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**COMBINED SCIENCE**

**0653/32**

Paper 3 (Core)

**October/November 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 **19** printed pages and **1** blank page.

1 (a) Fig. 1.1 shows two cells.

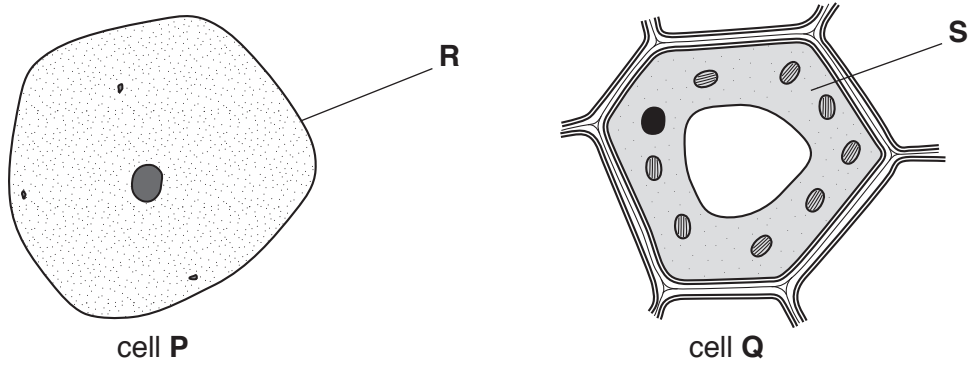


Fig. 1.1 (not to scale)

(i) Identify structures R and S, as shown on Fig. 1.1.

R .....

S .....

[2]

(ii) Cell Q is a plant cell.

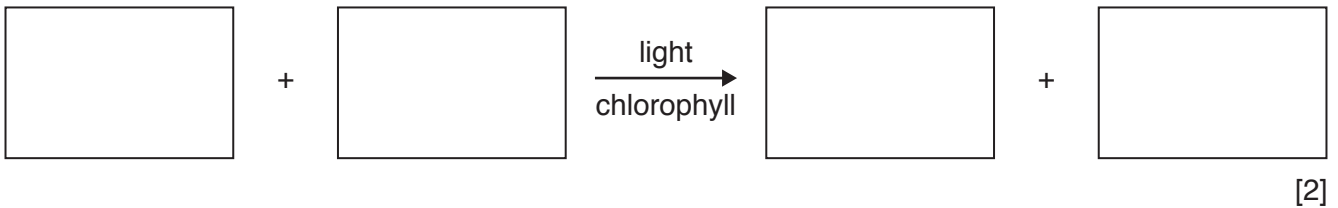
State **two** pieces of evidence from Fig. 1.1 that support this statement.

1. ....

2. ....

[2]

(b) Complete the word equation for photosynthesis.



(c) One of the food chains in a garden is shown in Fig. 1.2.

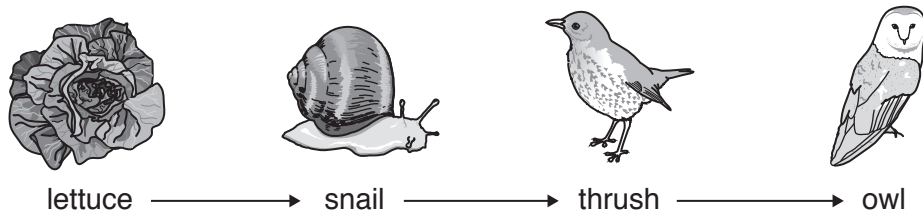


Fig. 1.2

(i) Name **one** organism in the food chain shown in Fig. 1.2 which is a herbivore.

..... [1]

(ii) Name **one** organism in the food chain shown in Fig. 1.2 which is a secondary consumer.

..... [1]

(iii) A gardener removes the lettuces.

Suggest what happens to the number of snails.

Explain your answer.

the number of snails will .....

