Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

2897005728

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **October/November 2016**

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 24.

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.

1 Fig. 1.1 shows a wireless doorbell to alert people inside the house to someone coming to visit.

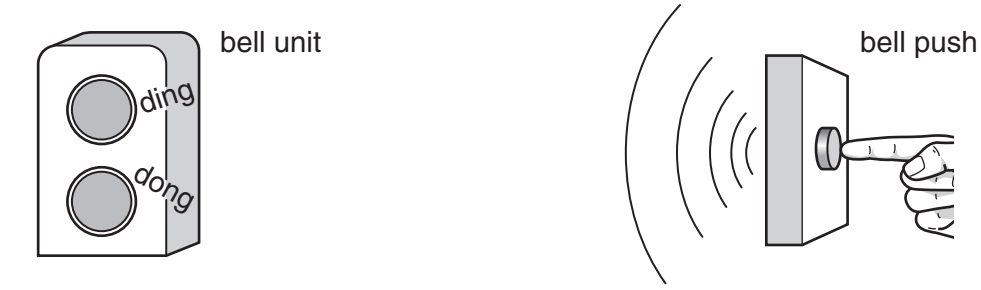


Fig. 1.1

When the button in the bell push is pressed, a radio signal is sent to the bell unit, and the bell sounds.

(a) Table 1.1 shows part of the electromagnetic spectrum.

Table 1.1

	X-rays	ultraviolet		infra-red		

highest frequency ⟷ lowest frequency

In Table 1.1, write the name of the electromagnetic waves used for radio signals in the correct position in the electromagnetic spectrum. [1]

(b) The bell push contains an electrical circuit including a source of stored energy.

(i) Name the component in an electrical circuit that provides the energy.

.....[1]

(ii) Name the form of energy stored in the component named in **(b)(i)**.

.....[1]

(c) The bell unit also contains an electrical circuit.

Fig. 1.2 shows two different bells, **A** and **B,** inside the bell unit. When the radio signal is received, an arm moves and hits the two bells.

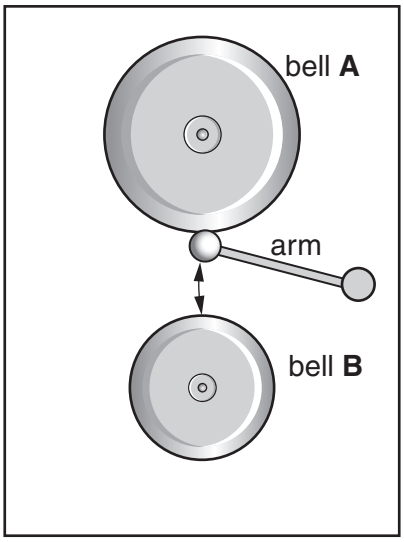


Fig. 1.2

(i) Complete the sequence of useful energy transfers when someone hears the bells.

from ...electrical..... energy

to ..... energy

to ..... energy. [2]

(ii) Bell **A** emits a loud sound of frequency 500 Hz.

Bell **B** emits a quieter sound of frequency 250 Hz.

State which bell, **A** or **B**, produces the sound with the

1. higher pitch, ...

2. larger amplitude. .....

[1]

(d) Fig. 1.3 shows a mains powered bell unit plugged into the mains electricity supply at 220 V in a kitchen.

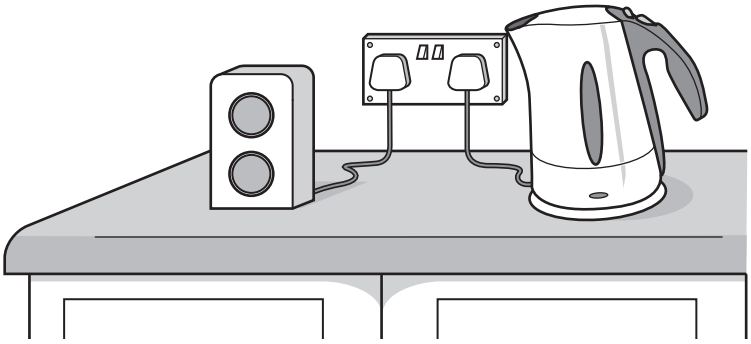


Fig. 1.3

(i) There are hazards when using any appliance connected to the mains electricity supply.

