A**, **B** and **C**.

[3]

(c) Fig. 8.2 shows a surface view of the heart of someone who has coronary heart disease.

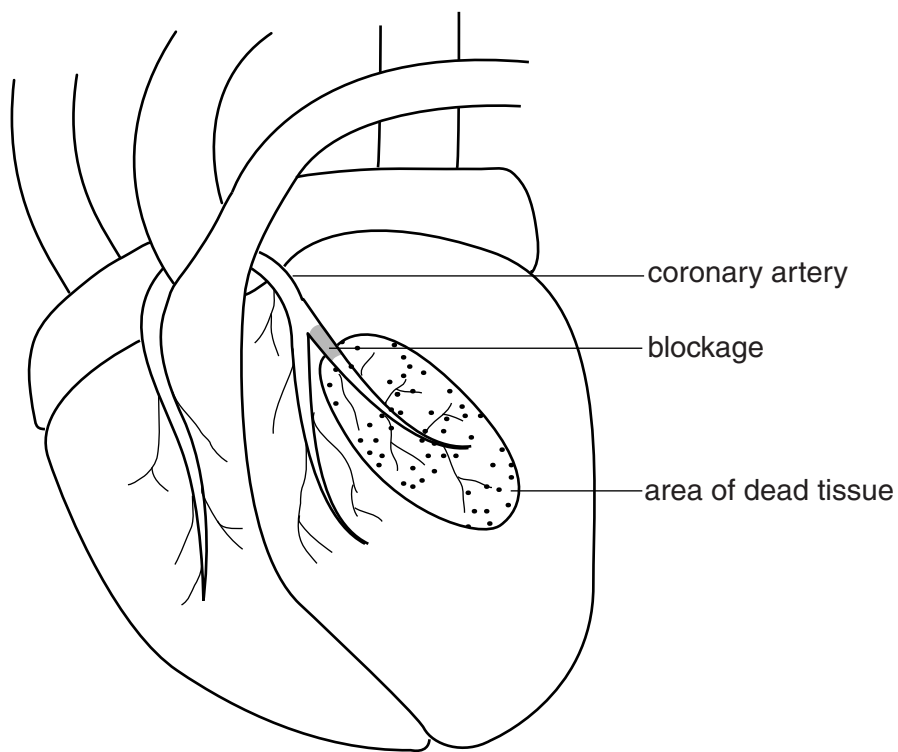


Fig. 8.2

The blockage in the coronary artery has prevented blood reaching some of the heart tissue. This tissue has died.

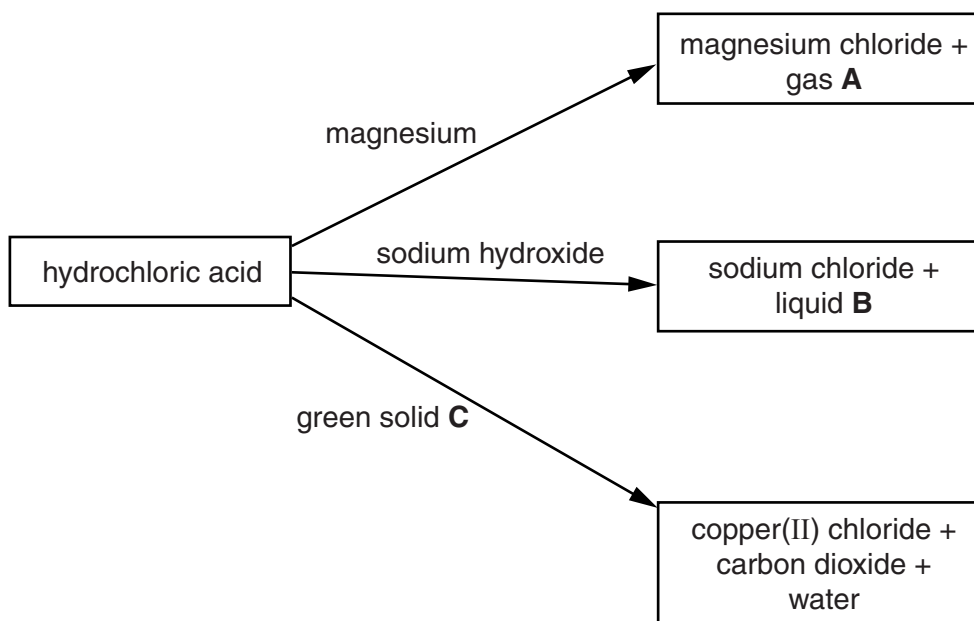
(i) Explain why lack of blood causes heart tissue to die.

