



Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/32

Paper 3 (Core)

May/June 2019

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 **20** printed pages.

1 (a) Fig. 1.1 is a diagram showing five of the characteristics of living organisms.

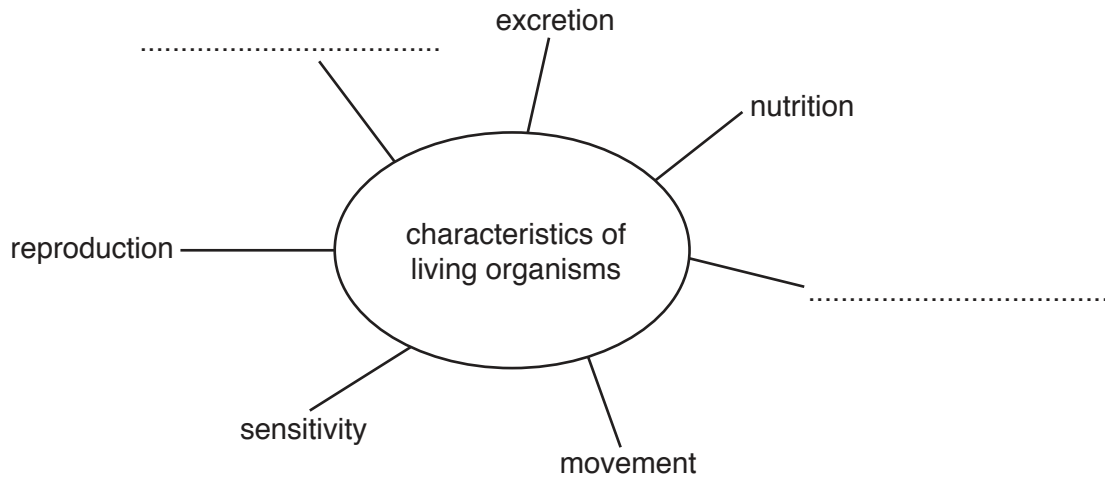


Fig. 1.1

- (i) Complete Fig. 1.1 by adding the **two** missing characteristics of living organisms. [2]
- (ii) Describe the differences in how plants and animals obtain their nutrition.

Plants obtain their nutrition by

.....

Animals obtain their nutrition by

.....

[2]

(b) Plants and animals can detect and respond to changes in their environment.

(i) Name this characteristic.

..... [1]

(ii) Use words in the list to complete the following sentences about plant responses.

You may use each word once, more than once or not at all.

- downwards gravitropism gravity photosynthesis
- phototropism sideways upwards

When a seed germinates in the soil the radicle (young root) grows

.....

This response is called When the plumule

(young shoot) is above ground it grows towards light. This response is called

.....

[3]

(c) Animals can use hormones to produce responses. An example of a hormone is adrenaline which is secreted into the blood when the body is under stress.

State **two** effects of adrenaline on the body.

1.

2.

[2]

[Total: 10]

2 (a) Sodium chloride is an ionic compound. It dissolves in water.

Water is a covalent compound.

(i) State the formula of sodium chloride.

..... [1]

(ii) Describe the formation of ionic bonds and of covalent bonds.

Use ideas about electrons in your answer.

ionic bonds

.....

.....

covalent bonds

.....

.....

[2]

(iii) Use the words *solvent*, *solute* and *solution* to describe sodium chloride, water and aqueous sodium chloride.

Sodium chloride is a

Water is a

Aqueous sodium chloride is a

[2]

(b) A student uses the apparatus shown in Fig. 2.1 for the electrolysis of concentrated aqueous sodium chloride.