Describe **one** electrical hazard that might affect the bell unit shown in Fig. 1.3.

.....

.....[1]

(ii) Name a safety component you would expect to find in the bell unit.

.....[1]

(e) The bell push also contains a small lamp which lights up when the bell sounds.

Fig. 1.4 shows a lens in front of the lamp. The light from the lamp is concentrated by the lens to form a parallel beam.

(i) On Fig. 1.4, draw rays to show how the light from the lamp emerges from the lens as a parallel beam.

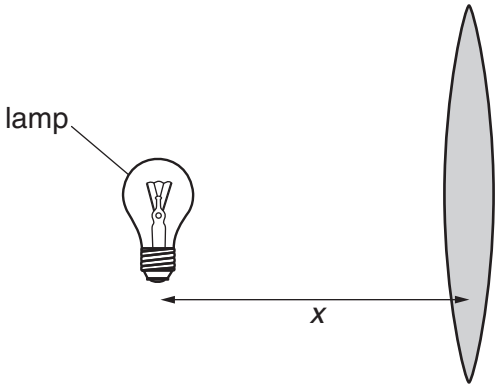


Fig. 1.4

[1]

(ii) State the name of distance *x* shown on Fig. 1.4.

.....[1]

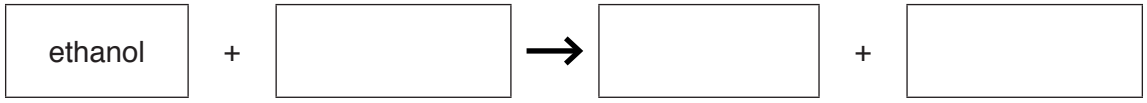
2 **(a)** A molecule of ethanol contains two carbon atoms, six hydrogen atoms and one oxygen atom.

Deduce the formula of ethanol.

..... [1]

(b) Ethanol burns completely to form carbon dioxide and water.

Complete the word equation for this reaction.



[2]

(c) Complete Table 2.1 to show the chemical tests and the results for carbon dioxide and for oxygen.

Table 2.1

	test	result
carbon dioxide		
oxygen		

[4]

(d) The combustion of ethanol is exothermic.

Describe the temperature change in an exothermic reaction.

.....[1]

(e) A mixture contains liquid ethanol and water.

Name the process that is used to separate two liquids in a mixture.

.....[1]

3 Fig. 3.1 shows a plant palisade cell as seen under the microscope.

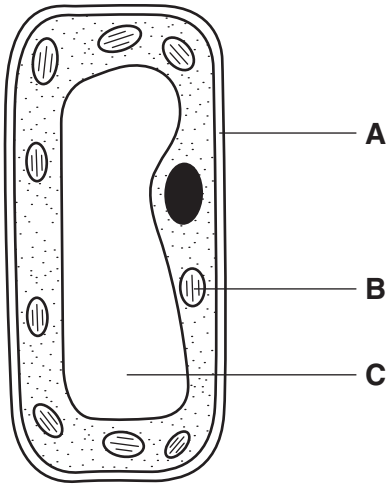


Fig. 3.1

(a) Name the cell parts **A**, **B** and **C**.

A .....

B .....

C ..... [3]

(b) The cell in Fig. 3.1 is found in the leaf. Fig. 3.2 shows a cross-section of a leaf with most of the cells missing.

