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BEDOK SOUTH SECONDARY SCHOOL END-OF-YEAR EXAMINATION 2022

1EXP

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

LOWER SECONDARY SCIENCE

11 October 2022

Candidates answer on the OMS and Question Booklet.

2 hours

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.

Write in dark blue or black pen, except for Section A.

You may use a soft pencil for any diagrams or graphs.

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

This paper consists of three sections. You are required to answer **ALL** questions in Section A and B and **FOUR** questions in Section C.

SECTION A (30 marks)

There are **30** questions. Answer **ALL** questions.

For each question there are four possible answers, **A, B, C** and **D**. Choose the one you consider correct and record your choice in **soft pencil** on the OMS provided.

SECTION B (30 marks)

Answer **ALL** questions in the spaces provided.

Write your answers in the spaces provided on the question paper.

SECTION C (40 marks)

Answer only **four** questions in this section.

Write down your answers in the spaces provided on the question paper.

The use of an approved scientific calculator is expected, when appropriate.

Omission of essential working will result in loss of marks.

Round off all non-exact answers to 3 significant figures.

The number of marks is given in brackets [] at the end of each question or part question.

A copy of the Periodic Table is printed on page **33**.

Setter: Mr Hubert Song

For Examiner's Use	
Section A	30
Section B	30
Section C	40
Total	100

This paper consists of **33** printed pages including this cover page

SECTION A: Multiple Choice Questions (30 marks)

Each question below is provided with four answers. Select the correct answer and shade either **A**, **B**, **C** or **D** in the OMS provided.

- 1 What is the correct order of steps to be carried out for a scientific method of investigation?

- I draw conclusion
- II record and analyse the results
- III plan and carry out experiments
- IV identify an investigative question
- V propose a hypothesis

- A IV → V → III → II → I
- B IV → V → I → III → II
- C V → IV → III → II → I
- D V → IV → I → III → II

- 2 Two labels are found on the bottle of an unknown liquid.



Which statement best describes this unknown liquid?

- A corrosive chemical and releases oxygen easily
- B leads to allergic reaction to skin and may cause explosion
- C causes harmful effect to body and may cause oxygen deficiency
- D causes severe skin injury and breathing difficulty

[Turn Over

3

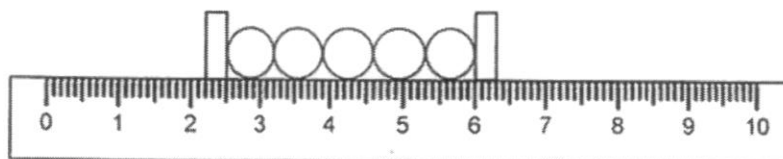
- 3 Which row describes the flame that is more suitable for heating in the laboratory?

	shape of flame	air hole of Bunsen burner
A	steady	close
B	unsteady	close
C	steady	open
D	unsteady	open

- 4 Which is **not** an SI unit?

- A** gram
- B** Joule
- C** Kelvin
- D** metre

- 5 A plastic ruler is used to measure the diameter of five plastic balls.



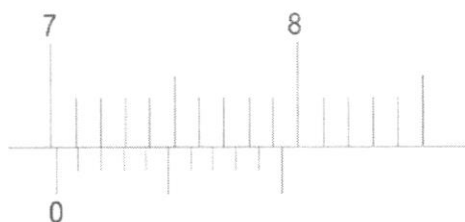
What is the average diameter of each ball?

- A** 0.66 cm
- B** 0.70 cm
- C** 0.82 cm
- D** 3.50 cm

[Turn Over

4

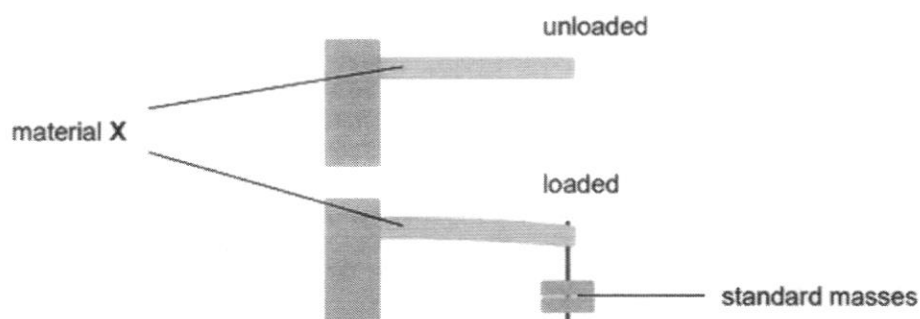
- 6 A pair of Vernier calipers is used to measure the depth of a cup. The reading on the Vernier calipers is shown.



Which row is correct?

	part of Vernier calipers	depth / cm
A	inside jaw	7.02
B	inside jaw	7.12
C	tail	7.02
D	tail	7.12

- 7 The experimental set-up shows some standard masses being hung onto material X, one at a time.