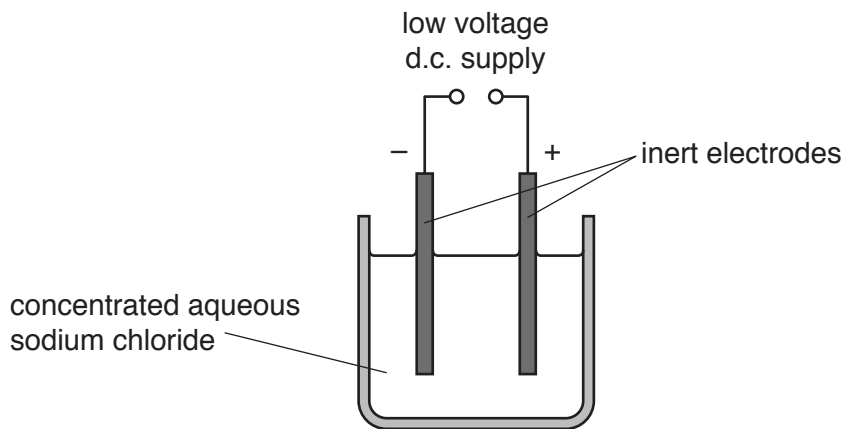


Fig. 2.1

- (i) State whether this electrolysis is a physical change or a chemical change.

Explain your answer.

change

explanation

..... [1]

- (ii) Name the non-metallic element used to make the inert electrodes.

..... [1]

- (iii) Name the positive and the negative electrodes.

positive

negative

[1]

- (iv) During this electrolysis two gases are produced.

Identify the gases produced at the positive and at the negative electrodes.

positive

negative

[2]

[Total: 10]

3 (a) Below is a list of some types of wave.

gamma infrared microwave sound
 ultraviolet visible light X-rays

State **one** wave from the list that is:

(i) **not** an electromagnetic wave

..... [1]

(ii) used in the transmission of satellite television

..... [1]

(iii) can cause sunburn.

..... [1]

(b) In some swimming pools a wave machine is used to generate water waves.

Fig. 3.1 shows how the machine's electric motor moves a large paddle backwards and forwards in the water to make the waves.

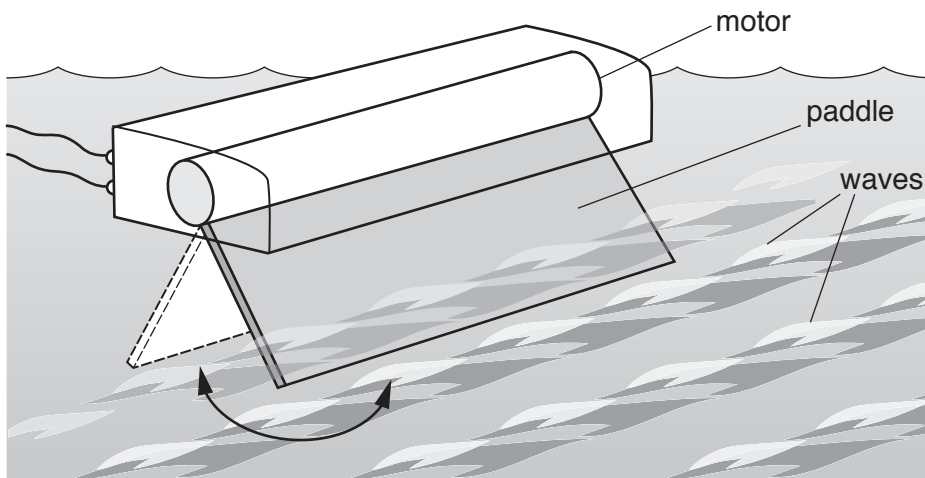


Fig. 3.1

Fig. 3.2 shows part of the circuit diagram for the electric motor.

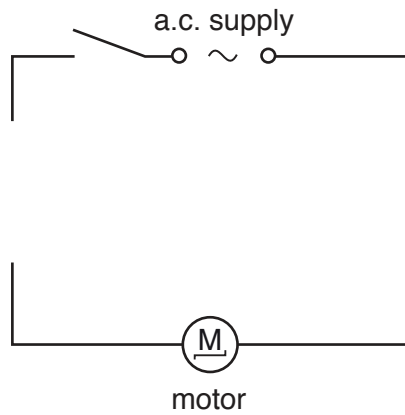


Fig. 3.2

On Fig. 3.2 complete the circuit diagram by adding the circuit symbols for:

1. an ammeter to measure the current through the motor
2. a circuit component that enables the value of the current in the circuit to be changed
3. a voltmeter to measure the voltage of the a.c. supply. [4]

(c) The motor speed is increased so the paddle moves faster.