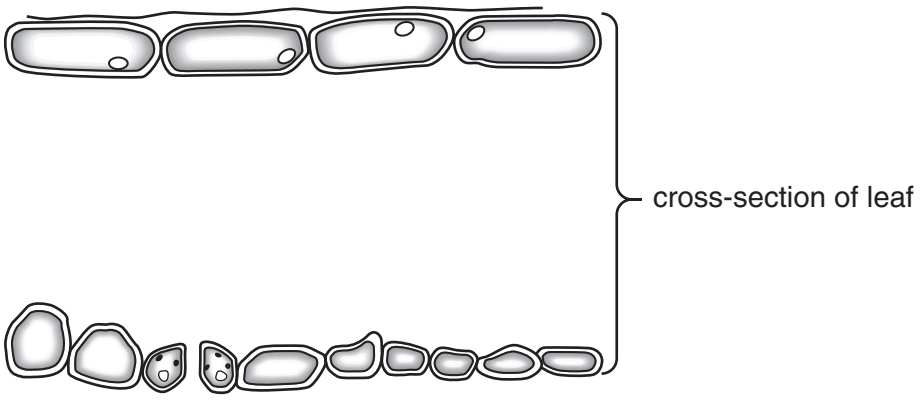


Fig. 3.2

(i) On Fig. 3.2 label the cuticle of the leaf. [1]

(ii) Draw the outline of the cell shown in Fig. 3.1 on the diagram of the leaf in Fig. 3.2 to show where the cell is found. [1]

(c) There are many palisade cells in the leaf. They carry out photosynthesis.

Complete the word equation for photosynthesis.

carbon dioxide + water → .....[1]

(d) The palisade cells need a supply of carbon dioxide and water for photosynthesis.

Describe how each of these substances is supplied to the cells.

carbon dioxide .....

.....

.....

water .....

.....

.....[4]

4 Fig. 4.1 shows an electric iron for smoothing clothes. An electric heater inside the iron is connected to the mains electricity supply.

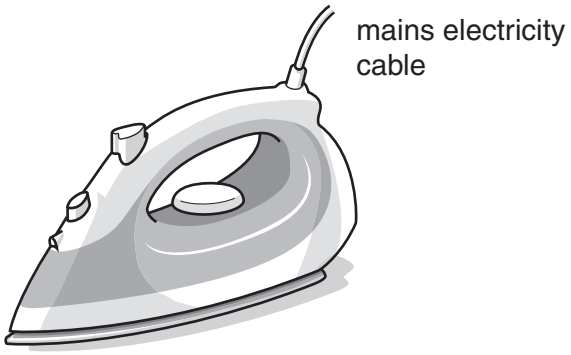


Fig. 4.1

(a) The heating element inside the electric iron is made of two long thin wires.

The wires are connected in parallel with each other, and connected to the mains a.c. power supply through a switch.

In Fig. 4.2 complete the circuit diagram for this arrangement. Use the resistor symbol to represent each of the wires connected in parallel.

Fig. 4.2

[3]

(b) The thermal energy from the heating element is transferred through a thin solid metal base to the clothes being ironed.

(i) Name the method of thermal energy transfer through the base of the iron.

.....[1]

(ii) The base is made of steel of density 8.0 g / cm^3.

The mass of the base is 128 g.

Calculate the volume of the base.

State the formula that you use and show your working.

formula

working

volume = ... cm^3 [2]

(iii) The area of the base of the iron is 160 cm^2.

Use your answer to **(ii)** to calculate the average thickness of the base.

Show your working.

thickness = ... cm [1]

(c) A steam iron uses steam to help iron the clothes.

Fig. 4.3 below shows a close-up of the molecules of steam and water in a steam iron. Some molecules have been drawn above and below the surface of the water.

Draw 4 more molecules to show the arrangement in the steam above the water surface.

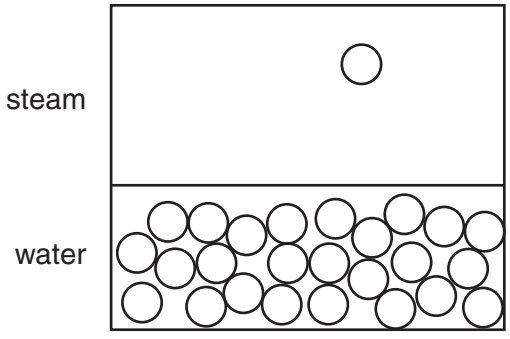


Fig. 4.3 [1]

(d) Fig. 4.4a and Fig. 4.4b show another switch included inside the iron to control the temperature.