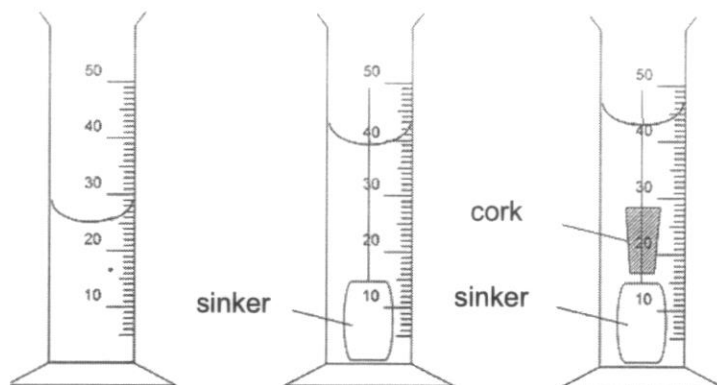
Which property of material X is being investigated in this experiment?

- A density
- B hardness
- C strength
- D thermal conductivity

[Turn Over

5

- 8 An experimental set up is shown. The mass of the cork is 3 g.

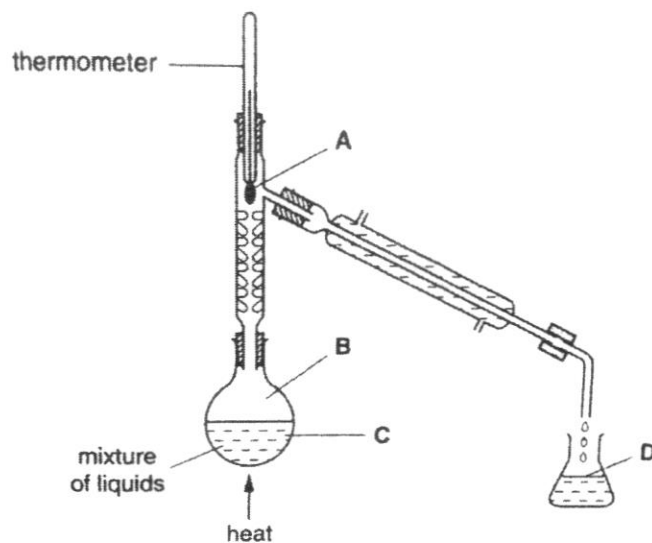


- What is the density of the cork?
- A 0.20 g/cm³
 B 0.75 g/cm³
 C 1.00 g/cm³
 D 1.33 g/cm³
- 9 Which list of substances consists of only elements and compounds?
- A steam, orange juice and air
 B muddy water, aluminium and air
 C aluminium, water and carbon dioxide
 D ethanoic acid, orange juice and muddy water
- 10 Which statements are **incorrect**?
- I A solution is a new compound.
 II A suspension is not a compound but a mixture.
 III A solution is a mixture in which one or more solutes dissolved in a solvent.
 IV When left to stand, a suspension does not have solid particles settling to the bottom.
- A III and IV only
 B I and IV only
 C I, III and IV only
 D all of the above

[Turn Over

6

- 11** A mixture of two liquids is being distilled.
At which point will there be the liquid with higher boiling point?



- 12** The table shows the readings of an object of 20.0 g from different sets of electronic balance.

reading 1 / g	reading 2 / g	reading 3 / g
17.3	17.6	17.5

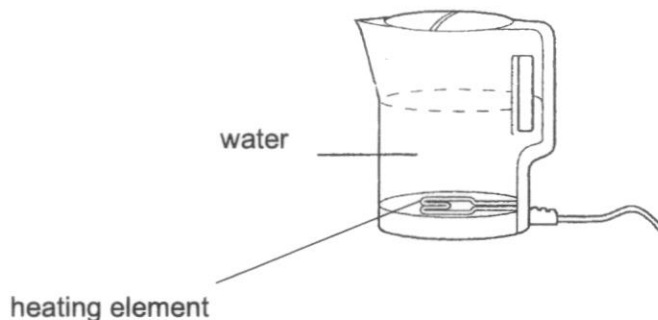
Which description of the 3 readings is correct?

- A** high accuracy but low precision
- B** low accuracy but high precision
- C** high accuracy and high precision
- D** low accuracy and low precision

[Turn Over

7

- 13 An electric kettle boils water using a heating element as shown.



The physical properties of four materials are given in the table.

Which material is most suitable for making the heating element inside a kettle?

material	melting point /°C	thermal conductivity
A	980	low
B	361	high
C	153	low
D	72	high

- 14 A very old painting has been sprayed accidentally with new paint. The solubilities of the old paint and the new paint in solvents **A**, **B**, **C** and **D** are shown in the table.