Suggest **one** effect this will have on the waves produced by the paddle.

..... [1]

[Total: 8]

- 4 (a) When a banana is peeled the exposed surface turns from white to brown, as shown in Fig. 4.1.

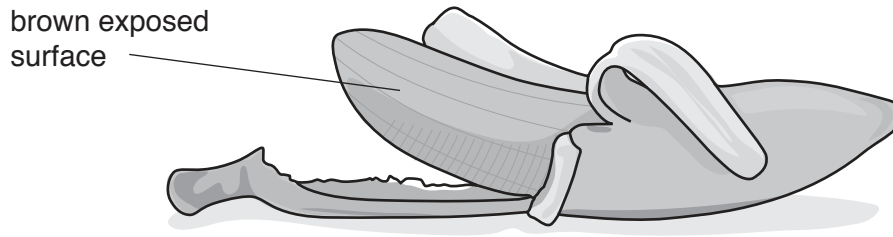


Fig. 4.1

A banana is cut into four equal slices. The slices are treated as shown in Fig. 4.2 and left in dishes on a laboratory bench for 30 minutes.

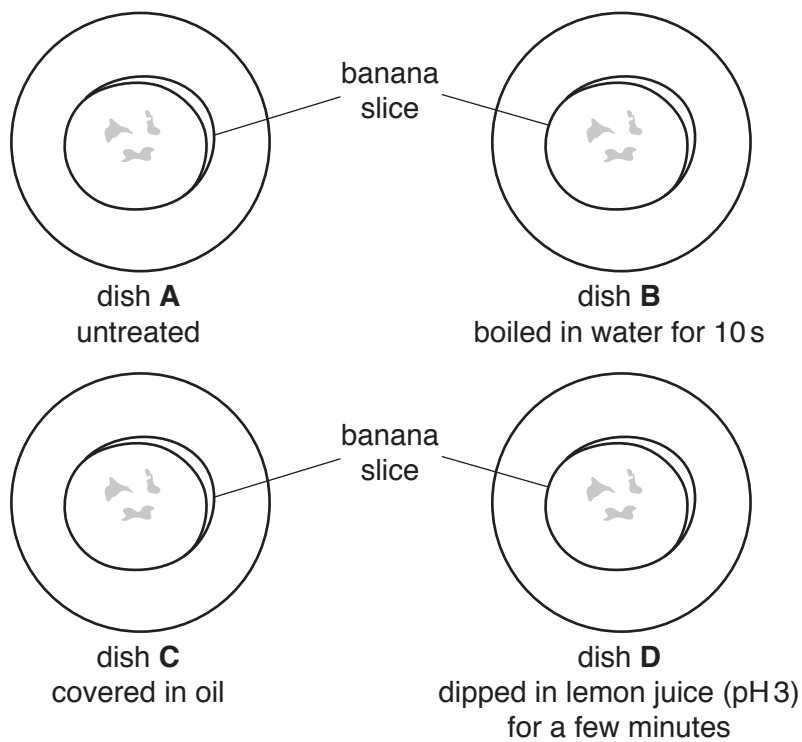


Fig. 4.2

The results are shown in Table 4.1.

Table 4.1

dish	colour of banana after 30 minutes
A	changes from white to brown
B	stays white
C	stays white
D	stays white

(i) Oxygen in the air is needed for a banana slice to change colour from white to brown.

Explain this using evidence from dish **C** in Fig. 4.2, and Table 4.1.

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

(ii) An enzyme is also needed for a banana slice to change colour from white to brown.

Explain this using evidence from dish **B** in Fig. 4.2 and Table 4.1.