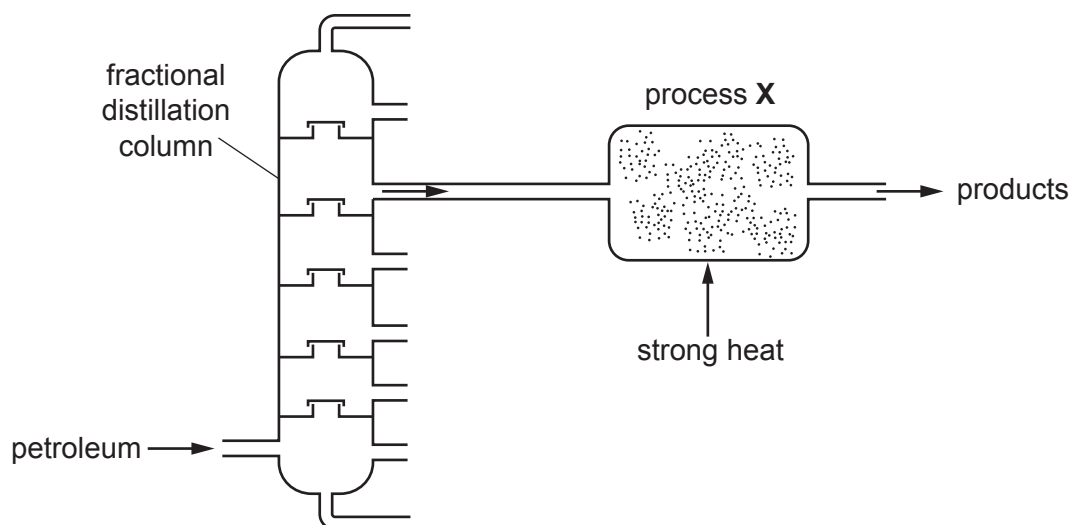
explanation .....

..... [1]

[Total: 9]

2 Petroleum is a mixture of compounds which are separated in a fractional distillation column.

Process **X** changes molecules in one fraction, as shown in Fig. 2.1.



**Fig. 2.1**

(a) The products of process **X** include alkenes.

(i) Identify process **X**.

..... [1]

(ii) Describe the colour change that is seen when aqueous bromine is mixed with an alkene.

from ..... to ..... [2]

(iii) Name the substance that is formed by the addition polymerisation of ethene.

..... [1]

(b) Most of the compounds in petroleum are alkanes.

Alkanes and alkenes contain carbon and hydrogen atoms only.

(i) Name the type of compound that contains carbon and hydrogen atoms only.

..... [1]

(ii) State the type of chemical bond that forms between carbon and hydrogen atoms.

..... [1]

(iii) Identify the **two** products of the complete combustion of alkanes.

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

(iv) The formula of methane is CH<sub>4</sub>.

Complete the dot-and-cross diagram to show the shared electron pairs in a molecule of methane.

H

C

[2]

[Total: 10]

3 Fig. 3.1 shows a game played on a sloping board.

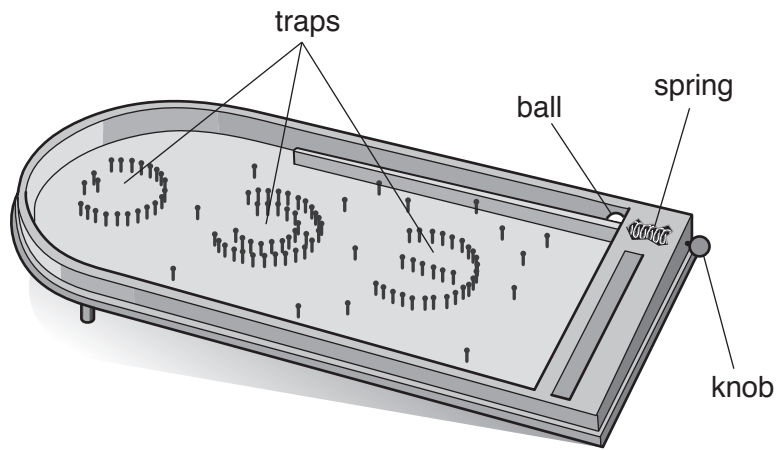


Fig. 3.1

A ball is launched by a spring up the slope and around the top of the board. The ball then rolls down the slope to fall into one of the traps.