This type of switch uses a bimetallic strip, made of two different metals, brass and steel, joined together.

Fig. 4.4a shows the switch when the iron is cold.

Fig. 4.4b shows the switch when the iron has reached the correct temperature for ironing.

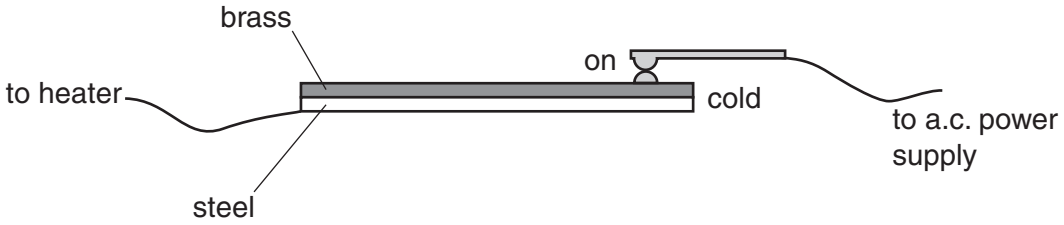


Fig. 4.4a

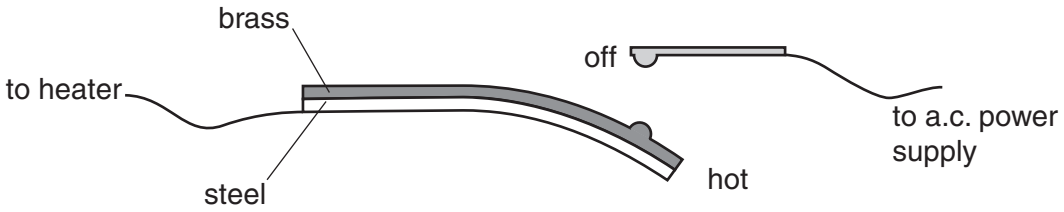


Fig. 4.4b

Explain why this bimetallic strip switches off the heating element when the temperature increases.

.....

.....

.....

.....[2]

Please turn over for Question 5.

5 Fig. 5.1 shows the apparatus used to pass an electric current through an aqueous copper chloride solution.

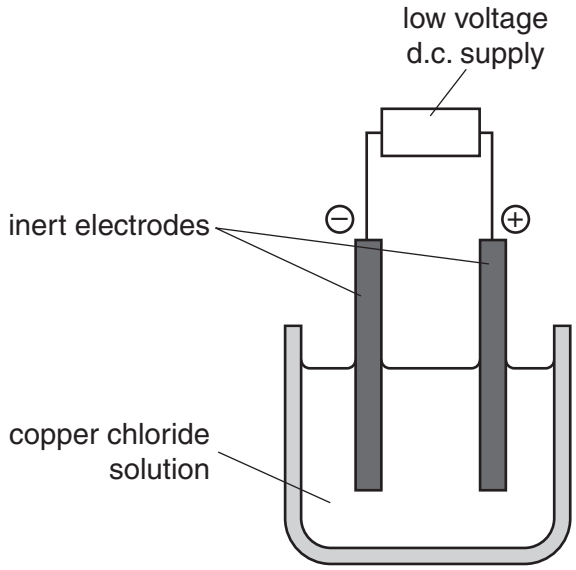


Fig. 5.1

(a) Complete the sentences.

The positive electrode is called the ..... and the negative

electrode is called the ..... .

The solution through which the electric current passes is called the

..... . [3]

(b) Name the substances formed at each electrode.

positive electrode .....

negative electrode .....[2]

(c) Copper chloride is made in the reaction between copper oxide and dilute hydrochloric acid.

copper oxide + hydrochloric acid $\rightarrow$ copper chloride + water

(i) Name **one other** compound that reacts with dilute hydrochloric acid to form copper chloride.