Which solvent could be used to remove the new paint without damaging the original painting?

solvent	old paint	new paint
A	soluble	soluble
B	soluble	insoluble
C	insoluble	soluble
D	insoluble	insoluble

[Turn Over

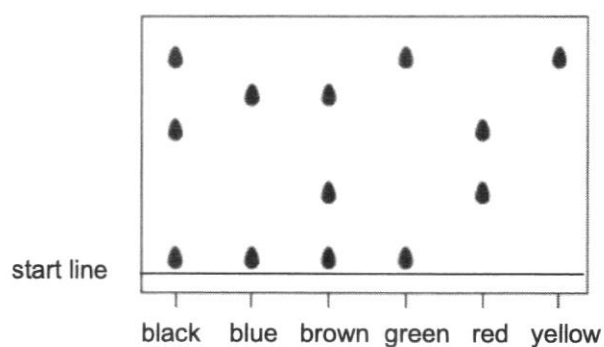
- 15 Gold panning is a traditional method of separating insoluble gold from other particles by washing the mixture in a pan with water, as shown below.



Which row best describes the method shown and the term used to describe the gold left in the pan?

	method	gold in the pan is known as
A	evaporation	residue
B	filtration	residue
C	filtration	filtrate
D	distillation	distillate

- 16 The diagram shows a chromatogram with different ink samples.



Based on the chromatogram, which statement is correct?

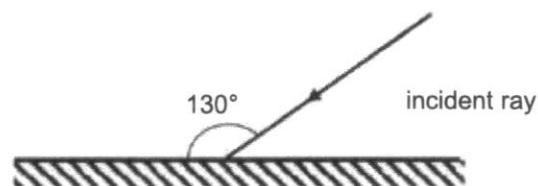
- A Black ink can be made by mixing green, brown and yellow inks.
- B Brown ink is a mixture of two inks.
- C Yellow ink may be present in black ink.
- D Red ink and blue ink are pure substances.

[Turn Over

- 17 Shopkeepers use security mirrors to monitor the customers in their shop.
Which option shows the type of mirror used and the correct reason for its use?

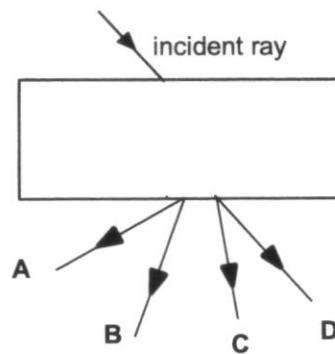
	type of mirror	reason
A	concave	the image is bigger and clearer
B	convex	a wider view can be seen
C	concave	a wider view can be seen
D	plane	the image is upright

- 18 The diagram shows a ray striking a plane mirror.



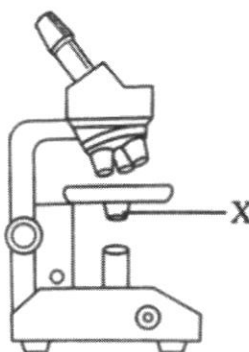
What is the angle of reflection?

- A 20°
 B 40°
 C 50°
 D 130°
- 19 Which light ray shows the correct path of a ray of light emerging through a glass block?



[Turn Over

- 20** Which is a harmful effect of visible light?
- A** discolouration of paintings
 - B** global warming
 - C** skin cancer
 - D** sunburn
- 21** Which object will not produce a regular reflection when a parallel beam of light is shone on it?
- A** plane mirror
 - B** polished metal sheet
 - C** surface of still water
 - D** white piece of paper
- 22** The diagram shows a microscope.



Which statement correctly describes the function of part X?

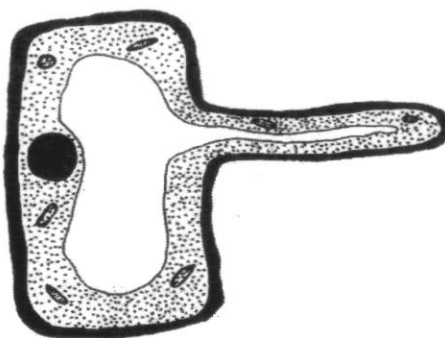
- A** allows adjustments to the position of the stage to obtain a sharp focus of the specimen.
- B** moves the stage up and down to obtain a clear image
- C** controls the amount of light entering the lens
- D** provides light to the eye

[Turn Over

- 23 An amoeba had its nucleus removed. For several days it continued to move and feed, but it did not reproduce. An intact amoeba, used as a control, reproduced twice during that period.

What conclusion can be drawn from this experiment about the role of nucleus in amoeba?

- A controls the normal activity of the cell
 - B essential for cell division
 - C essential for life
 - D is the only part of the cell that contains DNA
- 24 Which statement is **not** a reason for the division of labour in a multicellular organism?
- A Simple movement alone is not sufficient for efficient exchange of substances.
 - B The innermost cells of the multicellular organism are too far away from the external environment.
 - C The presence of many different systems allows the multicellular organism to perform many tasks together.
 - D Each individual cell is already differentiated and adapted to perform any function.
- 25 The diagram shows a specialised plant cell involved in the absorption of water and mineral salts.



Which statement explains the feature that allows this cell to carry out its function more effectively?