(a) Fig. 3.2 shows the compressed spring when the knob is pulled back.

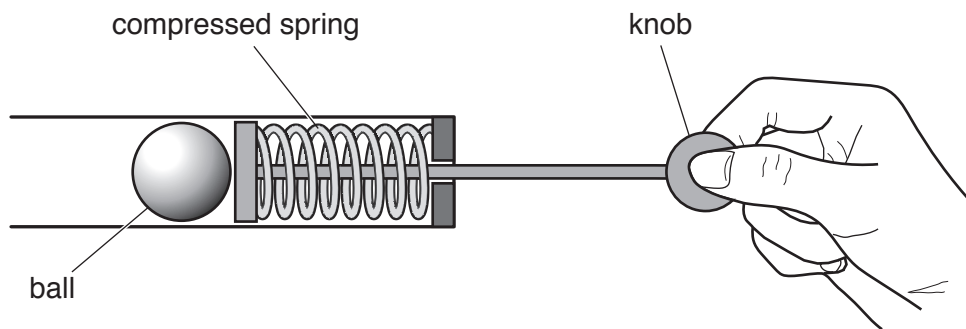


Fig. 3.2

Fig. 3.3 shows the spring before it is compressed.

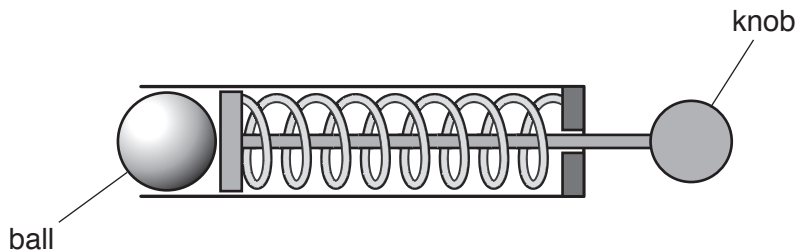


Fig. 3.3

(i) On Fig. 3.3 draw a force arrow to show the direction of the force used to compress the spring. [1]

(ii) State **two** effects that a force can have on an object.

1. ....

2. ....

[2]

(iii) As the spring is pulled back, work is done.

State the **two** quantities that are needed to calculate the work done.

1. ....

2. ....

[2]

(b) When the ball is launched up the slope, energy is transferred from the compressed spring to the ball. The energy of the ball changes as it moves up the slope to other types of energy.

Complete the sequence of energy changes. One has been done for you.

from ..... *elastic* ..... potential energy in the spring

to ..... energy of the ball as it begins to move up the slope

to ..... potential energy as the ball slows down going up the slope

and ..... *thermal* ..... energy lost to the environment

[2]

(c) The ball is made from steel.

The mass of the ball is 6.0g.

The volume of the ball is 0.75 cm<sup>3</sup>.

Calculate the density of the steel ball. Show your working.

density = ..... g/cm<sup>3</sup> [2]

[Total: 9]

4 (a) Fig. 4.1 is a diagram of an insect-pollinated flower.

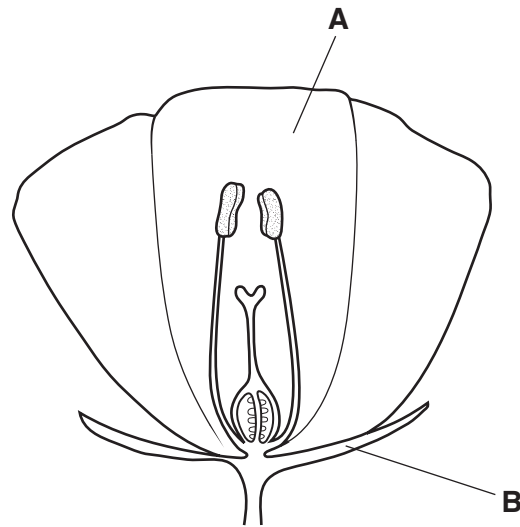


Fig. 4.1

(i) Name parts **A** and **B** shown in Fig. 4.1.