.....[1]

(ii) The speed of a reaction is increased by stirring.

Suggest **one other** way of increasing the speed of a reaction.

.....[1]

(d) Copper is a transition element.

Sodium is in Group I of the Periodic Table.

Copper is more dense than sodium.

Copper is less reactive than sodium.

State **two other** properties of copper that are different from the properties of sodium.

1. .....

2. .....
[2]

(e) Bronze is an alloy made by mixing copper and tin.

Explain why ancient cutting tools were made of bronze rather than pure copper.

.....

.....[1]

[Turn over

6 Fig. 6.1 is a diagram of an alveolus in the lungs.

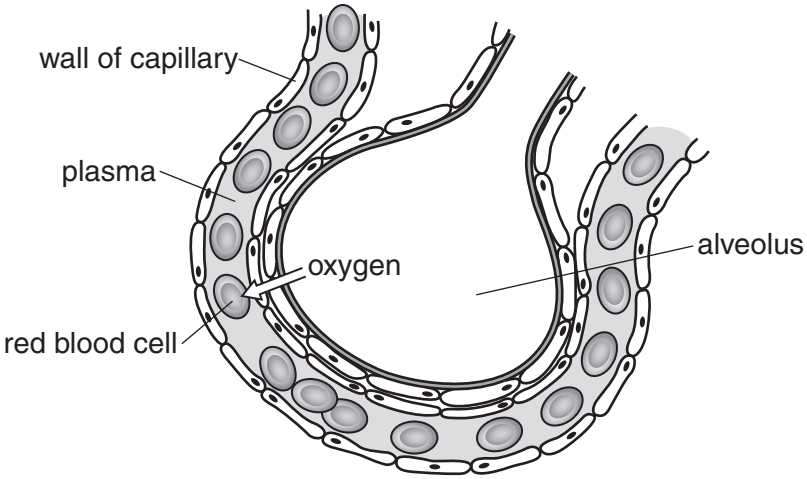


Fig. 6.1

(a) An arrow in Fig. 6.1 shows the diffusion of oxygen.

Draw another arrow to show the diffusion of carbon dioxide. [1]

(b) A student uses a machine to measure the volume of air breathed in and out of his lungs. The machine produces a graph showing the results.

Fig. 6.2 shows how the volume of his lungs changes as he breathes in and out while resting.

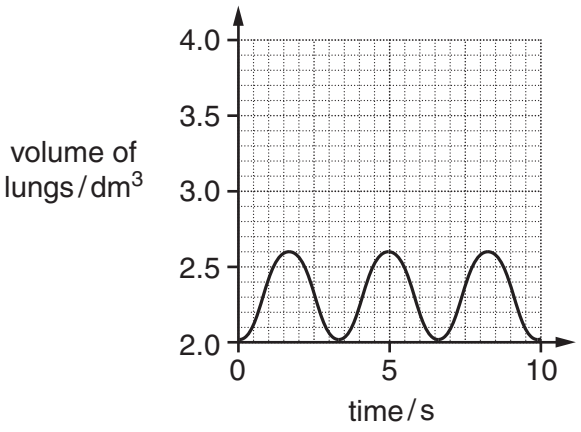


Fig. 6.2

(i) State the volume of air he breathes in with each breath.

volume = ... dm^3 [1]

(ii) Calculate the total volume that he breathes in during ten seconds.

Show your working.

total volume = ... dm^3 [1]

(c) The student then does a running exercise. His breathing pattern changes.

Fig. 6.3 shows how the volume of his lungs changes as he breathes in and out while exercising.

