

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com



[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)



**COMMONWEALTH SECONDARY SCHOOL
END-YEAR EXAMINATION 2017
SECONDARY 2 EXPRESS SCIENCE**

Name: _____ () Class: _____

SECONDARY TWO EXPRESS

Booklet 1

Tuesday 3 Oct 2017

Booklets 1, 2 and 3

1030h – 1230h

2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper and any separate answer sheets used. Write in dark blue or black pen.

Section A (30 marks)

Answer all questions. There are **thirty** questions in this section.

For each question there are four possible answers, A, B, C and D. Choose the one you consider correct and shade your choice in the OTAS provided. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

INFORMATION FOR CANDIDATES

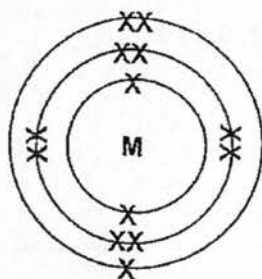
Calculators may be used. Take the gravitational field strength g on Earth to be 10 Nkg^{-1} . A periodic table is found on page 13 of this booklet. At the end of the examination, ensure that you have submitted all your work.

	For Examiner's use
Section	A
Marks	/30

This booklet consists of 13 printed pages including the cover page.

Turn over

- 1 The diagram below shows the electronic structure of Substance M.



What is the mass number of Substance M?

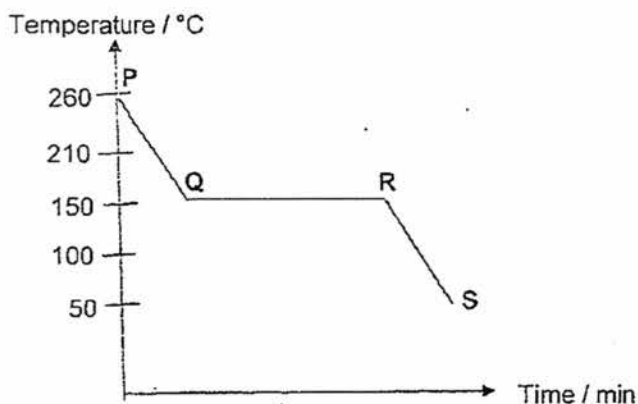
- A 10
B 13
C 27
D 31
- 2 P, Q and R have x , $(x+1)$ and $(x+2)$ protons respectively. P is from Group O. Which of the following is true about Q and R?

	Q	R
A	Group I	Non-metal
B	Period 4	Period 3
C	Period 3	Period 4
D	Group I	Metal

- 3 Which of the following consists of only substances with high melting points?

- A O_2 , H_2 , Cu
B Mg, Si, Ne
C H_2O , Ne, Mg
D Cu, Mg, Pb

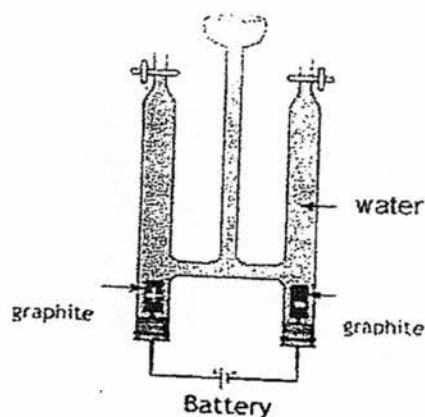
- 4 The graph below shows a gas being cooled down.



- Which of the following is **incorrect**?
- A The substance is not water.
 - B At R, the substance is in solid state.
 - C The boiling point of the substance is above 120 °C.
 - D From Q to R, the space between the particles reduces.
- 5 Green copper (II) carbonate is heated to form a gas and a black solid. Which of the following processes has taken place?
- A Combustion
 - B Electrolysis
 - C Oxidation
 - D Thermal Decomposition
- 6 A steel bar turns reddish brown overtime. Alan described the observation as a result of rusting. Which of the following is correct?
- A It is a physical change.
 - B The iron in steel corrodes.
 - C The reaction is reversible as rust can be removed.
 - D It is a reaction between steel and oxygen in the absence of water.

4

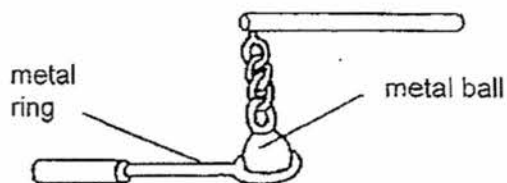
- 7 The diagram below shows an experimental set up for a chemical reaction. Graphite is made of carbon.



Which of the following is most likely the word equation for the above reaction?

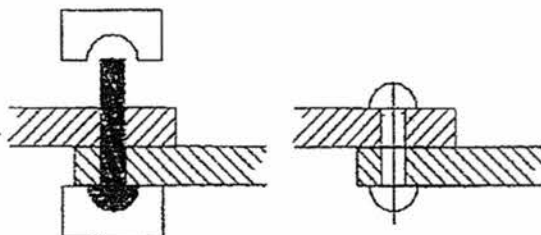
- A Water + hydrogen $\rightarrow$ oxygen
 - B Water + graphite $\rightarrow$ carbon dioxide
 - C Water $\rightarrow$ hydrogen and oxygen
 - D Water $\rightarrow$ graphite + oxygen + hydrogen
- 8 Which of the following is **incorrect** about an alkali?
- A It is soapy.
 - B It is more than pH 7.
 - C It can be found in detergents.
 - D It turns moist blue litmus paper red.
- 9 In some countries, plastics are disposed after use and burnt. Waste gases such as oxides of nitrogen and carbon monoxide are released. Which of the following is true about the impact of burning plastics on the environment?
- A Pollutants are produced.
 - B Energy is released for other uses.
 - C This helps to recycle the raw materials for other uses.
 - D This helps to break down the plastics into useful products.

- 10 The diagram below shows a metal ball sitting on a metal ring. The metal ball cannot go through the metal ring.



Which of the following should be done for the metal ball to go through the metal ring?

- A Heat the metal ball only
 - B Heat the metal ring only
 - C Heat both the metal ring and ball
 - D Place both the metal ring and ball in cold water
- 11 The diagram below shows a red hot rivet that is hammered flat to keep steel plates together.