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

(iii) Suggest why the banana does not go brown in dish **D**.

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

(b) When a boy eats the banana, it tastes sweet because it contains reducing sugar.

Describe the test for reducing sugar, and state the positive result.

test

result

[2]

[Total: 7]

- 5 (a) Petroleum contains hydrocarbons. These are separated into useful fractions by fractional distillation, as shown in Fig. 5.1.

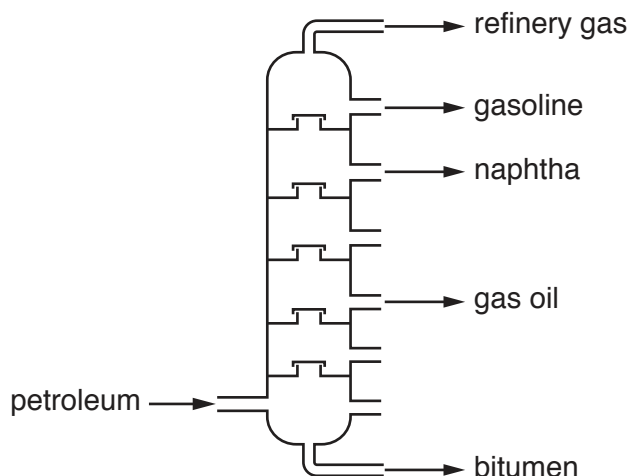


Fig. 5.1

- (i) Identify a fraction shown in Fig. 5.1 used for fuel in cars.
 [1]
- (ii) Identify a fraction shown in Fig. 5.1 used for bottled gas for heating and cooking.
 [1]
- (b) (i) Name the type of hydrocarbon which contains only single bonds.
 [1]
- (ii) Identify the products of the complete combustion of hydrocarbons.
 and [1]
- (c) Compound **X** is made from large hydrocarbon molecules in a reaction called cracking.
 Compound **X** reacts with aqueous bromine, changing it from orange to colourless.
 Molecules of compound **X** join together to form a polymer.
- (i) Suggest the identity of compound **X**.
 [1]
- (ii) State the type of polymerisation in which molecules of compound **X** form a polymer.
 [1]

(d) Hydrocarbon molecules contain atoms of the elements carbon and hydrogen only.

(i) A carbon atom has 6 electrons.

Complete Fig. 5.2 to show the electronic structure of this carbon atom.

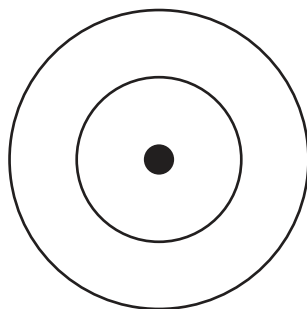


Fig. 5.2

[1]

(ii) Complete the dot-and-cross diagram in Fig. 5.3 to show the covalent bond in a molecule of hydrogen gas, H_2 .



Fig. 5.3

[1]

(iii) State why covalent bonds, rather than ionic bonds, form between carbon atoms and hydrogen atoms.

.....

..... [1]

[Total: 9]

6 (a) Fig. 6.1 shows the Celsius temperature scale from -273°C up to 300°C .

Six points on the scale are labelled **A**, **B**, **C**, **D**, **E** and **F**.

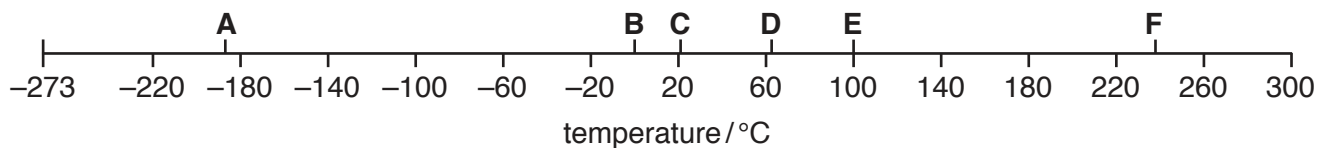


Fig. 6.1

On Fig. 6.2 draw lines to link each description to the letter showing the correct temperature in Fig. 6.1. One has been done for you.

description	temperature
melting point of ice	A
room temperature	B
boiling point of liquid air	C
boiling point of water	D
	E
	F

Fig. 6.2

[3]

(b) Fig. 6.3 and Fig. 6.4 show two different kinds of thermometer.