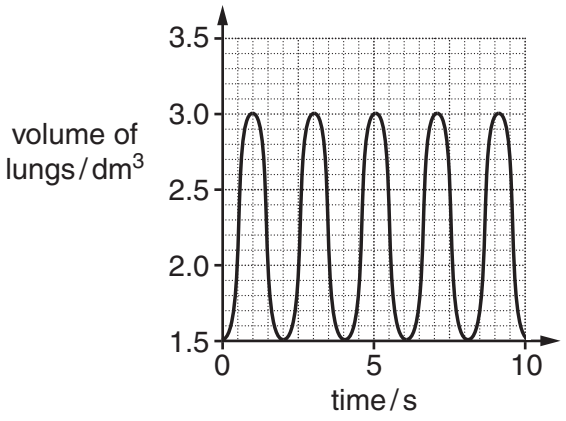


Fig. 6.3

Describe **two** ways in which the student's breathing changes when he starts to exercise.

1. .....

2. .....
[2]

(d) The student uses oxygen to release energy through respiration.

State **two** uses in humans of the energy released by respiration.

1. .....

2. .....
[2]

7 A boy uses a catapult to launch a ball vertically upwards as shown in Fig. 7.1.

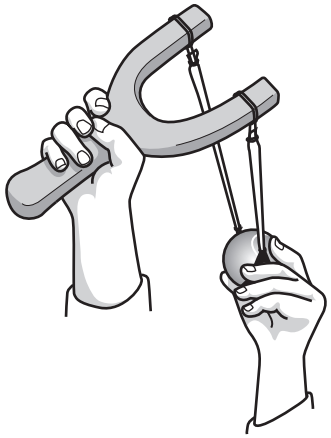


Fig. 7.1

The boy places a ball of mass 0.055 kg in the catapult.

He applies a force to stretch the elastic cords before the ball is launched. This is shown in Fig. 7.2.

When the elastic cords are fully stretched, the boy holds the ball at rest in the catapult.

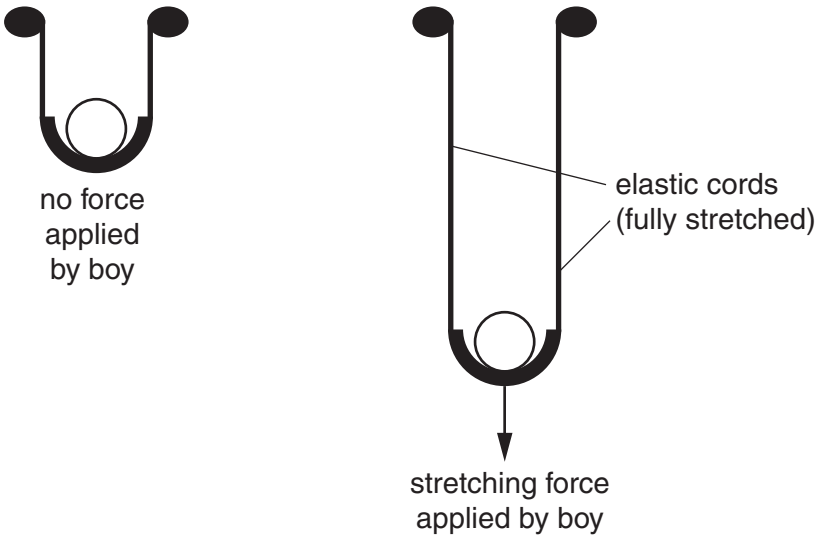


Fig. 7.2

(a) (i) State the name of the unit of force.

.....[1]

(ii) Before the boy stretches the catapult, there is already a small force stretching the elastic cords.

State the name of this force.

.....[1]

(b) Fig. 7.3 shows part of a force (load)/extension graph for the elastic cords.