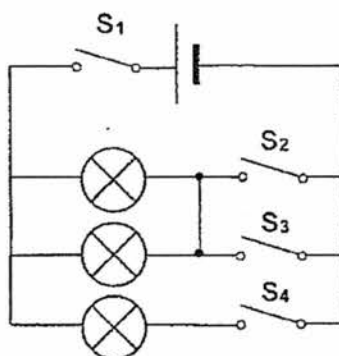


Which of the following processes aids the use of rivets in keeping steel plates together?

- A Conduction
 - B Contraction
 - C Convection
 - D Radiation
- 12 Which of the following substances has the greatest change in density when its temperature increases by 5°C ?
- A 50 cm^3 of air
 - B 50 cm^3 of brass
 - C 50 cm^3 of water
 - D 50 cm^3 of wood

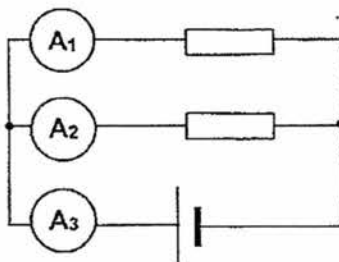
- 13 A student measured the temperature of water in a cup using a thermometer in the laboratory. Which of the following is a temperature reading that would be recorded in his data table?
- A 36.5 K
 - B 36.05 K
 - C 36.5 °C
 - D 36.05 °C
- 14 Which of the following statements about conduction is correct?
- I Conduction involves the transfer of heat through a medium without any movement of the medium.
 - II Conduction cannot occur in fluids.
 - III Conduction is the transfer of heat from one place to another in the form of infra-red radiation.
- A I only
 - B I and II only
 - C II and III only
 - D I and III only
- 15 The Earth receives a large amount of energy from the Sun daily. Which of the following process is/are responsible for the transfer of energy from the Sun to the Earth?
- A Conduction only
 - B Conduction and convection only
 - C Radiation only
 - D Radiation and convection only
- 16 What of the following is defined by the work done when one unit charge passes between two points in a circuit?
- A Current
 - B Resistance
 - C Potential difference
 - D Power

- 17 The circuit below shows three light bulbs in a circuit controlled by 4 switches.



Which of the following pair of switches should be closed so that only one of the three light bulbs would light up?

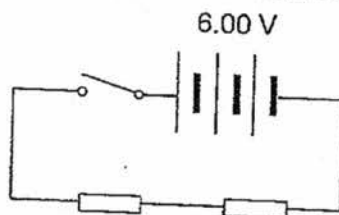
- A S_1 and S_2
 - B S_1 and S_3
 - C S_1 and S_4
 - D S_2 and S_3
- 18 Two resistors are connected in the circuit as shown below. A_1 , A_2 and A_3 represent the ammeter readings at their respective positions.



Which of the following correctly describes the relationship between A_1 , A_2 and A_3 ?

- A $A_1 = A_2 + A_3$
- B $A_2 = A_1 + A_3$
- C $A_3 = A_1 + A_2$
- D $A_1 = A_2 = A_3$

- 19 The circuit below has two identical resistors with a total resistance of $2.00\ \Omega$.



Given that $V = RI$, what is the current flowing through the resistor?

- A 1.50 A
 - B 3.00 A
 - C 6.00 A
 - C 12.0 A
- 20 Which of the following is most likely an application of the lighting effect of electric current?
- A Electroplating metal jewellery with silver
 - B Heating water using an electric kettle
 - C High resistance wire in an electric bulb
 - D Lifting iron and steel objects using cranes
- 21 In order to ensure the safe use of electricity, some electrical appliances have an earth wire connected to a part of the appliances to prevent accidental electrocution.



For a washing machine, where should the earth wire be connected to?

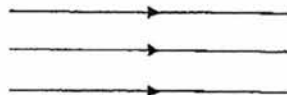
- A The internal metal drum of the washing machine.
- B The glass window on the door
- C The plastic handle on the door
- D The rubber feet at the bottom

22 Which of the following diagrams represents a converging beam of light rays?

A



B



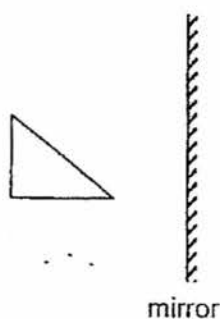
C



D



23 The figure below shows a triangular object in front of a mirror.



Which of the following diagrams represents the image of the object in the mirror?

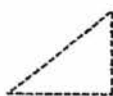
A



B



C



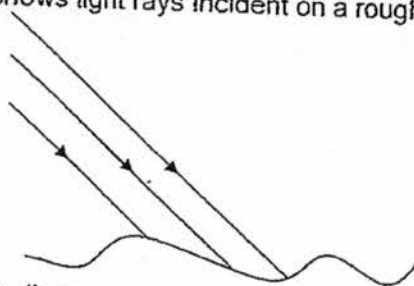
D



24 Which of the following correctly describes how we are able to see a red apple in white light?

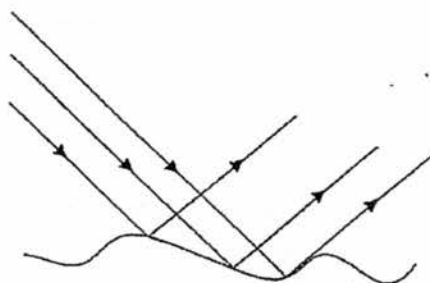
- A Red light is reflected from the apple into our eyes.
- B Blue light is reflected from the apple into our eyes.
- C White light is reflected from the apple into our eyes.
- D All colours of light except red light is reflected from the apple into our eyes.

- 25 The diagram below shows light rays incident on a rough surface.

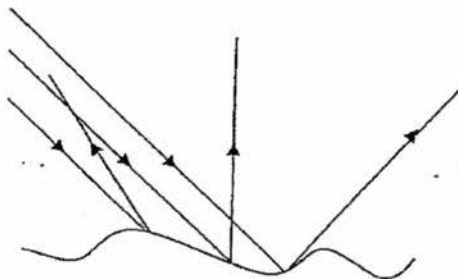


Which of the following diagrams represents the reflection of the light rays off the rough surface?