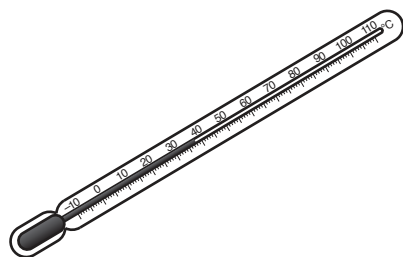


Fig. 6.3

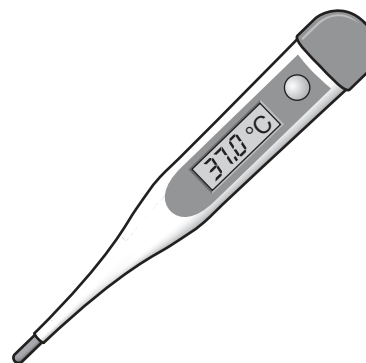


Fig. 6.4

(i) Describe the property of liquids that is used in the thermometer in Fig. 6.3.

.....
 [1]

(ii) The thermometer in Fig. 6.4 uses electrical properties to measure temperature.

Suggest an electrical property of materials that might change with temperature and so be used to measure temperature.

..... [1]

(c) The temperature at the surface of the Sun is nearly 6000 °C, so it is losing a lot of energy into space all the time.

(i) On Earth, people feel the thermal energy as the energy from the Sun falls on their skin.

State how energy from the Sun is transferred through space to the Earth.

..... [1]

(ii) The Sun is made of very hot gases. The centre of the Sun is hotter than the surface of the Sun.

Suggest the main method of thermal energy transfer from inside the Sun to the surface of the Sun.

Give a reason for your answer.

method

reason

..... [2]

[Total: 8]

- 7 (a) A person's balanced diet must contain all nutrients in the correct amounts according to the person's needs.

The person eats the meal shown in Fig. 7.1. The food items and the main nutrients they contain are labelled.

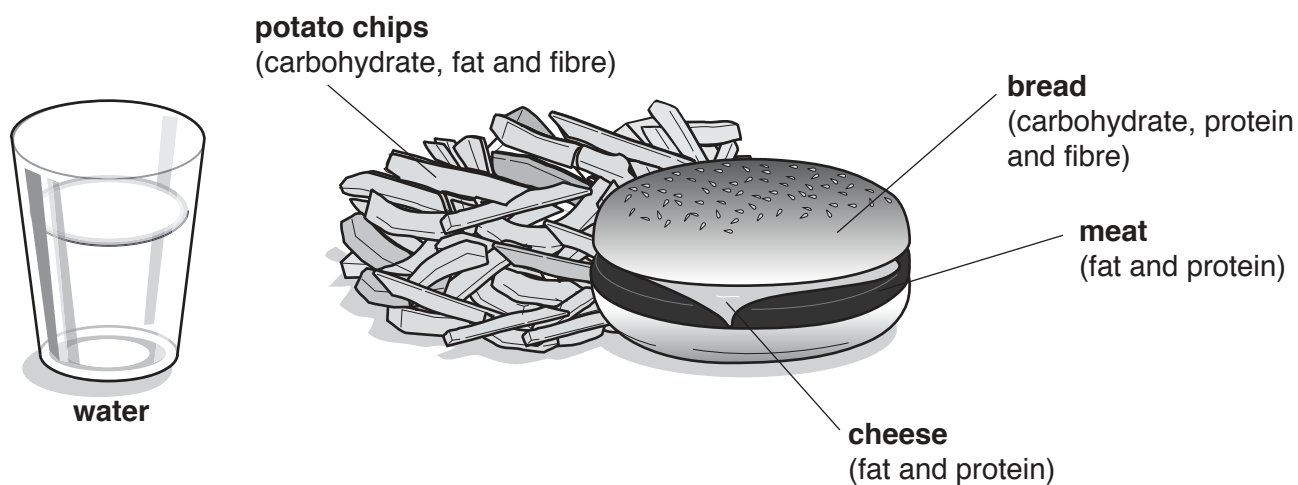


Fig. 7.1

- (i) State **two** reasons why the meal shown in Fig. 7.1 is unbalanced.