- A more chloroplasts for photosynthesis
- B larger vacuole can store more substances
- C cell wall that maintains the shape of the cell
- D elongated structure increases surface area to volume ratio for absorption

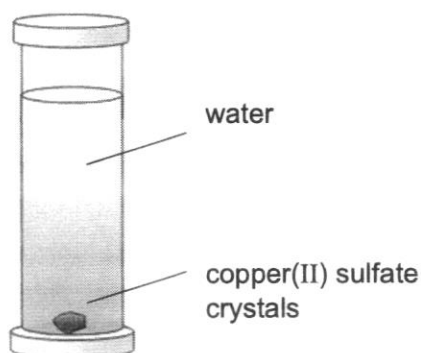
[Turn Over

- 26 The heart is made up of muscles, nerves and other structures. The function of the heart is to pump blood through the circulatory system.

Which row best describes the heart, muscles and nerves?

	heart	muscles	nerves
A	tissue	tissue	cell
B	tissue	cell	cell
C	organ	tissue	tissue
D	organ	cell	tissue

- 27 An experiment was set up.



After a while, the entire jar turns blue.

Which statement is **incorrect**?

- A Diffusion takes place when there are different concentrations in different regions.
- B The copper(II) sulfate particles will move from a region of higher concentration to a region of lower concentration.
- C The particles will stop moving when the concentration throughout the beaker is uniform.
- D The water particles are in constant random motion.

[Turn Over

SECTION B: Structured Questions (30 marks)

Answer **all** questions in the spaces provided.

- B1** A group of farmers developed four types of fertilisers **P**, **Q**, **R** and **S**, to increase the growth rate of their crops. The farmers think that fertiliser **R** is the best because it is the most expensive fertiliser to create.

The farmers carried out an experiment to investigate the effectiveness of these fertilisers. They grew crop plants using different fertilisers and noted the height of the crop plants after two weeks.

- (a) State the farmers' hypothesis for this experiment.

..... [1]

- (b) For the experiment, state whether the data collected by the farmers is qualitative or quantitative.

..... [1]

- (c) The table below shows the details of the experiment the farmers carried out.

fertilisers	mass of fertiliser used / g	plant	type of soil used	increase in average height of plants after two weeks / cm
P	3.0	onion	peat	4.4
Q	3.4	chilli	peat	4.0
R	3.2	onion	peat	5.9
S	3.1	chilli	peat	2.8

The farmers made mistakes in this experiment.

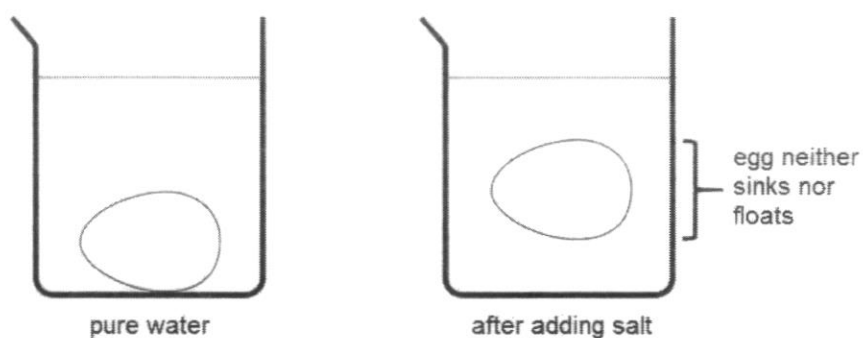
State and explain one mistake made by the farmers.

..... [2]

[Total: 4 marks]

[Turn Over

- B2** The diagram shows a fresh egg in a beaker of pure water and the same egg in the same beaker of water after salt was added.



Some information about the fresh egg, pure water and salt water is shown.

substance	mass / g	volume / cm ³	density / g / cm ³
fresh egg	66	60	
pure water	200	200	1.0
salt water		200	

- (a) Calculate the density of the fresh egg. Show your working clearly.

density of the fresh egg = [1]

- (b) Deduce the density of the salt water. Explain how you obtained your answer.

.....

 [2]

[Turn Over

16

- (c) Calculate the mass of salt that has to be added to the beaker of water for the fresh egg to neither sink nor float.

Assume that dissolving salt does not affect the volume of the water.
Show your working clearly.

mass = [1]

[Total: 4 marks]

- B3** The table shows some tests carried out on three unknown materials **A**, **B** and **C**.

materials	strength test	scratch test	density test
A	breaks when a 1000 kg load is placed on it	material A scratches material B	floats on water
B	breaks when a 10 kg load is placed on it	material B cannot scratch material C	floats on water
C	breaks when a 2000 kg load is placed on it	material C scratches material A	sinks in water

- (a) By comparing the physical properties of the three materials, state and explain which material is **most** suitable for making a scratch-resistant display shelf in a museum.

.....

[2]

- (b) State the softest material.