**A** .....

**B** .....

[2]

(ii) Describe what happens during fertilisation in the flower.

.....

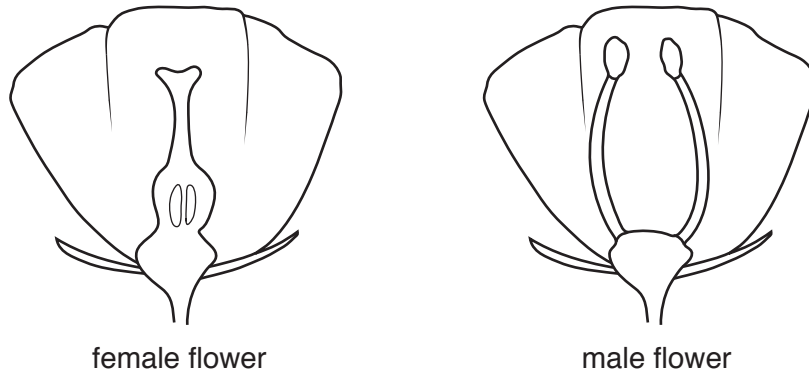
.....

..... [2]



(b) Some plants produce two different types of flowers on the same plant.

These flowers have either the male or female reproductive parts, as shown in Fig. 4.2.



**Fig. 4.2**

(i) Name **one** reproductive part of the **female** flower.

..... [1]

(ii) Name **one** reproductive part of the **male** flower.

..... [1]

(c) Fertilisation takes place in the reproductive system of the human female.

(i) State where fertilisation takes place in the human female reproductive system.

..... [1]

(ii) State the name of the fertilised egg which develops into the embryo.

..... [1]

(iii) Describe where the embryo continues its development.

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

[Total: 10]

- 5 (a) The electrolysis of concentrated aqueous sodium chloride is shown in Fig. 5.1.

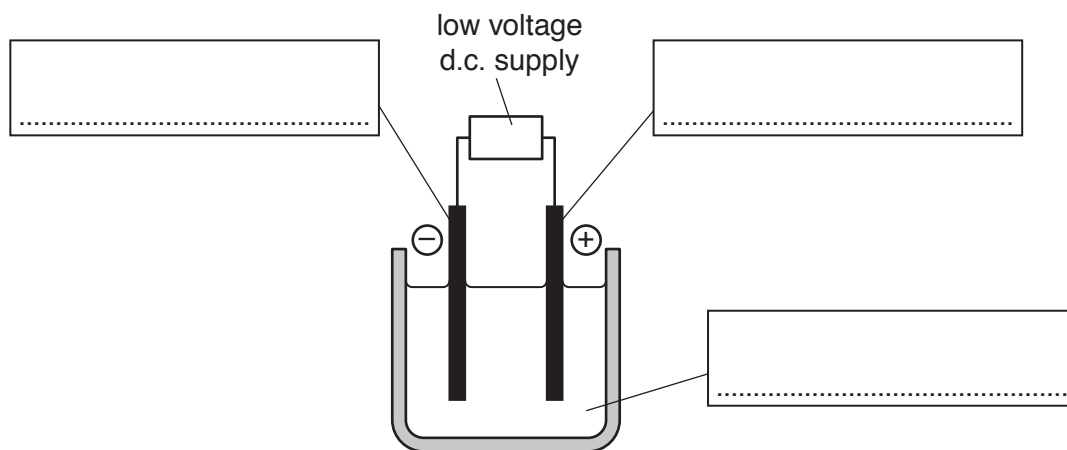


Fig. 5.1

- (i) Complete Fig. 5.1 by adding the labels *anode*, *cathode* and *electrolyte*. [2]

- (ii) One of the products of this electrolysis is chlorine gas.

Identify the **two** other products.

1. ....

2. ....

[2]

- (iii) Describe a chemical test for chlorine gas and state the positive result.

test .....

.....

result .....