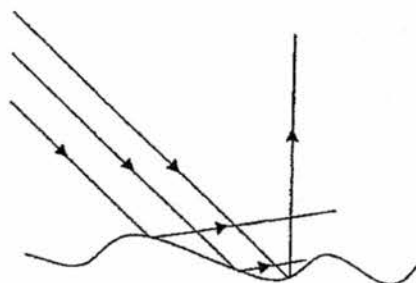
A



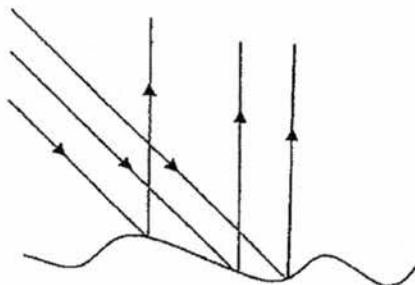
B



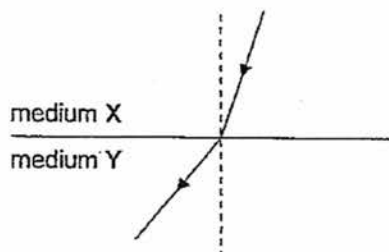
C



D

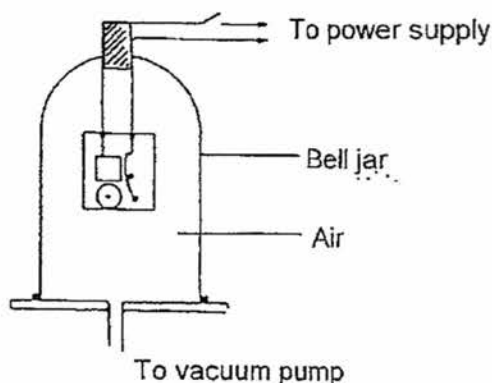


- 26 The figure below shows how a light ray travels from medium X to medium Y.



Which of the following correctly explains why light bends away from the normal when it travels from medium X to medium Y?

- A Light slows down as it travels from the optically denser X to the less dense Y.
 - B Light speeds up as it travels from the optically denser X to the less dense Y.
 - C Light slows down as it travels from the less optically dense X to the denser Y.
 - D Light speeds up as it travels from the less optically dense X to the denser Y.
- 27 An experiment is set up as shown below. The electronic bell is switched on and a loud ring is heard.



Which of the following explains what happens to the sound as the vacuum pump is switched on?

- A The sound becomes louder as air particles block the transmission of sound waves.
- B The sound becomes softer because sound requires a medium to travel.
- C The sound is not affected because sound does not require a medium to travel.
- D The sound is not affected because the vacuum pump cannot stop the bell from ringing.

- 28 Which of the following parts of the ear vibrates hearing sound?
- I Auditory nerves
 - II Cochlea
 - III Ear drum
- A I only
B I and II only
C I and III only
D II and III only
- 29 Which of the following is a frequency of a sound that cannot be heard by a healthy person?
- A 2 Hz
B 20 Hz
C 2000 Hz
D 20000 Hz
- 30 As a singer is performing towards the end of her song, her voice increases in pitch. Which of the following has to happen when the pitch of her sound increases?
- A A decrease in the amplitude of vibrations
B An increase in the amplitude of vibrations
C A decrease in the frequency of the vibrations
D An increase in the frequency of the vibrations

5092 CHEMISTRY GCE ORDINARY LEVEL SYLLABUS (2018)

The Periodic Table of Elements

Group																			
I	II											III	IV	V	VI	VII	0		
3 Li lithium 7	4 Be beryllium 9	Key																	
		proton (atomic) number atomic symbol name relative atomic mass																	
11 Na sodium 23		12 Mg magnesium 24	10 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
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 98	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
87 Fr francium 223	88 Ra radium 226	89-103 actinoids	80-103 lanthanoids	57-71 lanthanoids	72-73 Ta tantalum 181	74-75 W tungsten 184	76-77 Os osmium 190	78-79 Ir iridium 192	80-81 Pt platinum 195	82-83 Au gold 197	84-85 Hg mercury 201	86-87 Tl thallium 204	88-89 Pb lead 207	90-91 Bi bismuth 209	92-93 Po polonium 209	94-95 At astatine 210	96-98 Rn radon 222	99-100 Ac actinoids	101-103 lanthanoids
lanthanoids																			
57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium 145	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				72-73 lanthanoids	
actinoids																			
89 Ac actinium 227	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium 237	94 Pu plutonium 244	95 Am americium 243	96 Cm curium 247	97 Bk berkelium 247	98 Cf californium 251	99 Es einsteinium 252	100 Fm fermium 257	101 Md mendelevium 258	102 No nobelium 259	103 Lr lawrencium 262				104-105 actinoids	

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

Chemistry



**COMMONWEALTH SECONDARY SCHOOL
END-YEAR EXAMINATION 2017
SECONDARY 2 EXPRESS SCIENCE**

Name: _____ () Class: _____

SECONDARY TWO EXPRESS

Booklet 2

Tuesday 3 Oct 2017

Booklets 1, 2 and 3

1030h – 1230h

2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper and any separate answer sheets used. Write in dark blue or black pen.

Section B (12 marks) and Section C (9 marks)

Answer all questions. Write your answers in the spaces provided on the question paper. Drawings should be done in pencil. The number of marks is given in brackets [] at the end of each question or part question.

Candidates are reminded that all quantitative answers should include appropriate units.

Candidates are advised to show all their working in a clear and orderly manner.

INFORMATION FOR CANDIDATES

Calculators may be used. A periodic table is found on page 13 of Booklet 1. At the end of the examination, ensure that you have submitted all your work.

	For Examiner's use	
Section	B	C
Marks		
Total for booklet 2		
Parent's Signature:		

This booklet consists of 5 printed pages including the cover page.

on over

Section B: Structured Question (12 marks)

- 1 Two atomic bombs made by the allied powers (USA and UK) from uranium-235 and plutonium-239 were dropped on Hiroshima and Nagasaki respectively early in August 1945. The Hiroshima bomb was made from highly-enriched uranium-235.

This was prepared by diffusion enrichment techniques using the very small differences in mass of the two main isotopes: U-235 (^{235}U) and U-238 (^{238}U). As UF_6 , there is about a one percent difference in mass between the molecules, and this enables concentration of the less common isotope. About 64 kilograms of highly-enriched uranium was used in the bomb which had a 16 kiloton yield. It was released over Hiroshima, Japan's seventh largest city, on 6 August 1945. Some 90% of the city was destroyed.