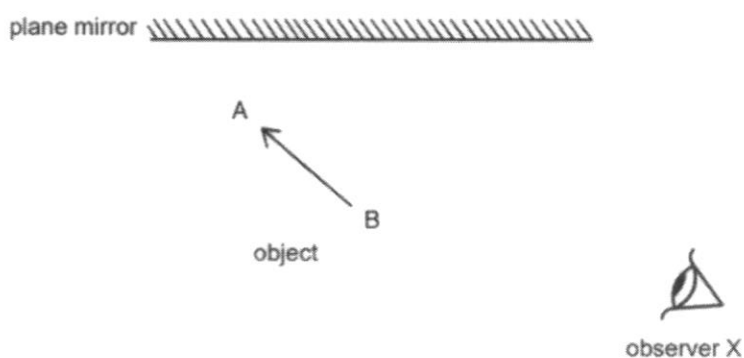
.....

[1]

[Total: 3 marks]

[Turn Over]

- B4 (a) (i)** State the type of mirror used to make a rear view mirror of a car.
 [1]
- (ii)** Describe one property of the image formed by the type of mirror in **(a)(i)**.
 [1]
- (b)** The diagram shows the position of the eyes of observer **X**, a plane mirror and an object **AB**.

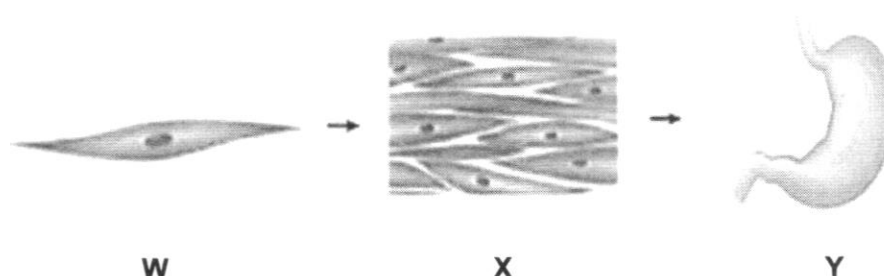


- (i)** On the diagram, draw the image of object **AB**. [1]
- (ii)** On the diagram, complete the ray diagram to show how the light ray from point **A** is seen by observer **X**. [2]

[Total: 5 marks]

[Turn Over]

- B5** The diagram shows how a muscle cell (**W**) is organised to make up the organism.



- (a) Label on cell **W**, the structure where cell activities occur in. [1]
- (b) State one difference in structure between cell **W** and a red blood cell.
 [1]
- (c) Explain why division of labour is important in this system.
 [1]
- (d) Define the level of organisation shown in **Y**.
 [1]

[Total: 4 marks]

- B6** The table shows the numbers of protons, neutrons and electrons in three particles **X**, **Y** and **Z**.

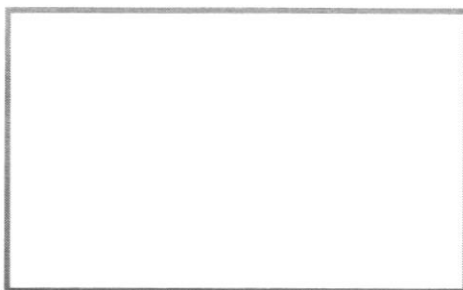
particle	protons	neutrons	electrons
X	12		12
Y	19	20	18
Z		42	33

- (a) Using the Periodic Table of Elements, complete the table by filling in the empty boxes. [1]
- (b) Which particle has the
- (i) largest atomic mass? particle [1]
- (ii) smallest atomic number? particle [1]
- (c) (i) Which particle is not electrically neutral? particle [1]
- (ii) Explain your answer in (c)(i).
 [1]

[Turn Over

19

- (d) The melting point and boiling point of **X** are 63°C and 760°C respectively. Draw the arrangement of particles in **X** at 25°C .



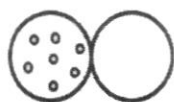
[1]

[Total: 6 marks]

[Turn Over]

- B7** When drawing molecular diagrams, atoms of different elements are shaded differently.

The diagrams shows the molecular diagrams used to represent nitrogen monoxide (NO) and water (H₂O).

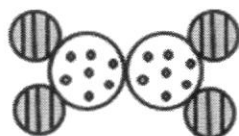


NO

H₂O

- (a)** State the chemical formulae of the following molecules.

(i)



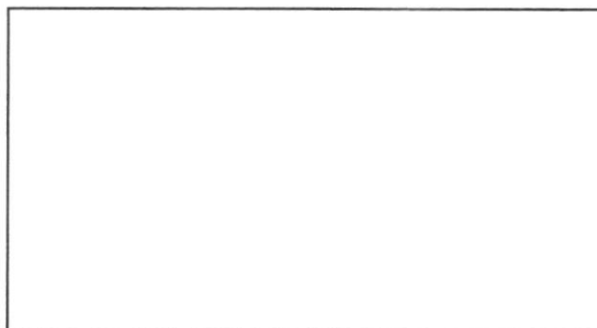
chemical formula [1]

(ii)



chemical formula [1]

- (b)** In the box provided below, draw the molecular diagram for a mixture of ammonia (NH₃) and nitrogen monoxide (NO). You only need to draw one molecule of each compound.