[2]

- (b) An atom of sodium has atomic number 11 and nucleon number 23.

State the number of protons and the number of neutrons in this atom of sodium.

protons .....

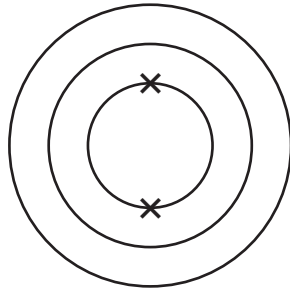
neutrons .....

[2]

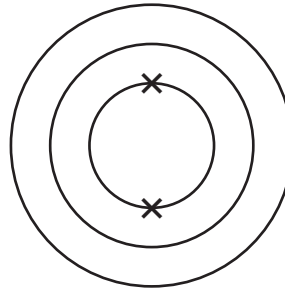
(c) A chlorine atom has 17 electrons.

A chloride ion has the symbol  $Cl^-$ .

Complete Fig. 5.2 to show the electron arrangements in a chlorine atom and in a chloride ion.



chlorine atom



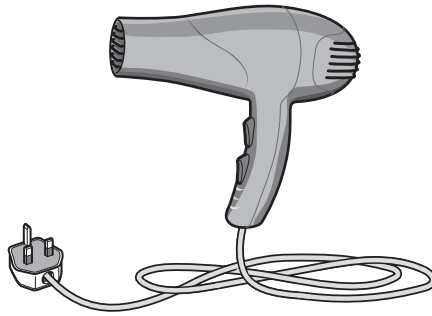
chloride ion

Fig. 5.2

[2]

[Total: 10]

6 Fig. 6.1 shows an electric hair dryer.



**Fig. 6.1**

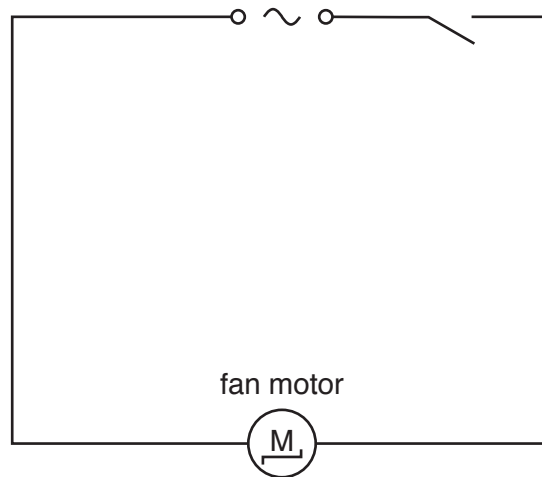
The hair dryer contains:

- an electrical heater to heat the air used to dry the hair
- a fan driven by the electric motor in the circuit to blow the air over the wet hair.


When the heater is switched off, the fan blows cool air over the hair.

When the heater is switched on, hot air is blown over the hair.

**(a)** Fig. 6.2 shows an incomplete circuit diagram for the hair dryer.



**Fig. 6.2**

The circuit symbol for a heater is 

On Fig. 6.2 complete the circuit diagram to show:

- how the heater is connected
- how the heater can be switched off so the fan only blows cool air.

[2]

(b) The hair dryer operates from a 240 V supply. The current through the hair dryer is 3.0 A.

(i) Calculate the total resistance of the circuit.

Show your working and state the unit of your answer.

resistance = ..... unit ..... [3]

(ii) Circle the correct fuse value to use in the hair dryer.

1 A          3 A          5 A          10 A          13 A          [1]

(c) Wet hair will dry without the use of a hair dryer.

(i) Name the process by which hair dries.

..... [1]

(ii) Describe in terms of water molecules how this process causes wet hair to dry.

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

(iii) When hair is dried without using a dryer, the head feels colder as the hair dries.

Explain why the head feels colder.

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

[Total: 10]

7 (a) Chemical digestion occurs in the alimentary canal.

Use words from the list to complete the sentence about chemical digestion.

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

- absorbed      atoms      egested      excreted**  
**ions      molecules**

Chemical digestion in the alimentary canal produces small, soluble

..... that can be .....

