



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**COMBINED SCIENCE**

**0653/31**

Paper 3 (Core)

**October/November 2018**

**1 hour 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 or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 20.

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 **18** printed pages and **2** blank pages.

1 (a) The list shows some processes that occur in living organisms.

- breathing
- digestion
- excretion
- growth
- movement
- reproduction
- sensitivity

State **two** processes shown in the list which are **not** characteristics of all living things.

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

(b) Fig. 1.1 shows a palisade cell which is found in the leaf of a plant.

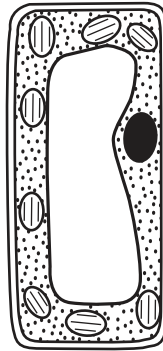


Fig. 1.1

(i) On Fig. 1.1 use a label line and the correct name to show **one** structure that is present in **all** plant cells but is absent from animal cells. [2]

(ii) Describe the pathway taken by water in the plant, from the soil to the palisade cells.

- .....
  - .....
  - .....
  - .....
- [3]

(c) Fig. 1.2 shows a plant growing in front of a large rock.



Fig. 1.2

(i) The leaves of the plant in Fig. 1.2 turn towards the light.

Name the plant's response to light.

.....[1]

(ii) The leaves of the plant in Fig. 1.2 are separated from each other as much as possible and do not overlap.

Suggest **and** explain why this is an advantage for the plant.

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

2 (a) Complete the following sentences using words from the list.

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

- atoms            compounds            covalent            elements**  
**ionic            ions            mixtures            molecules**

- (i) The smallest parts of an element are ..... [1]
- (ii) All ..... contain atoms joined by sharing pairs of electrons  
in ..... bonds. [2]
- (iii) Atoms which lose or gain electrons form particles called  
..... [1]
- (iv) Elements in ..... cannot be separated by simple physical  
processes.  
Substances in ..... can be separated by simple physical  
processes. [2]

(b) A student passes an electric current through aqueous copper chloride using the apparatus shown in Fig. 2.1.

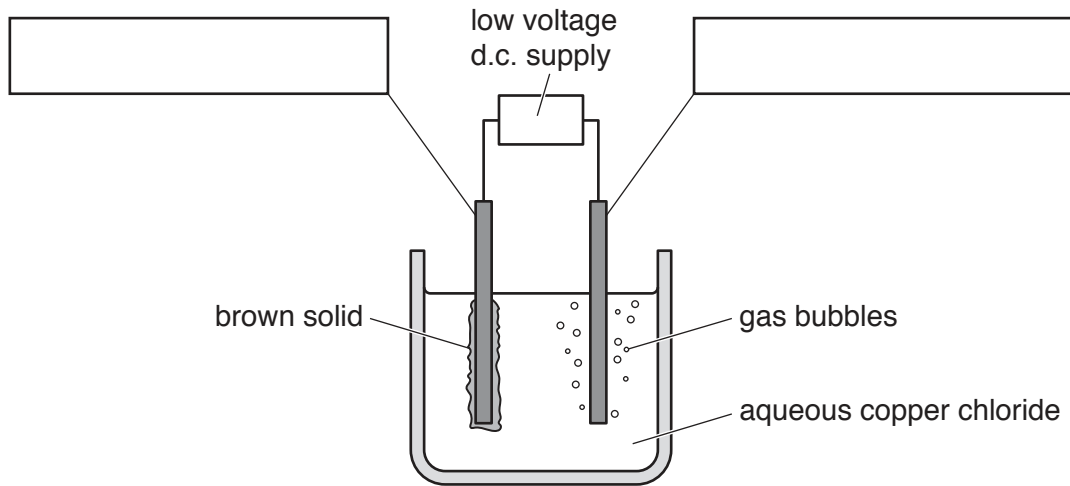


Fig. 2.1

- (i) Complete the labels in Fig. 2.1 by naming the two electrodes. [2]
- (ii) Name the solid and the gas formed in this process.  
solid .....  
gas .....