Source: <http://www.world-nuclear.org/information-library/safety-and-security/radiation-and-health/hiroshima,-nagasaki,-and-subsequent-weapons-testin.aspx>

- (a) Isotopes are atoms of the same element with same number of protons but different number of neutrons. Using the periodic table, complete the blanks in the table below. [2]

Isotope	Number of protons	Number of neutrons	Number of electrons
^{235}U			
^{238}U			

- (b) Uranium can also react with other elements to form compounds such as hexafluoride, UF_6 , which was mentioned in the source above. Other examples of uranium compounds are uranium (V) oxide, U_2O_5 and uranium (IV) chlorate, $\text{U}(\text{ClO}_3)_4$. [3]

Complete the table below.

Compound	Number of types of atoms	Number of atoms
UF_6		
U_2O_5		
$\text{U}(\text{ClO}_3)_4$		

- (c) Uranium atom and fluorine atom reacts to form UF_6 . Fluorine can also form a diatomic molecule by itself. Describe the difference between an atom and a molecule. [1]

2 Using Particulate Nature of Matter, explain the following:

(a) Densities of gases are lower than liquids.

[2]

(b) Solids cannot be compressed but gases can be compressed.

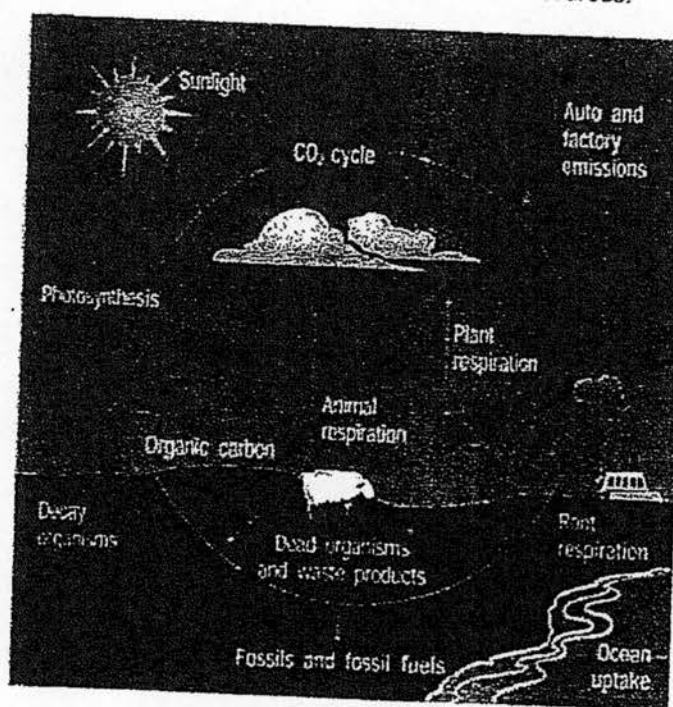
[2]

(c) Solids have fixed shape but liquids do not have fixed shape.

[2]

Section C: Free Response Question (9 marks)

- 3 (a) The diagram below shows the carbon cycle. The arrows show the direction of release and production of carbon dioxide in different processes and sources.



Picture from: <https://eo.ucar.edu/kids/green/cycles6.htm>

Write the word equations for the following:

[3]

- (i) combustion of methane (methane is a fuel which combusts in air similarly like how carbon combusts in air)

- (ii) respiration

- (iii) photosynthesis

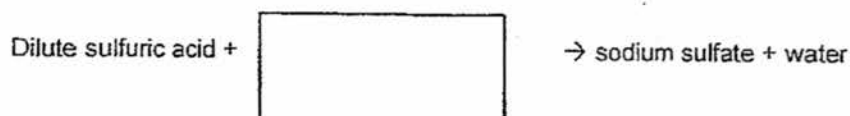
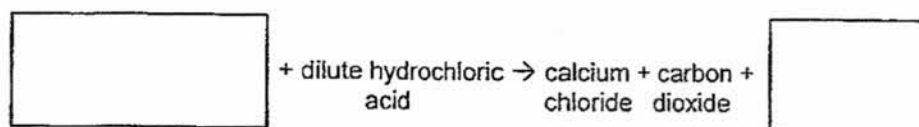
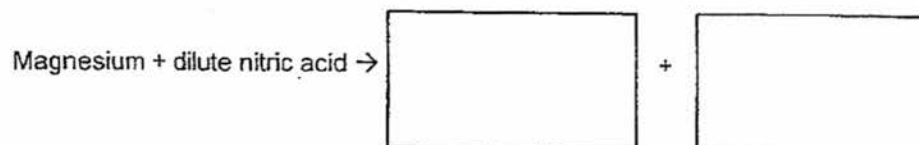
- (b) Combustion, respiration and photosynthesis are examples of chemical reactions.

- (i) Explain what a chemical reaction means.

[1]

- (ii) Acids react with several substances through mixing.

Complete the word equations below. If there is no reaction, write no reaction in the blank. [4]



- (iii) Describe the observation when an alkali is added (gradually drop by drop till excess) into a mixture of universal indicator and acid solution. [1]

Physics



**COMMONWEALTH SECONDARY SCHOOL
END-YEAR EXAMINATION 2017
SECONDARY 2 EXPRESS SCIENCE**

Name: _____ () Class: _____

SECONDARY TWO EXPRESS

Booklet 3

Tuesday 3 Oct 2017

Booklets 1, 2 & 3

1030h – 1230h

2 hours

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on the question paper and any separate answer sheets used. Write in dark blue or black pen.

Section B (28 marks) and Section C (21 marks)

Answer all questions. Write your answers in the spaces provided on the question paper.

Drawings should be done in pencil. The number of marks is given in brackets [] at the end of each question or part question.

Candidates are reminded that all quantitative answers should include appropriate units.

Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of physics than for correct answers.

INFORMATION FOR CANDIDATES

Calculators may be used. Take the gravitational field strength g on Earth to be 10 Nkg^{-1} . At the end of the examination, ensure that you have submitted all your work.