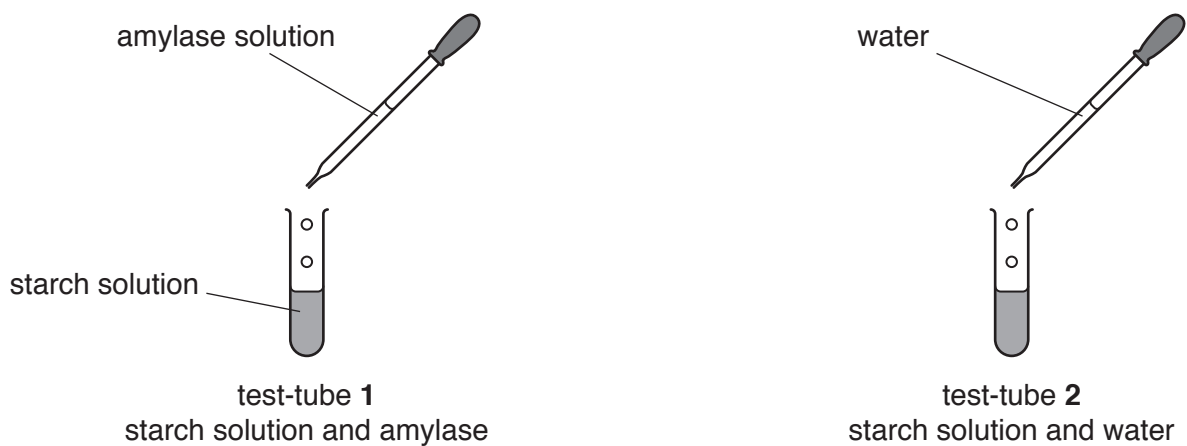
[2]

(b) Amylase is an enzyme that breaks down starch into simpler reducing sugars.

Starch solution is placed in each of two test-tubes.

Amylase solution is added to test-tube 1 and water is added to test-tube 2.

The apparatus is shown in Fig. 7.1.



**Fig. 7.1**

After 10 minutes the contents of each test-tube are tested with Benedict's solution.

The results of the investigation are shown in Table 7.1.

**Table 7.1**

test-tube	amylase present	reducing sugar present	colour of result of Benedict's test
<b>1</b>	yes	yes	
<b>2</b>	no	no	

(i) Complete Table 7.1 with the colours of the Benedict's test results.

[2]

- (ii) The experiment is repeated with boiled enzyme in test-tube 1. This time there is **no** reducing sugar present in test-tube 1 after 10 minutes.

Explain why there is no reducing sugar in test-tube 1.

.....

.....

..... [1]

- (c) Table 7.2 shows four main processes that occur in the alimentary canal.

Complete each row of Table 7.2 with **one** region of the alimentary canal where each process takes place.

One is done for you.

**Table 7.2**

process	one region of the alimentary canal
absorption	small intestine
digestion	
egestion	
ingestion	

[3]

[Total: 8]

- 8 (a) Duralumin is a mixture of aluminium and copper.

Aluminium is in Group III in the Periodic Table, and copper is a transition element.

- (i) State the general name of mixtures of metals.

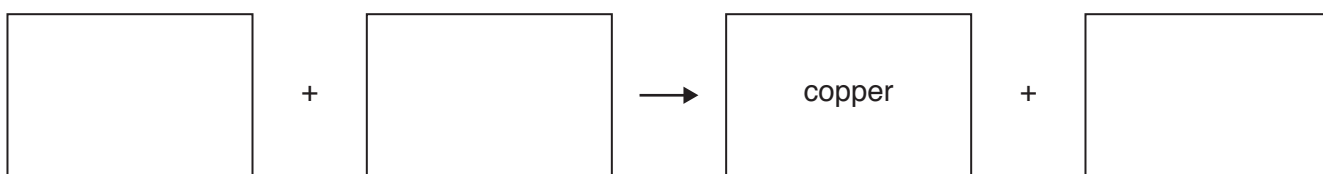
..... [1]

- (ii) Suggest **one** physical property of copper that is also a physical property of aluminium.