[2]



3 Fig. 3.1 shows a train made up of a steam engine and a passenger coach.

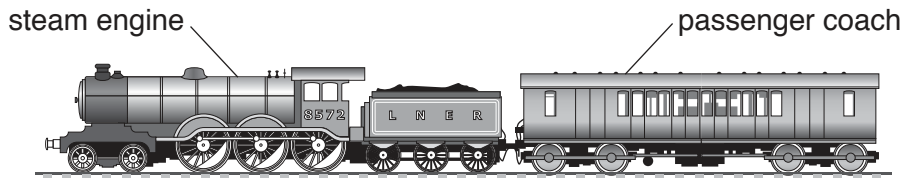


Fig. 3.1

(a) The train is travelling at a constant speed along a level track. Fig. 3.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the train.

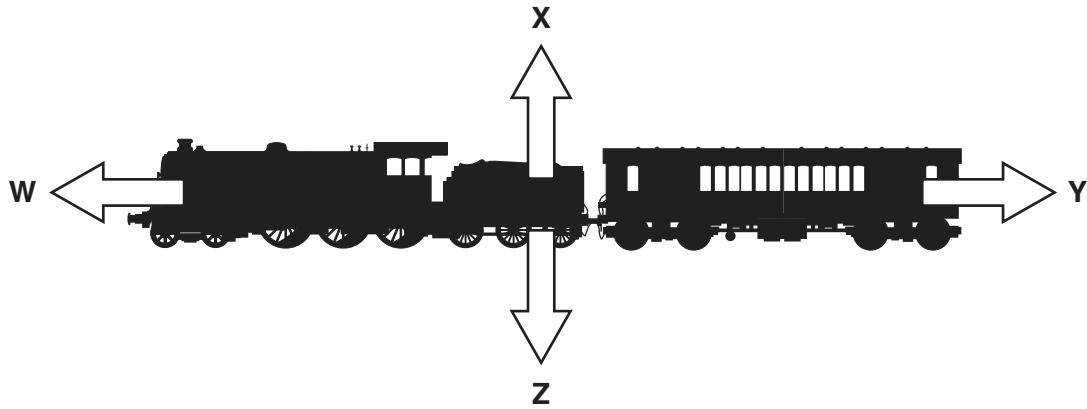


Fig. 3.2

(i) Name force **Z**.

.....[1]

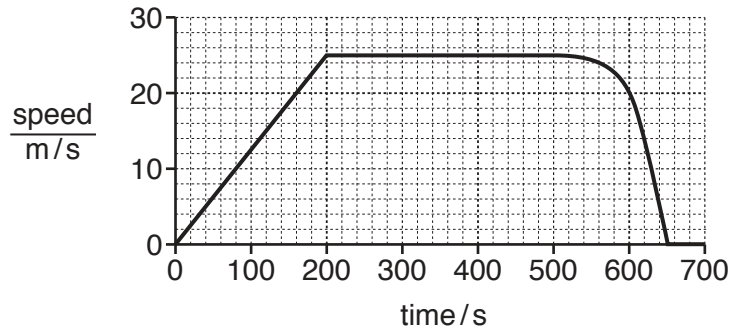
(ii) The force arrows on Fig. 3.2 do not show the sizes of the forces.

State whether or not the driver has made force **W** equal in size to force **Y**.

Explain your answer.

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

(b) Fig. 3.3 shows a speed–time graph of the train as it travels between two stations.



**Fig. 3.3**

(i) On Fig. 3.3, use the letter **P** to label **one** point in the journey when the train is travelling with changing speed. [1]

(ii) The distance between the two stations is 12.8 km.

State the distance between the stations in metres.

distance = ..... m [1]

(iii) Use your answer to (b)(ii) and information from the graph to calculate the average speed of the train on this journey in m/s.

Show your working.

average speed = ..... m/s [2]

(c) The steam engine is powered by burning coal to boil water. This makes steam that moves the engine.

Complete the energy transfer that moves the train.

..... energy in the coal

→ ..... energy of the train. [2]

(d) State the **original** source of the energy stored in coal.