[2]

[Total: 4 marks]

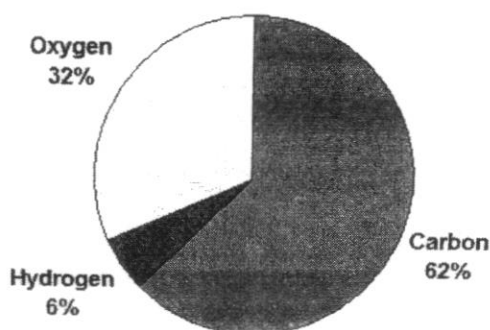
- End of Section B -

[Turn Over

SECTION C: Free Response Questions (40 marks)

Answer any **four** questions in the section in the spaces provided.

- C1 (a)** Vanillin is a common flavouring agent that can be extracted from vanilla beans. It is one of the most important aromatic flavours used in foods, beverages and perfumes. Due to its wide usage, it is produced on a scale of more than 10,000 tonnes per year by chemical industries. Vanillin is soluble in water and its composition is as shown in the pie chart.



- (i) Based on the information given, state if Vanillin is an element, compound or mixture. Explain your answer.

.....

[2]

- (ii) A tablespoon of Vanillin was added to a beaker of water. The resulting mixture was then filtered.

Predict what would be observed on the filter paper. Explain your answer.

.....

[2]

- (iii) If Vanillin was accidentally mixed with some iron filings, describe how you would separate the mixture of Vanillin and iron filings.

.....

[2]

[Turn Over]

(b) A student measured 20 g of coarse table salt with an electronic scale. The lumps of coarse table salt were about to be dissolved in water.

- (i) Draw an apparatus that the student used to contain the 20 g of coarse table salt.

[1]

- (ii) The student was investigating the factors that affect the rate of dissolving. State two factors that enable him to make the table salt dissolve faster in water.

.....

..... [2]

- (ii) After all the table salt had dissolved, the student added another 10 g of table salt into the mixture. However, the salt could not be dissolved.

Explain why is this so.

.....

..... [1]

[Total: 10 marks]

[Turn Over]

- C2 (a)** A student carried out an experiment in an attempt to obtain pure sugar crystals.

She used an apparatus to contain 20 cm^3 of sugar solution and heated it with a Bunsen flame.

- (i) Draw the set up for this experiment. Label your diagram.

[2]

- (ii) State a procedure to prevent strike-back from happening.

[1]

- (iii) State one safety precaution that should be taken when heating is involved in an experiment.

[1]

- (iv) Instead of pure sugar crystals, the student obtained a black solid at the end of the experiment.

Suggest one scientific attitude that the student should exhibit when she is faced with such situation.

Describe how she can demonstrate the named attitude in this case.

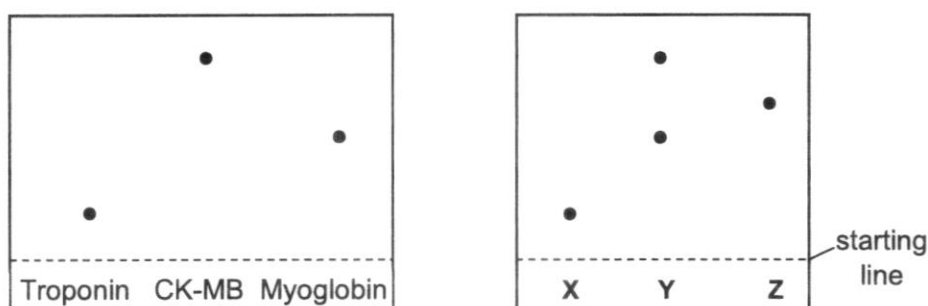
[1]

[Turn Over]

- (b) Paper chromatography may be used in the detection of heart disease by checking for substances that are released when muscle cells are damaged.

Troponin, CK-MB and Myoglobin are three substances that can be found in the blood of a patient at risk of a heart disease.

The chromatograms shown are those of the three substances, Troponin, CK-MB and Myoglobin and the blood samples of three patients, X, Y and Z.



- (i) Explain why the starting line should be drawn in pencil.
- [1]
- (ii) Two of the patients may have heart disease.

Identify the patients and the substance(s) that reveal that they may have heart disease in the table below.

patient (X, Y or Z)	substance(s) that reveal that they may have heart disease (Troponin, CK-MB or Myoglobin)

[2]

- (iii) A student claimed that Myoglobin is more soluble than CK-MB in the given solvent.