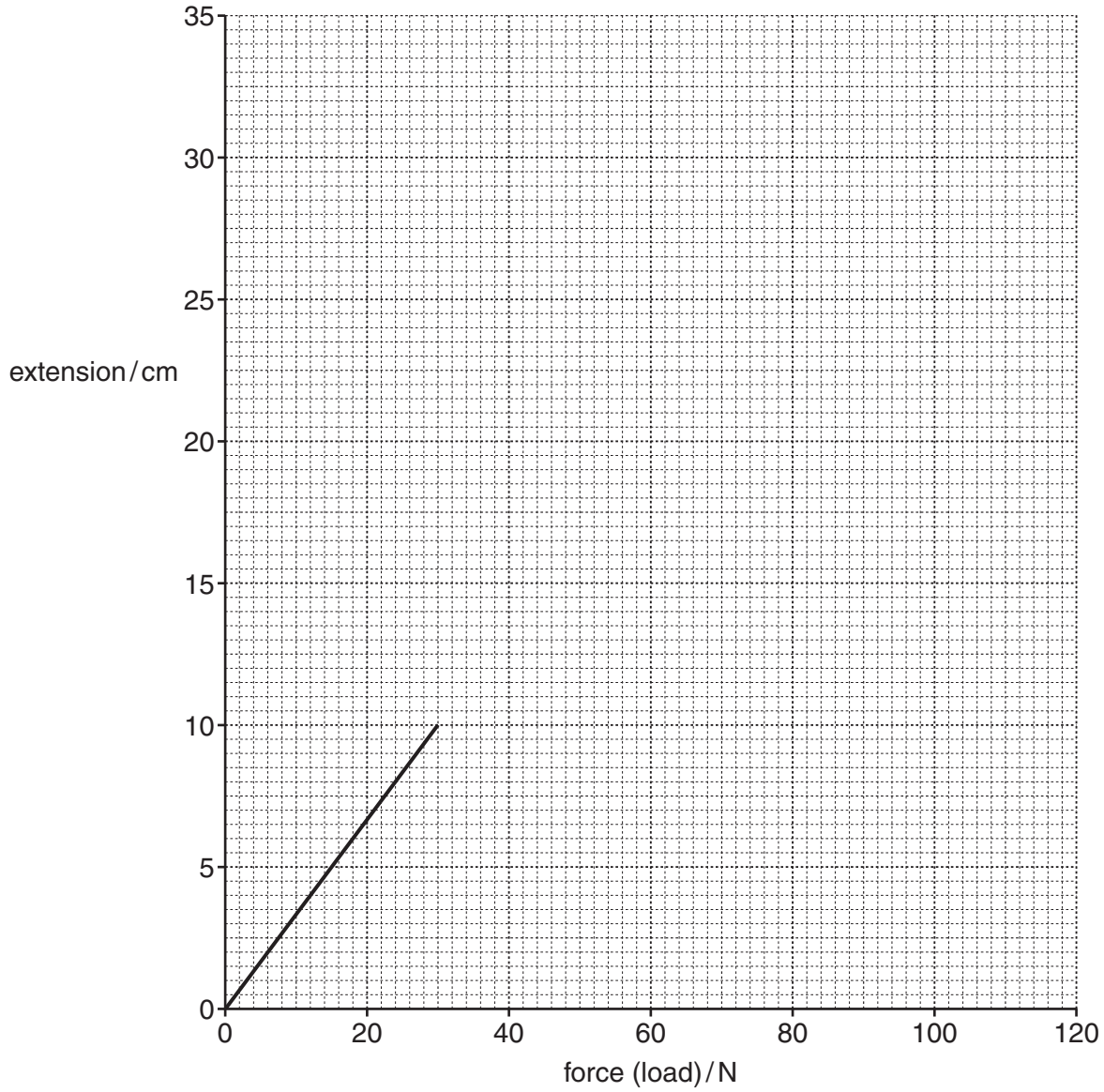


Fig. 7.3

When a force of 45 N is applied, the extension is 15 cm.

When a force of 60 N is applied, the extension is 20 cm.

(i) On Fig. 7.3 plot this data and draw the line of best fit. [2]

(ii) Predict the extension when a force of 90 N is applied.

extension = ...cm [1]

[Turn over

(c) As the elastic stretches, the forces in the two elastic cords change.

When the cords are fully stretched by a total force of 100 N, the boy holds the ball without moving the catapult.