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

(ii) State three possible causes of coronary heart disease.

1
2
3 [3]

9 Study the following reaction scheme.



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

gas **A**

liquid **B**

green solid **C**

[3]

(b) (i) State the colour of Universal Indicator after it is added to hydrochloric acid.

.....

[1]

(ii) State the name of the ion which causes acidity.[1]

(c) State the test to show that carbon dioxide is produced when green solid **C** is added to hydrochloric acid.

test

.....

result

[2]

- 10 A student uses the apparatus shown in Fig. 10.1 to measure the force exerted on an iron cube by a magnet. The diagram is not to scale.

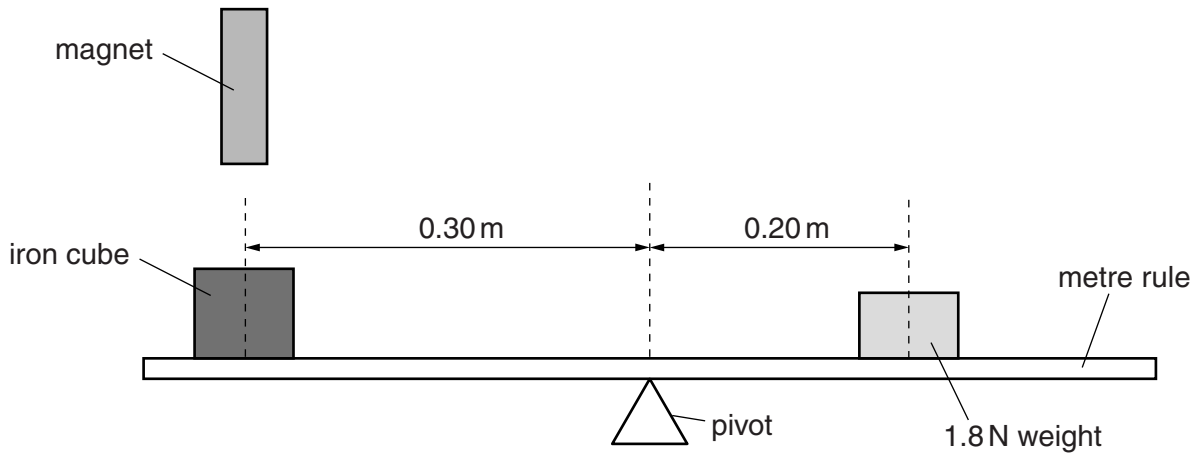


Fig. 10.1

The pivot is at the centre of a uniform metre rule.

The iron cube is placed 0.30 m from the pivot with a magnet held a fixed distance above the cube.

The metre rule is balanced when a weight of 1.8 N is placed 0.20 m from the pivot.

- (a) (i) Calculate the clockwise moment produced by the 1.8 N weight.

moment = N m [2]

- (ii) The force exerted by the magnet on the iron cube produces a clockwise moment about the pivot of 0.24 N m.

Calculate the force exerted by the magnet on the iron cube.

force = N [1]

- (iii) Calculate the anti-clockwise moment produced by the weight of the iron cube.

moment = N m [1]

- (b) The iron cube is replaced by a lead cube.