Section	For Examiner's use	
	B	C
Marks		
Total for booklet 3		

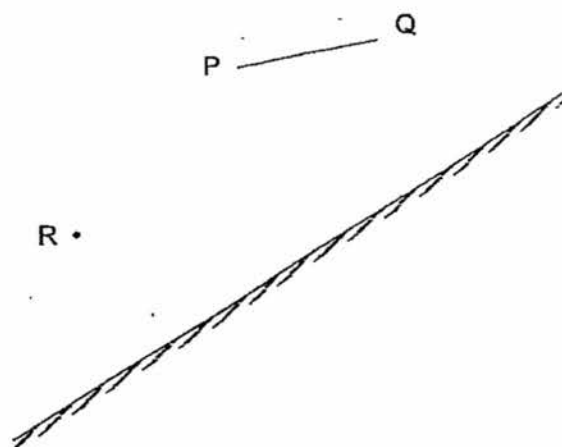
Parent's Signature: _____

This booklet consists of 9 printed pages including the cover page.

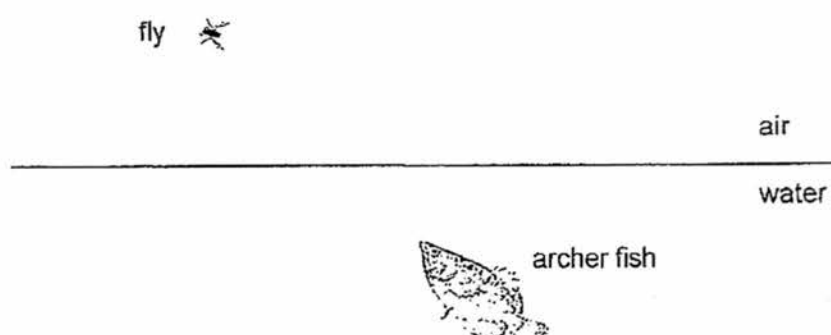
[Turn over

Section B: Structured Question (28 marks)

- 1 (a) The figure below shows a student looking into a smooth metal surface from position R. He sees the reflection of a straight wire PQ in the surface.



- (i) Locate the image of the wire in the surface as seen by the student and mark it with a line P'Q'. [2]
- (ii) On the diagram, draw rays to show how light from point P of the wire enters the student's eyes. [3]
- (b) The figure below shows an archer fish under the surface of water in a lake as it is looking at a fly above water.

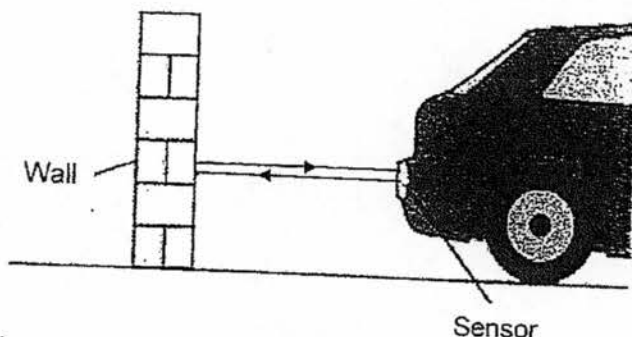


- (i) Given that water is denser than air, draw on the diagram, the path of the light ray from the insect to the archer fish's eyes. Label the angle of incidence and the angle of refraction. [3]

3

- (ii) Indicate on the diagram in (b), with an 'X', the position where the archer fish will observe the fly to be at. Show your working clearly. [1]

- 2 Ultrasound parking sensors are usually installed in cars and use echolocation to detect obstacles when the car is in reverse gear. The diagram below shows a sensor on the back of a car.



The parking sensors give out ultrasound waves and when the ultrasound waves hit an object, the waves bounce back to the car.

- (a) The time between emitting the ultrasound wave and receiving it back at the car is 0.00400 s. [2]

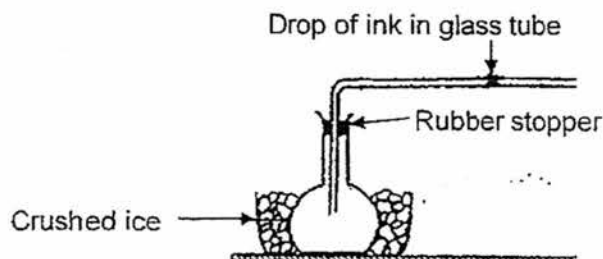
Given the speed of ultrasound waves in air is 330 m/s, calculate the distance between the wall and the back of the car.

- (b) Suggest a reason why ultrasound frequencies are used instead of frequencies within the human hearing range. [1]

- (c) Other than use in echolocation and sonar, state another use of sound. [1]

- 2 (d) When parking outdoors in heavy rain, a layer of water can accumulate on the sensor and record an apparent distance different from the actual distance.
- (i) Describe the difference between the speed of sound travelling in air and in water. [1]
- _____
- _____
- (ii) Explain how the difference in (d)(i) will change the apparent distance recorded compared to the actual distance. [2]
- _____
- _____
- _____

- 3 An air-tight conical flask with a glass tube with a drop of ink was placed in a bowl of crushed ice. The drop of ink was allowed to settle until it remains stationary in the glass tube.



- (a) The setup was then removed from the crushed ice and left to stand at room temperature.
- (i) Describe the movement of the drop of ink in the glass tube. [1]
- _____
- _____
- (ii) Explain your answer to (a)(i). [2]
- _____
- _____
- (b) The experiment is repeated but this time the conical flask was half-filled with sand instead. Predict what happens to the movement of the ink and explain. [2]
- _____
- _____
- _____

- 4 Alice sets up a circuit as shown in Figure 6.1 below.

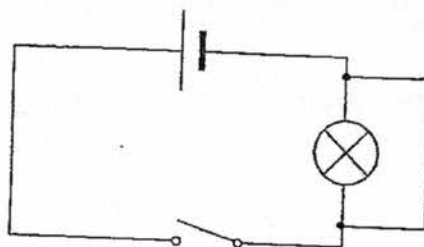


Figure 6.1

Before Alice can complete the circuit, Ben tells her that the bulb would not light up and that there is a potential hazard in the setup.

- (a) (i) Explain why the bulb does not light up even though all the electrical components are working. [1]

- (ii) State the potential hazard in the setup. [1]

- (iii) Draw the correct circuit diagram so that Alice can switch on the bulb safely. [1]

- (b) Alice wants to introduce another electrical component into the circuit so that she is able to control the brightness of the bulb.