..... [1]

4 Fig. 4.1 shows part of an aquatic food web.

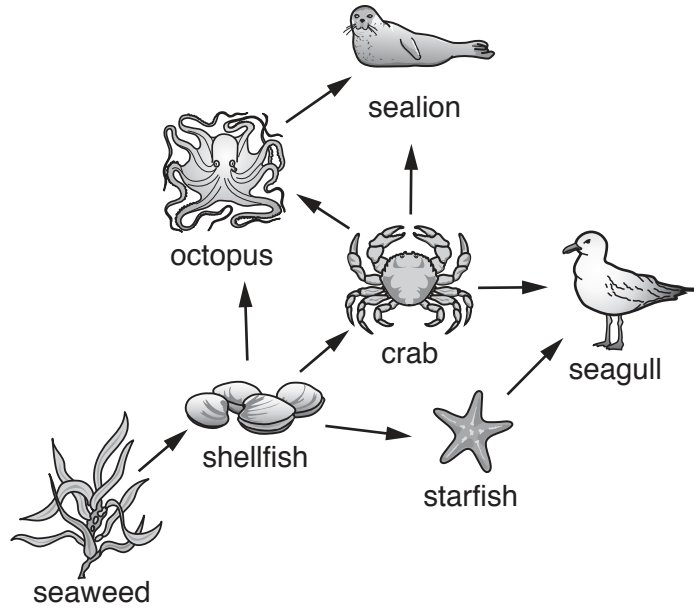


Fig. 4.1

(a) From Fig. 4.1 state the name of

a producer,

.....

a herbivore,

.....

a consumer.

.....

[3]

(b) The food web in Fig. 4.1 is made from interconnected food chains.

Write **two** complete food chains which contain the crab.

1. ....

2. ....

[3]



(c) The population of crabs reduces suddenly.

Suggest **two** reasons why this causes the octopus population to decrease.

1. ....

.....

2. ....

.....

[2]

5 (a) A student makes magnesium sulfate by reacting magnesium with a dilute acid.

(i) Name the acid.

.....[1]

(ii) Describe the pH change of the mixture during the reaction.

.....[1]

(iii) Name **one other** substance that reacts with this acid to make magnesium sulfate.

.....[1]

(iv) The reaction between magnesium and this acid is exothermic.

State what is meant by the term *exothermic*.

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

(b) Another student reacts calcium with excess dilute acid in a beaker.

Calcium sulfate forms as a solid in the beaker.

Suggest the separation method that is used to separate the solid calcium sulfate from the excess acid.

Explain how this separation method removes the solid from the liquid.

method .....

explanation .....

.....  
.....

[2]

(c) Calcium is in Group II of the Periodic Table.

(i) Complete the following sentences using words from the list.

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

**good      high      low      poor**

Calcium is a ..... electrical conductor.

Calcium has a ..... melting point.

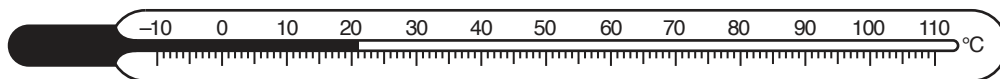
[1]

(ii) State the order of reactivity of calcium, magnesium and sodium.

..... most reactive  
.....  
.....  
..... least reactive

[1]

- 6 Fig. 6.1 shows a liquid-in-glass thermometer at room temperature.



**Fig. 6.1**

- (a) State the property of a liquid that is used in a thermometer when measuring temperature.

.....[1]

- (b) Table 6.1 gives a list of the melting point and boiling point of five substances that are used in liquid-in-glass thermometers.

**Table 6.1**

substance	melting point /°C	boiling point /°C
ethanol	-114	78
gallium	30	2403
glycol	-12	198
mercury	-39	357
water	0	100

- (i) Ammonia has a melting point of  $-78^{\circ}\text{C}$  and a boiling point of  $-33^{\circ}\text{C}$ .

State which substance could be used in a liquid-in-glass thermometer to measure both the melting point and boiling point of ammonia. Explain your answer.

substance .....

explanation .....

.....

[2]

- (ii) Explain why a thermometer that uses liquid gallium has to be kept in a warm container, well above room temperature.

.....

.....

.....[2]

- (c) An infra-red thermometer measures temperature in a different way. The wavelength of the infra-red radiation emitted by a hot body changes with temperature.

An infra-red thermometer measures the wavelengths of the infra-red radiation emitted and converts these to temperature readings.

- (i) Fig. 6.2 shows a wave motion with the waves moving from left to right.