State the total upward force exerted by the elastic cords.
Give a reason for your answer.

total upward force = ... N

reason .....

.....[2]

8 Petroleum is a mixture of hydrocarbons. Fig. 8.1 shows how it is separated.

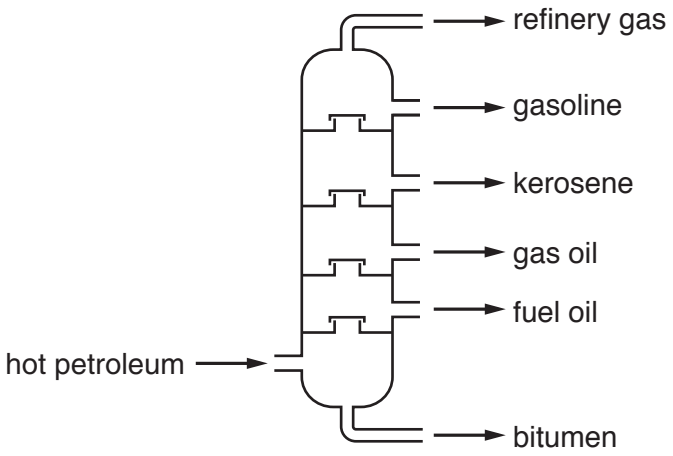


Fig. 8.1

(a) Explain why this process is described as a physical change and not a chemical change.

.....

.....[1]

(b) State what is meant by the term *hydrocarbon*.

.....

.....[2]

(c) Suggest **one** use for each of the three substances below.

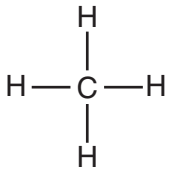
refinery gas .....

gasoline .....

gas oil .....[3]

(d) Methane, CH_4, and ethane, C_2H_6, are found in petroleum.

The structure of methane is shown in Fig. 8.2.



methane

Fig. 8.2

Complete the structure of ethane below.

ethane

[2]

9 Fig. 9.1 shows a food web in a lake.

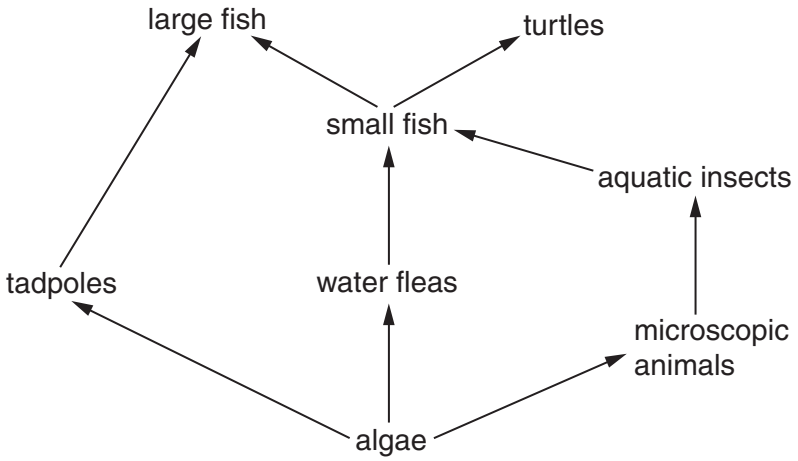


Fig. 9.1

(a) Define the term *food web*.

.....

.....

.....[2]

(b) Use the words or phrases in the list below to complete the following sentences.

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

consumers **Earth** **environment** **lake** **parasites**

producers **turtles** **Sun** **water fleas**

The source of energy for this food web is the ..... . The algae are ..... because they make their own food by photosynthesis. All the remaining organisms are ..... . In this food web ..... are an example of herbivores and ..... are an example of carnivores. [5]

(c) Later in the year the tadpoles develop into frogs and leave the lake.

Predict and explain how this would affect

(i) the algae,

.....

.....

.....[1]

(ii) the large fish.

.....

.....

.....[1]

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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.)