..... [1]

- (b) Carbon is used in the extraction of copper from copper oxide.

- (i) Complete the word equation for the reaction between carbon and copper oxide.



[2]

- (ii) State the type of chemical change that happens when oxygen is removed from a substance.

..... [1]

- (iii) The reaction between carbon and copper oxide is exothermic.

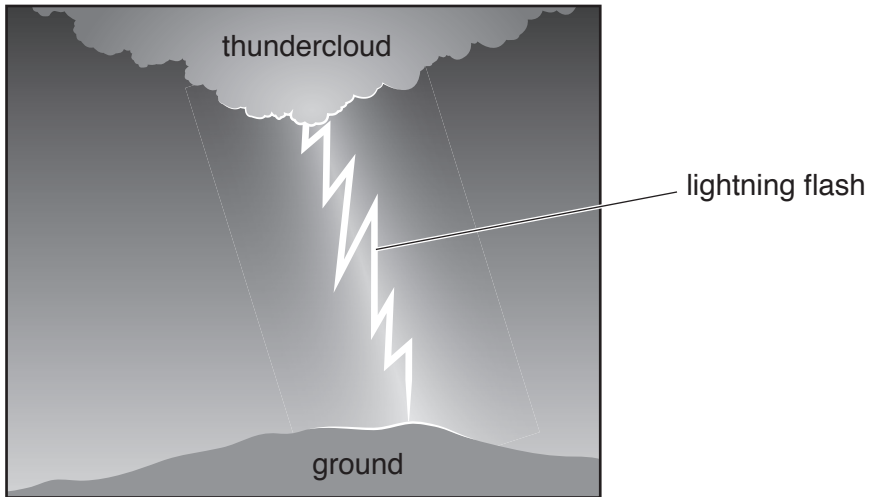
State what is meant by *exothermic*.

..... [1]

[Total: 6]



9 Fig. 9.1 shows a lightning flash, which is a form of electrostatic discharge.



**Fig. 9.1**

(a) Name the **two** opposite types of electric charge.

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

(b) Lightning occurs when clouds become highly charged. A very high potential difference of more than 1 000 000 V exists between the thundercloud and the ground.

Name the unit which has the symbol V.

..... [1]

(c) The thundercloud consists mainly of water droplets. The droplets in the cloud become electrically charged.

Suggest what happens to the water molecules to cause them to become electrically charged.

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

- (d) A lightning flash emits a range of wavelengths between 390 nm and 590 nm.  
(1 nm = 0.000 000 001 m).

Table 9.1 shows the range of wavelengths of different parts of the electromagnetic spectrum.

**Table 9.1**

type of electromagnetic wave	range of wavelengths
gamma rays	less than 0.001 nm
X-rays	0.001–10 nm
ultraviolet	10–400 nm
visible light	400–750 nm
infrared	750 nm–1 mm
microwaves	1 mm–100 cm
radio waves	more than 100 cm

Identify the **two** parts of the electromagnetic spectrum emitted by lightning.

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

- (e) Thunder is the sound energy produced by the lightning flash.

- (i) A woman hears the sound of thunder 5.0 seconds after she sees the lightning flash hit the ground on top of a distant hill.

The speed of sound in air is 330 m/s.

Calculate the distance of the woman from the top of the hill.

Show your working.

distance = ..... m [2]

- (ii) Explain why the thunder from a distant lightning flash is heard some time after the flash is seen.

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

[Total: 8]

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## The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII										
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	1 <b>H</b> hydrogen 1	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20									
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	<b>Key</b> atomic number atomic symbol name relative atomic mass															
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Al</b> aluminium 27	32 <b>Si</b> silicon 28	33 <b>P</b> phosphorus 31	34 <b>S</b> sulfur 32	35 <b>Cl</b> chlorine 35.5	36 <b>Ar</b> argon 40
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	—	—	—	—

lanthanoids	57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
actinoids	89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).