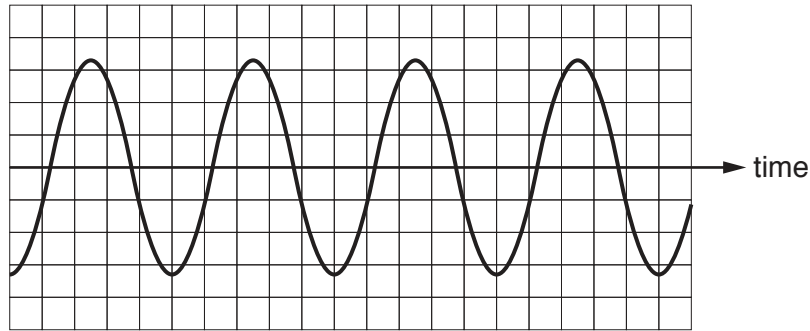


Fig. 6.2

State the number of complete wavelengths shown in Fig. 6.2.

.....[1]

- (ii) The wavelength of the infra-red radiation emitted decreases as the temperature of the hot body increases.

Predict what happens to the frequency of the infra-red radiation as the temperature of the hot body increases.

Explain your answer.

prediction .....

explanation .....

.....[2]

- (iii) In the infra-red thermometer, the radiation is focused onto the detector by a thin converging lens.

On Fig. 6.3 complete the ray diagram to show how this happens.

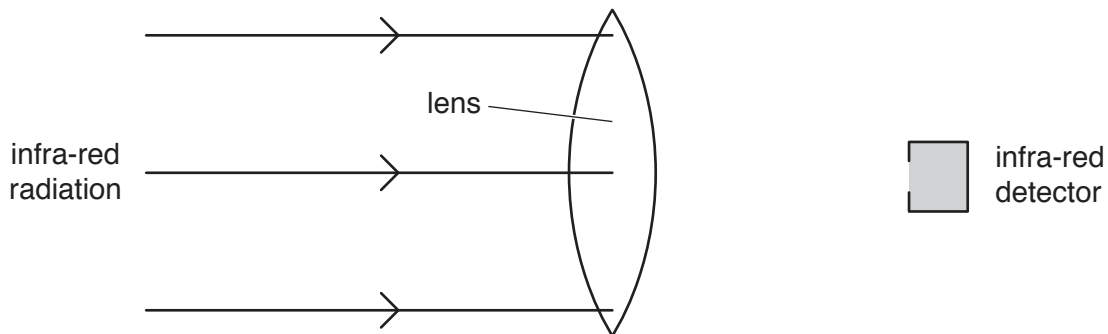


Fig. 6.3

[1]

[Turn over

7 (a) Table 7.1 shows some features of arteries, veins and capillaries.

Place a tick (✓) in the correct boxes in Table 7.1 to show the features of each blood vessel.

**Table 7.1**

feature	blood vessel		
	artery	vein	capillary
carries blood away from the heart			
contains valves			
walls are one cell thick			
exchange of materials occurs here			

[3]

(b) A boy starts to play football. Immediately the concentration of the hormone adrenaline in his blood increases.

(i) Describe **two** effects of adrenaline in the boy's body.

1. ....
2. ....

[2]

(ii) The concentration of adrenaline in the boy's blood decreases after playing football.

Describe how the adrenaline is removed from his blood.

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

(c) The boy is 10 years old. It is important that he includes enough calcium and iron in his diet.

(i) State **one** food which is a good source of calcium.

.....[1]

(ii) Describe why calcium is important in the body.

.....[1]

(iii) Describe the symptoms the boy may have if he does not have enough iron in his diet.

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



- 8 Petroleum is separated into more useful substances using the process shown in Fig. 8.1.

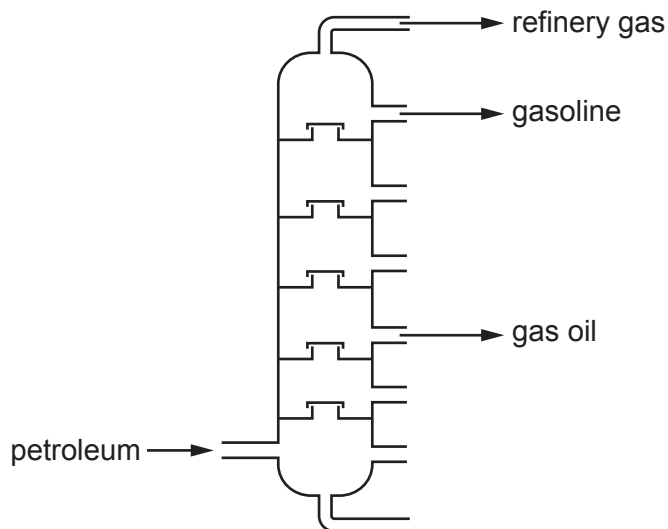


Fig. 8.1

- (a) (i) Name this process.