Explain why the lead cube and iron cube must have different weights if the metre rule is to remain balanced.

.....
 [1]

11 Fig. 11.1 shows a section through a leaf when viewed under a microscope.

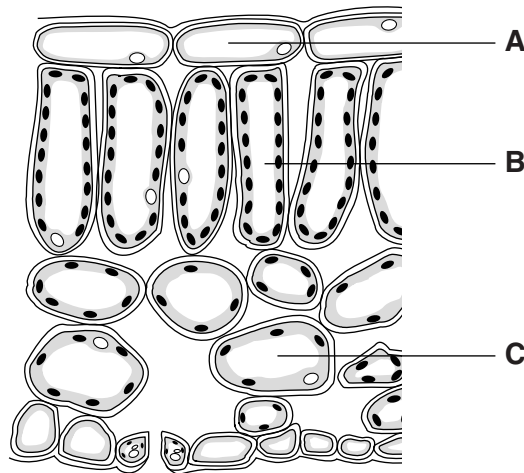


Fig. 11.1

(a) Name the types of cell labelled **A**, **B** and **C**.

- A
 - B
 - C
- [3]

(b) (i) The main function of a leaf is to carry out photosynthesis.

State the word equation for photosynthesis.

.....[2]

(ii) Explain the function of chlorophyll during photosynthesis.

.....

.....

.....

.....[2]

12 Fig. 12.1 shows the fractional distillation of petroleum.

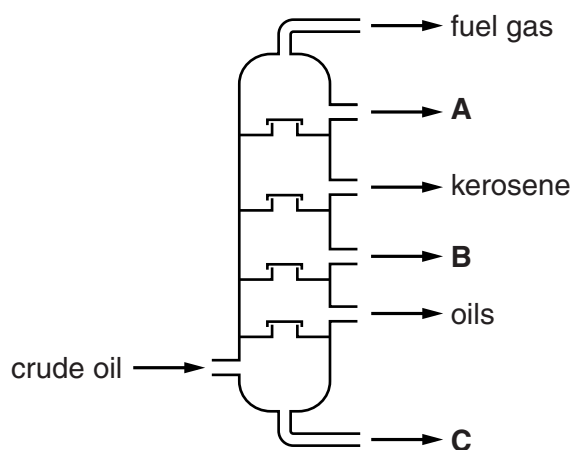


Fig. 12.1

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

A

B

C

[3]

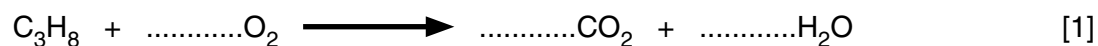
(b) The fractions obtained by fractional distillation contain hydrocarbons from the homologous series known as the alkanes.

State the general characteristics of a homologous series.

.....

 [2]

(c) (i) Balance the equation for the combustion of propane.



(ii) State the condition in which propane burns to produce carbon monoxide rather than carbon dioxide.

..... [1]

13 A liquid-in-glass thermometer is shown in Fig. 13.1.

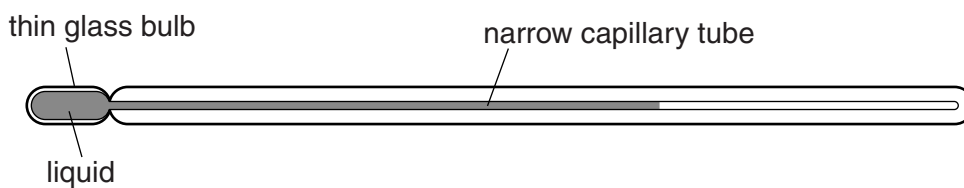


Fig. 13.1

(a) The thermometer is at room temperature and is then placed in hot water.

State the change that occurs, if any, to

(i) the volume of the liquid in the thermometer,

.....[1]

(ii) the mass of the liquid in the thermometer.

.....[1]

(b) The thermometer in Fig. 13.1 has no scale marked on it.