1.

2.

[2]

- (ii) Suggest **one** food the person can add to the meal to make it balanced.

Explain your answer.

food

explanation.....

.....

[2]

- (b) Some carbohydrates have small molecules, others have very large molecules called polymers which are made when many glucose molecules join together.

Fig. 7.2 shows a molecule of glucose, and a part of a polymer of glucose.

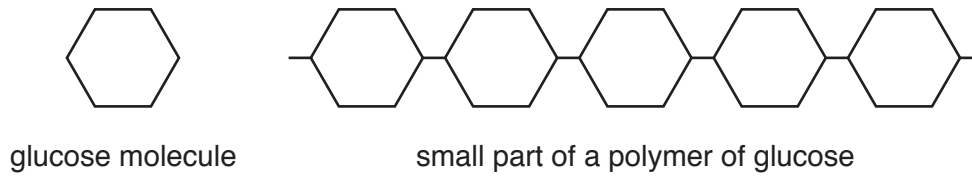


Fig. 7.2

- (i) Underline the names of **two** polymers of glucose in the list.

amino acid fat enzyme glycogen hormone
oil protein starch sugar

[2]

- (ii) Explain why chemical digestion of large molecules is needed in the alimentary canal.

.....

 [2]

- (iii) State **two** areas in the alimentary canal where chemical digestion takes place.

1.
 2. [2]

[Total: 10]

8 (a) Aluminium reacts with iron oxide to form iron in an exothermic reaction.

Aluminium does not react with calcium oxide.

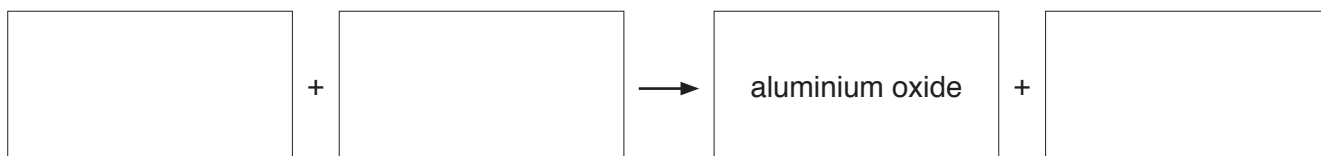
(i) Place the three metals, aluminium, iron and calcium, in order from most to least reactive.

..... most reactive

 least reactive

[1]

(ii) Complete the word equation for the reaction between aluminium and iron oxide.



[2]

(iii) State whether aluminium is oxidised or reduced during this reaction.

Explain your answer.

aluminium is

explanation

[1]

(b) Copper oxide, CuO, contains copper(II) ions.

When copper oxide is mixed with carbon, there is no reaction.

(i) State what must be done to this mixture to obtain copper.

..... [1]

(ii) State the test for copper(II) ions.

Give the result that shows the presence of copper(II) ions.

test

result

[2]

[Total: 7]