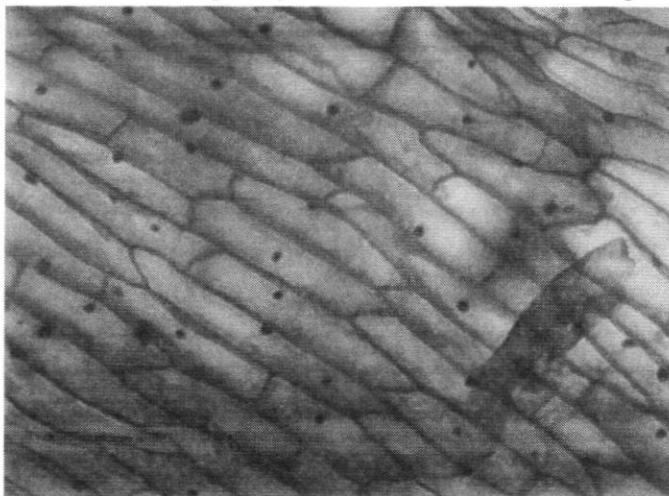
Do you agree with the student? Explain your answer.

..... [2]

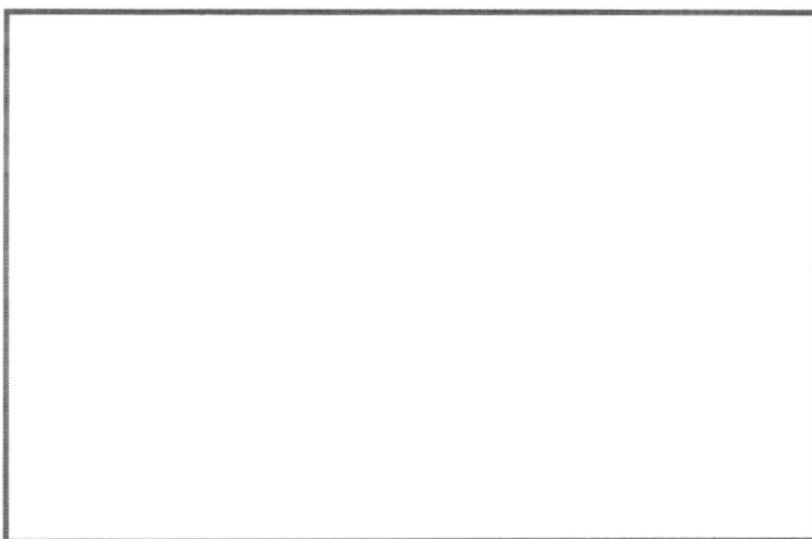
[Total: 10 marks]

[Turn Over

- C3 (a)** The diagram shows a single layer of cells taken from an organism.



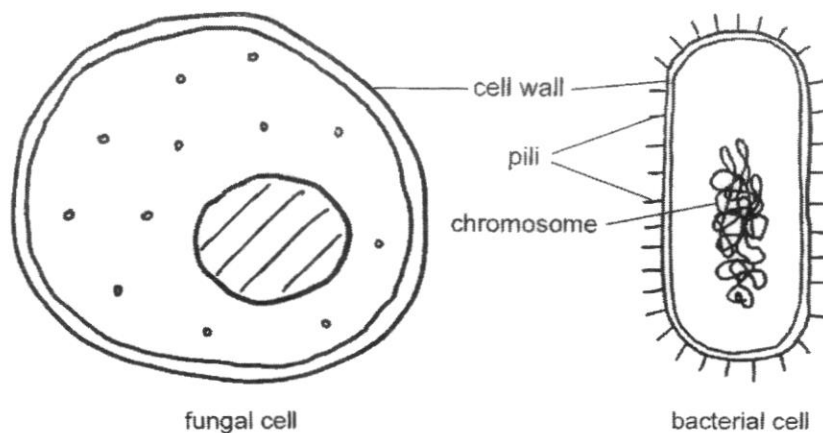
- (i) Draw a **single cell** in the space below.
- (ii) In your drawing, label the structure that contains genetic material.



[3]

[Turn Over

- (b) Fungi and bacteria, like plants and animals, are made out of cells. The diagrams below show a fungal cell and a bacteria cell (not shown to scale).



State

- (i) one similarity between a plant cell and a bacterial cell.

..... [1]

- (ii) two differences between a plant cell and a bacterial cell.

1: [1]

2: [1]

- (c) Suggest a function of the bacterial cell wall.

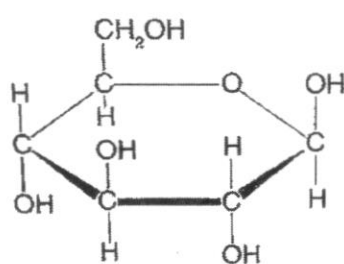
..... [1]

[Turn Over

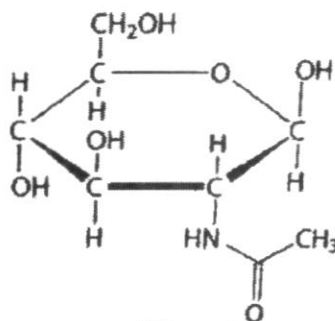
- (d) Plant cell walls are made of cellulose, a large molecule that is made of many β -glucose molecules bound together.

Fungal cell walls are made of chitin. Just like cellulose, chitin is made of many of the same molecules bound together.