To mark two fixed points on the thermometer, it is placed in melting ice and then in boiling water.

State the temperatures of the two fixed points.

.....°C and°C [1]

(c) Clinical thermometers contain a constriction, as shown in Fig. 13.2.

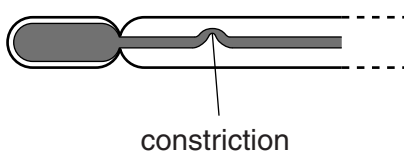


Fig. 13.2

Explain the purpose of the constriction.

.....
[1]

14 (a) Describe how a covalent bond is formed between two atoms.

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

(b) State **two** ways in which the physical properties of covalent compounds differ from the physical properties of ionic compounds.

1.
.....
2.
.....
[2]

(c) State one chemical difference between the oxides of metals and non-metals.

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

15 Fig. 15.1 shows part of a food chain.

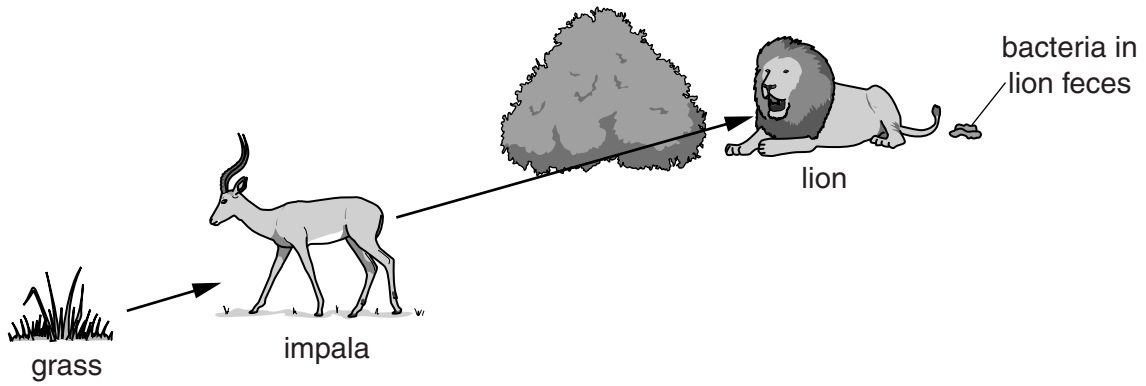


Fig. 15.1

(a) Use Fig. 15.1 to identify the

- (i) decomposer,
- (ii) producer,
- (iii) carnivore.

[3]

(b) Explain **two** ways in which energy is lost between second and third trophic levels.

- 1.
.....
- 2.
.....

[2]

16 Microwave ovens use microwave radiation with a frequency of 2.5×10^9 Hz.

(a) (i) Explain what is meant by the *frequency* of a wave.

.....[1]

(ii) The speed of microwave radiation is 3.0×10^8 m/s.

Calculate the wavelength of this microwave radiation.

wavelength = m [2]

(b) Infra-red radiation may also be used to heat food.

Compared to microwave radiation, state whether infra-red radiation has higher, lower or the same value of

(i) frequency, [1]

(ii) speed in a vacuum. [1]

17 The following is a list of metals.

aluminium calcium iron potassium zinc

From the list, select a metal to complete each sentence.

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

(a) The metal extracted from haematite is [1]

(b) An amphoteric oxide is formed by [1]

(c) The catalyst in the manufacture of ammonia is [1]

(d) Brass is a mixture of copper and [1]

(e) Sodium is less reactive than [1]

18 Tritium ${}^3_1\text{H}$ is an isotope of hydrogen.

(a) Explain what is meant by *isotopes of an element*.

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

(b) A tritium ${}^3_1\text{H}$ nucleus emits a beta-particle to form a nucleus of a helium isotope.

Calculate the number of protons and the number of neutrons in the nucleus of this helium isotope.

number of protons

number of neutrons

[1]

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