9 Fig. 9.1 shows a forklift truck moving a large heavy box towards a shelf.

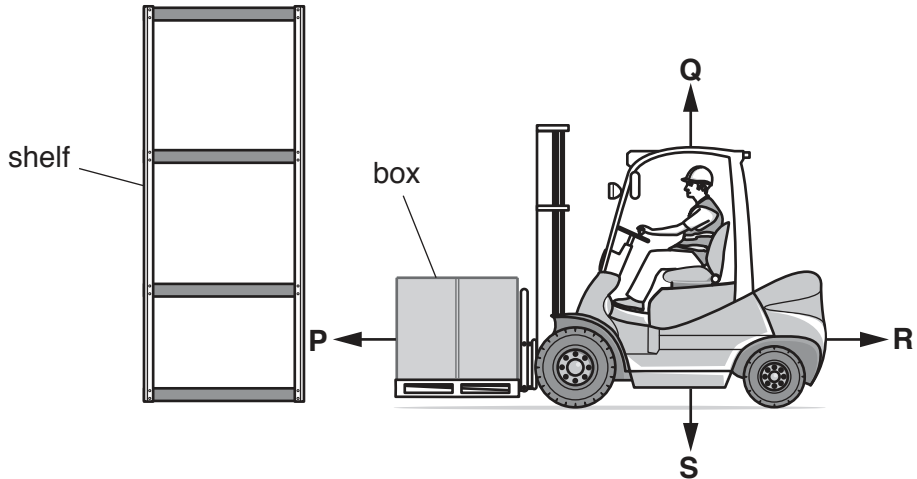


Fig. 9.1

(a) The arrows labelled **P**, **Q**, **R** and **S** show four forces acting on the forklift truck.

(i) State which letter represents the frictional forces acting on the moving truck.

..... [1]

(ii) The truck stops and the motor is switched off. State the letters of all the forces that now have a value of 0N.

..... [1]

(b) The box has a mass of 500 kg.

The forklift truck lifts the box upwards from rest on the ground using a force to push the box up. Fig. 9.2 shows the directions of the forces acting on the box.

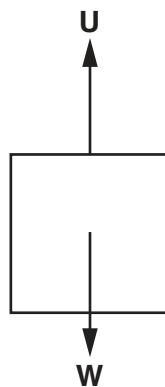


Fig. 9.2

(i) The gravitational field strength g is 10 N/kg.

Calculate the weight **W** of the box.

W = N [1]

- (ii) State how the upward force **U** on the box compares with the weight **W** of the box as the box begins to move upwards.

..... [1]

- (iii) The truck lifts the box towards two shelves, one at 1 m above the ground, the other at 3 m above the ground.

Compare the work required to lift the box from the ground to the higher shelf with the work required to lift the box from the ground to the lower shelf.

Explain your answer.

.....

 [2]

- (c) The truck is driven a distance of 225 m to collect another box.

Fig. 9.3 shows the speed–time graph for this journey.

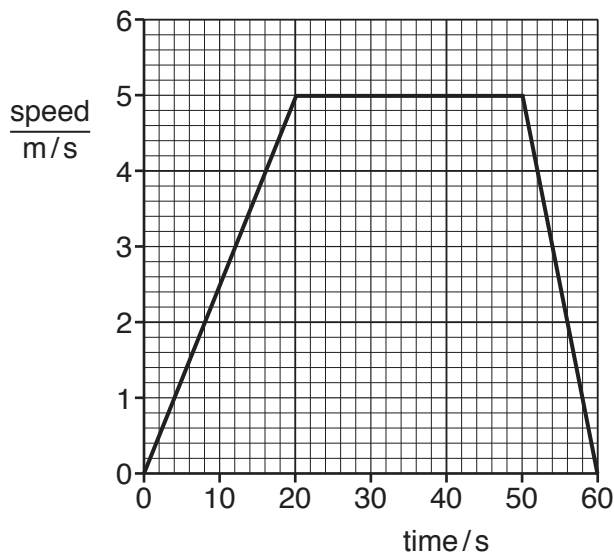


Fig. 9.3

- (i) Calculate the average speed of the truck on this journey.

Show your working.

average speed = m/s [2]

- (ii) Describe the motion of the truck between 0 s and 20 s.

..... [1]

(iii) The truck is driven by an electric motor powered by a battery.

Complete the energy transfers involved.

from energy in the battery

to energy driving the motor

to kinetic energy of the truck.

[2]

[Total: 11]

The Periodic Table of Elements

		Group															
I	II											III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										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 —				

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
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 —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).