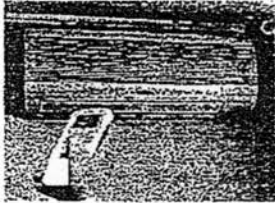
- (i) Name this electrical component that she needs. [1]

- (ii) Indicate with an arrow on Figure 6.1 which part of the circuit she can place the electrical component named in (b)(i). [1]

- (iii) Explain your answer to (b)(ii). [2]

Section C: Free Response Question (21 marks)

- 5 The table below shows the data obtained from SP Services on the power rating of a typical standing fan and air conditioner respectively.

	Standing fan 	Air-conditioner 
Power rating	75.0 W	1.00 kW

- (a) Explain what is meant by a power rating of 75.0 W for the standing fan. [1]

- (b) The above two electrical appliances are switched on at night for 8.00 hours each.

- (i) Calculate the respective energy consumption (in kWh) of operating the standing fan and air conditioner for 8.00 hours. [2]

- (ii) Given that the electricity tariff is 20.72 cents per kWh, calculate the cost of operating the air conditioner for 8.00 hours. [1]

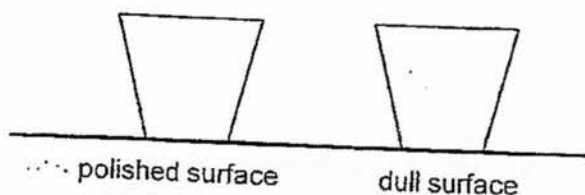
- (iii) Which of the above electrical appliances would result in a larger impact in global warming? Explain. [2]

- 5 (c) A safety fuse can be found in the plug of the electrical fan. Explain how it protects the user from electrical hazards. [2]

- (d) Due to the electrical demands of the air conditioner, the fuse is not found in the electrical plug. Instead, circuit breakers can protect the user from electrical hazards. [2]

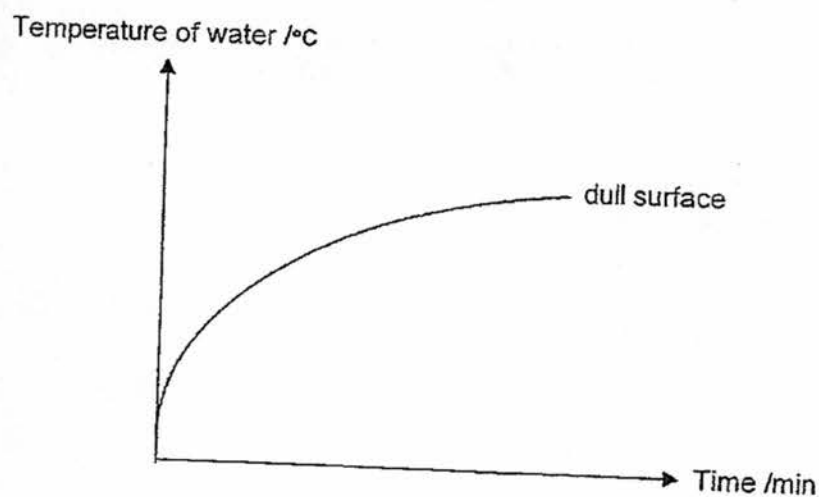
Explain, using one of the effects of electric current, how the circuit breaker works.

- 6 (a) The figure below shows two silver cups, one with a polished surface and the other with a dull surface.



Cold water of the same initial temperature was poured in the two cups and lids were placed over the cups. The temperature of the water in the two cups were then measured over time.

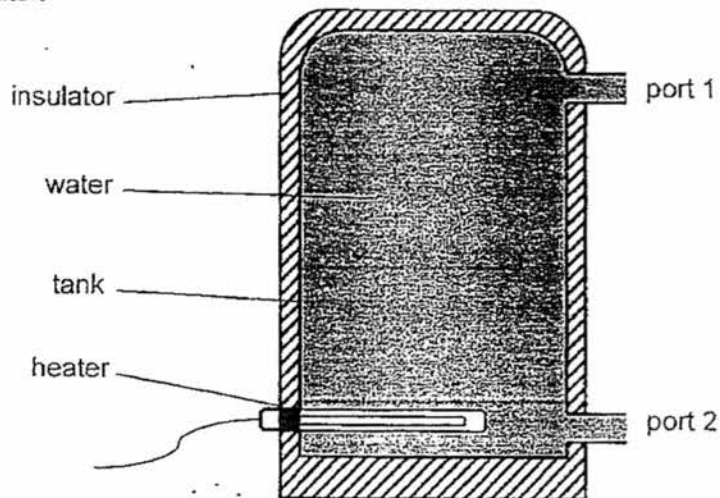
The graph below shows the change in temperature of the water over time in the cup with the dull surface.



- (i) In which of the two cups would the water have a faster rate of temperature change? Explain. [2]

- (ii) Sketch and label on the graph, the expected change in temperature over time for the cup with the polished surface. [1]

- 6 (b) The figure below shows an electric heater that is commonly used to boil water.



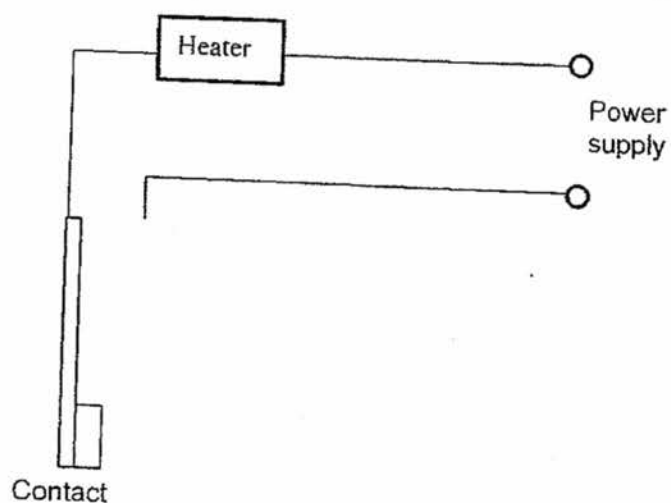
- (i) Describe how the position of the heater allows the water to heat up the water effectively throughout the tank. [3]

- (ii) Cold water flows into the tank through one of the two ports and hot water flows out through the other port. Draw arrows to show the direction of water flow at port 1 and 2 so that water can be heated effectively. [1]

- (iii) Typically a wool-like material made from fibreglass is used as an insulator for the electric heater. Explain how this helps in reducing heat loss. [2]

- (iv) To prevent the water from overheating, a thermostat is installed in the circuit with the heating unit. The bimetallic strip within the thermostat [2]
is made of two materials, brass and steel.