.....[1]

- (ii) State **one** use for gas oil.

.....[1]

- (b) During the complete combustion of gasoline, the amounts of some gases in the air change.

Name **two** of these gases and describe the change in the amount of each.

**gas 1**

name .....

change .....

**gas 2**

name .....

change .....

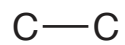
[4]



(c) The formula of ethanol is  $C_2H_5OH$ .

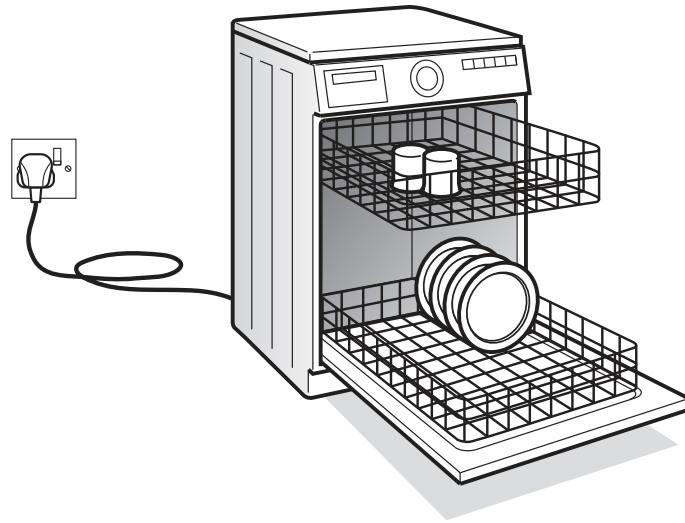
Complete the structure of a molecule of ethanol.

Show all of the bonds between the atoms.



[2]

9 Fig. 9.1 shows a dishwasher (an electric dishwashing machine).



**Fig. 9.1**

The dishwasher uses electrical energy to power

- a heater to heat the water used,
- a motor to pump the hot water through the machine.

The circuit symbols for a heater and a motor are:

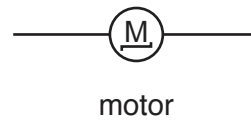
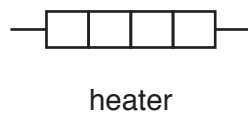
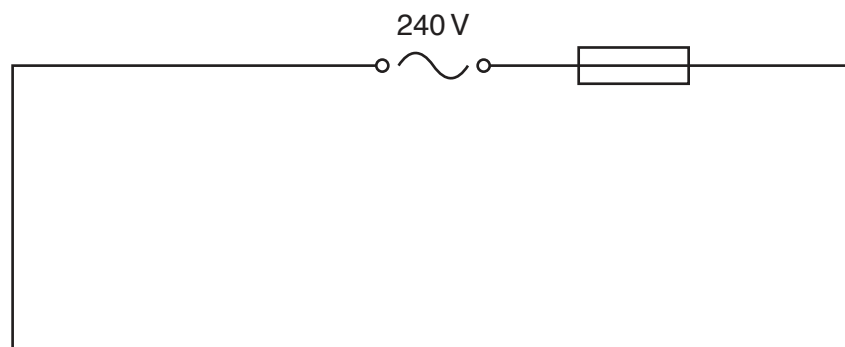


Fig. 9.2 shows part of the circuit diagram for the dishwasher.

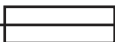


**Fig. 9.2**

- (a) (i) The heater and the motor are connected in parallel.

A switch turns both the heater and the motor on and off.

On Fig. 9.2 complete the circuit diagram for the dishwasher. [3]

- (ii) Name the component in Fig. 9.2 represented by the symbol  and state the reason for including it in the circuit.

component .....

reason .....

..... [2]

- (b) When switched on, the resistance of the heater is  $24\ \Omega$  and the resistance of the motor is  $4\ \Omega$ .

- (i) Use the formula  $R = \frac{V}{I}$  to calculate the current through the heater.

Show your working and give the unit of your answer.

working

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

- (ii) Put a circle around the likely value of the combined resistance of the heater and motor in this circuit. Give a reason for your choice.

3.4  $\Omega$       28  $\Omega$

reason .....

..... [1]

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