Draw and label the diagram below, the position of the bimetallic strip, showing how the strip will bend when the tank is too hot.



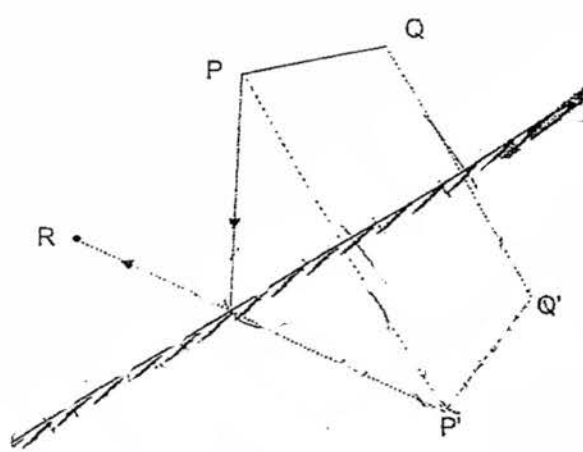
2017 Sec 2E EOY Phy Answer

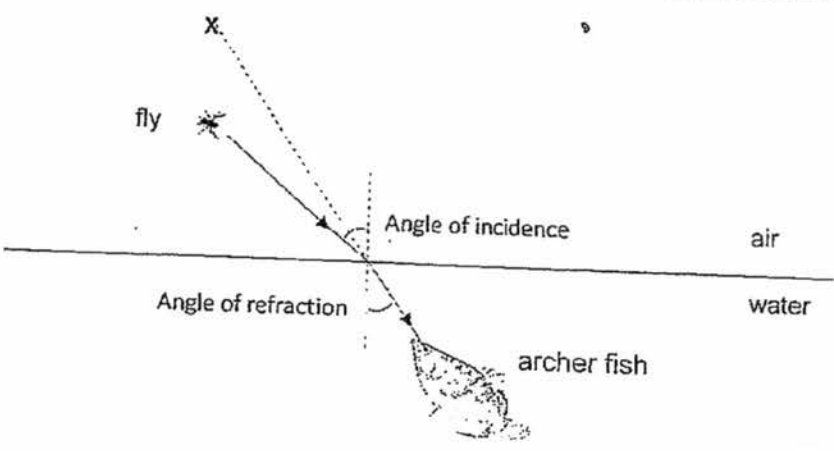
Booklet 1:

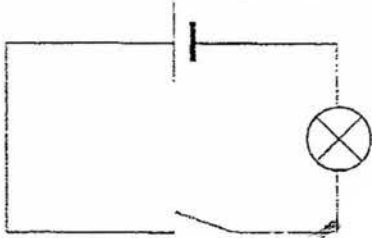
10	11	12	13	14	15	16
B	B	A	C	A	C	C
17	18	19	20	21	22	23
C	C	B	C	A	D	C
24	25	26	27	28	29	30
A	C	B	B	D	A	D

Booklet 3:

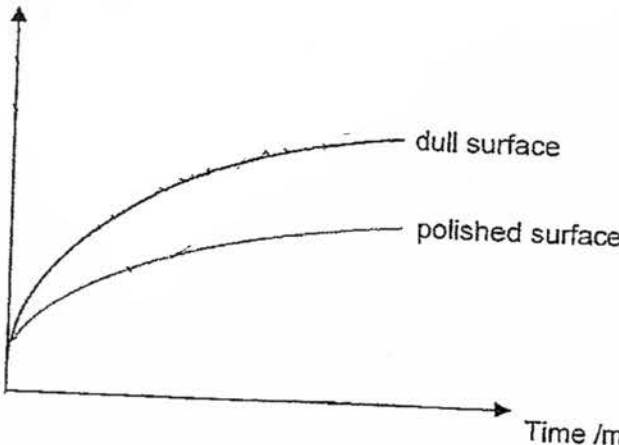
Section B:

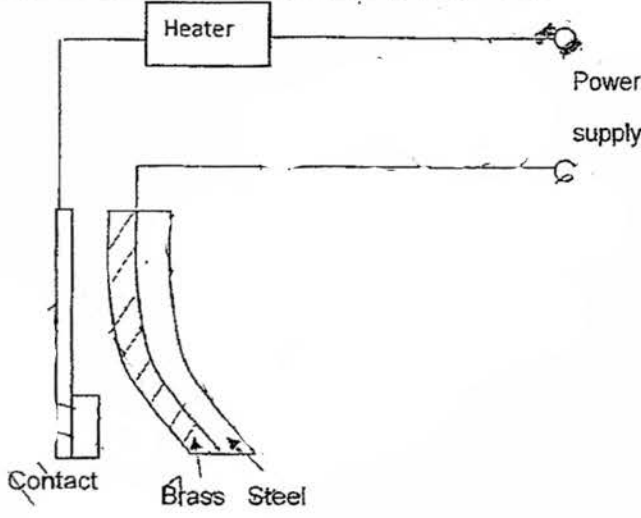
Qn No.	Answer	Remarks
1ai/1aii		
1ai	[1] for correctly labelled image P'Q' [1] for correct perpendicular distance from mirror to P/Q and to P'Q' with dotted constructions' lines (Distance between P and mirror is 3.0 ± 0.1 cm and distance between Q and mirror is 2.2 ± 0.1 cm)	
1aii	Correct incident ray [1] (from P to point of incidence) Correct reflected ray [1] (extended from P') Correct direction of ray [1] (reject if arrow is not present)	

1bi/1bii		
1bi	Correct path of light ray drawn [1] Angle of incidence larger than angle of refraction [1] Correct label for angle [1]	
1bii	Correct position of image X higher than the fly with a dotted line extended from the refracted ray [1]	
2a	$2d = vt$ $d = vt/2$ $= (330 \times 0.00400)/2$ [1] $= 0.660 \text{ m}$ [1]	
2b	If the sound is within the human frequency then the user will hear the pulses of the sound during parking and disturb the user. [1] Or it could cause noise pollution Or: less interference by other sounds/measure the frequency more accurately	
2c	Communications/ Warning alarms / Music/ Ultrasound imaging/detection of cracks in objects [1]	
2di	Sound travels faster in water than in air.	
2dii	The overall time taken (to receive the emitted sound wave) is shorter [1] and hence this causes the apparent distance to be shorter. [1]	
3ai	The drop of ink would move to the right/ move away from conical flask. [1] Reject: up/down	
3aii	The temperature of the conical flask increases/the flask warms up/absorbs heat from the surrounding. [1] The air in the conical flask expands and pushes the drop of ink to the right. [1]	

3b	The drop of ink would still move to the right but to a lesser extent. [1] The sand expands less upon warming up as solids expand less than gases. [1]	
4ai	No current will flow through the bulb as the current will flow through the wire in parallel instead. [1]	
4aii	There will be an excessively high current might cause the battery/wire/circuit to heat up/lead to an electrical fire. [1]	
4aiii	 Any arrangement with the three (dry cell, bulb and switch) are in series as accepted [1]	
4bi	Rheostat/Variable resistor	
4bii	The arrow must be pointing at the wires in series to the bulb and not parallel to the wire or bulb	
4biii	When the resistance of the variable resistor increases, the current flowing through the bulb will decrease [1]. This decrease in current through the bulb will result in a decrease in brightness. [1] OR The rheostat cannot be placed in parallel because both the potential difference across the bulb and the resistance of the bulb does not change [1] so the current would always be constant and the brightness would always be the same [1].	

Section C:

Qn No.	Answer	Remarks
5a	75 J of electrical energy is converted to other forms of energy every second Or: 75 J of energy is being consumed every second	
5bi	Energy consumption of standing fan: $= 75.0 \text{ W} \times 8.00 \text{ hours} / 1000 = 0.600 \text{ kWh}$ Energy consumption of air-conditioner: $= 1.00 \text{ kW} \times 800 \text{ hours} = 8.00 \text{ kWh}$	
5bii	Cost = 20.72 cents $\times$ 8.0 kWh = \$1.66	
5biii	The air-conditioner [1]. Since more energy is needed, more fossil fuels are consumed and produces more greenhouse gases [1] , leading to an increase in global warming.	
5c	It will blow when an excessively high current flows through it [1] , protecting the wires from overheating and an electrical fire [1] .	
5d	The circuit breaker makes use of the magnetic effect of electric current [1] When the circuit breaker detects a large current, it trips the circuit breaker/switches off the current/breaks the circuit.	
6ai	The cup with dull surface would have a faster rate of temperature change. [1] Dull surfaces are better absorbers of radiation. [1]	
6aii	Temperature /$^{\circ}\text{C}$  Time /min Graph must start at same initial temperature and have a more gentle gradient compared to the other graph.	
6bi	When the water at the bottom near the heater becomes warm, the hot water expands and rises to the top as its density decreases [1] The cooler water at top then sink to the bottom and becomes heated by the heater. [1]	

	This sets up a convection current and the water throughout the tank can be heated effectively. [1]	
6bii	Port 1: Out of tank and Port 2: Into tank [1]	
6biii	The wool traps air [1] and since air is a poor conductor of heat it prevents heat loss by conduction [1].	
6biv	 Shape [1] Correct labelling of bimetallic strip [1]	

2017 2E EOY Chem Answers

1	C
2	D
3	D
4	B
5	D
6	B
7	C
8	D
9	A

B1a	<table border="1"> <tr> <th>Isotope</th> <th>Number of protons</th> <th>Number of neutrons</th> <th>Number of electrons</th> </tr> <tr> <td>^{235}U</td> <td>92</td> <td>143</td> <td>92</td> </tr> <tr> <td>^{238}U</td> <td>92</td> <td>146</td> <td>92</td> </tr> </table>	Isotope	Number of protons	Number of neutrons	Number of electrons	^{235}U	92	143	92	^{238}U	92	146	92	[2]
Isotope	Number of protons	Number of neutrons	Number of electrons											
^{235}U	92	143	92											
^{238}U	92	146	92											
	Every correct row 1 m. Must be correct row for sub atomic composition to be logical.													
B	<table border="1"> <tr> <th>Compound</th> <th>Number of Types of atoms</th> <th>Number of atoms</th> </tr> <tr> <td>UF_6</td> <td>2</td> <td>7</td> </tr> <tr> <td>U_2O_5</td> <td>2</td> <td>7</td> </tr> <tr> <td>$\text{U}(\text{ClO}_3)_4$</td> <td>3</td> <td>12</td> </tr> </table>	Compound	Number of Types of atoms	Number of atoms	UF_6	2	7	U_2O_5	2	7	$\text{U}(\text{ClO}_3)_4$	3	12	[3]
Compound	Number of Types of atoms	Number of atoms												
UF_6	2	7												
U_2O_5	2	7												
$\text{U}(\text{ClO}_3)_4$	3	12												
	Every correct row 1m.													
c	A molecule is made up of <u>2 or more atoms chemically combined</u> while an atom is the <u>smallest particle of an element</u> .	[1]												
B2a	<u>Attractive forces between gas particles are very weak</u> and particles are <u>very far apart per unit volume</u> of gas hence <u>low</u> densities. [1] <u>Attractive forces between liquid particles are strong</u> and particles are <u>closely packed per unit volume of liquid</u> hence <u>higher</u> densities than gases. [1]	[2]												
b	Particles in solid are <u>very closely packed</u> and regularly arranged hence <u>no space</u> for particles <u>to move closer</u> together when force is applied to push particles together. [1] Particles in gases are <u>very far apart</u> and irregularly arranged hence a <u>lot of space for particles to move closer</u> when force is applied to push particles together. [1]	[2]												
c	Particles in solid are <u>orderly arranged</u> and very closely packed hence the particles can only <u>vibrate about fixed positions</u> and cannot move around freely. [1] Particles in liquids are <u>disorderly arranged</u> and closely packed hence can <u>move around slowly and randomly</u>. [1]	[2]												
C1a	methane + oxygen $\rightarrow$ carbon dioxide and water vapour	[1]												

ii	glucose + oxygen → carbon dioxide + water (+ energy optional)	[1]
iii	Carbon dioxide + water $\xrightarrow{\text{light energy}}$ glucose + oxygen	[1]
bi	It means that atoms are <u>rearranged</u> and <u>combine to form new products</u> .	[1]
ii	magnesium nitrate; hydrogen Calcium carbonate; water Sodium hydroxide	[3]
iii	The <u>solution</u> turns from <u>red to green</u> , then to <u>blue</u> .	[1]