The diagrams below show the molecular structure of β -glucose and chitin.



β -glucose



chitin

- (i) Using the information from the diagram, count the total number of atoms present in a β -glucose molecule.

..... [1]

- (ii) Define what is an element.

..... [1]

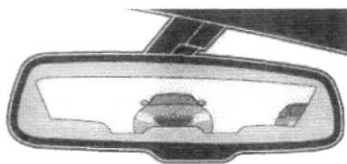
- (iii) Describe one difference in the elements that made up β -glucose and chitin.

..... [1]

[Total: 10 marks]

[Turn Over

- C4 (a)** The diagram shows the rear view mirror of a car.



A vehicle behind the car has a vehicle plate as shown.

SBA 1234A

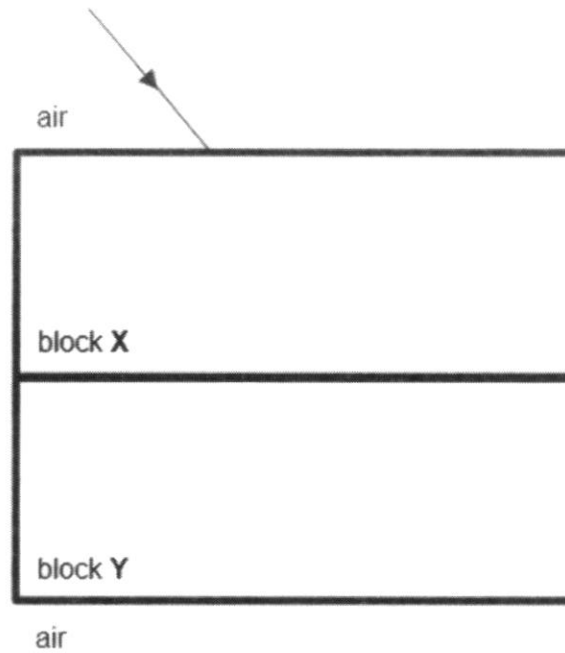
Draw in the box below the image of the vehicle plate as seen by the driver of the car through the rear view mirror.

A large, empty rectangular box with rounded corners, intended for the student to draw the image of the vehicle plate as seen through the rear view mirror.

[2]

[Turn Over

(b) The diagram shows how a light ray strikes block X.



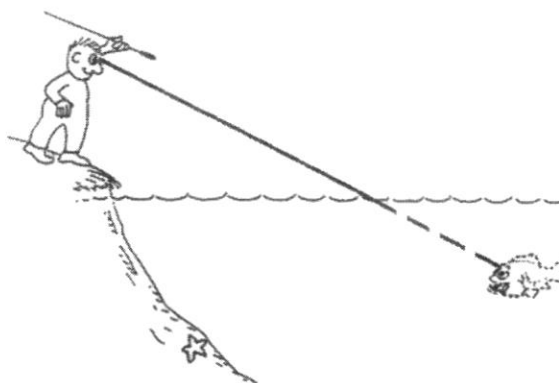
The table shows the relative optical density of air, block X and block Y.

medium	relative optical density
air	1.00
block X	1.92
block Y	1.33

On the diagram, draw the ray of light that passes into plastic block X, plastic block Y and out from plastic block Y. [3]

[Turn Over

- (c) The diagram shows the view of a hunter who is spearfishing by the riverbank.



- (i) Explain why the hunter is not likely to hit the fish with his spear if he aims at the position where the fish appears to him.

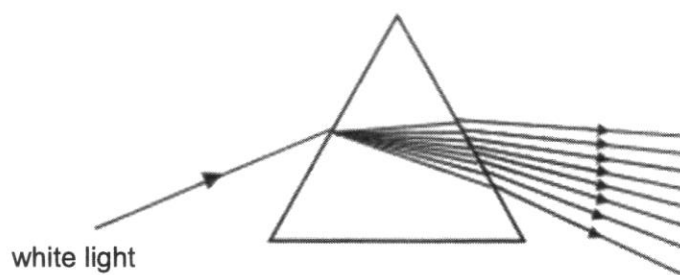
.....

[2]

- (ii) Mark the actual position of the fish with a cross.

[1]

- (d) White light undergoes dispersion as shown.



On the diagram, label the blue ray.

[1]

- (e) The speed of light in material **M** is estimated to be 2 900 000 m/s. It is known that material **M** has a lower optical density of material **P**.

Compare the speed of light in material **M** to the speed of light in material **P**.

.....

[1]

[Total: 10 marks]

[Turn Over]

- C5 (a)** The diagram shows a helium balloon when it was just inflated and the same balloon after it has been left out in the open for a few days.



- (i) Describe the arrangement and movement of the helium particles in the balloon.

.....

 [2]

- (ii) Explain the appearance of the balloon after it was left out in the open for a few days.

.....

 [2]

- (iii) Using the particulate nature of matter, state and explain what would be observed if the balloon is placed in a refrigerator for a few hours.

.....

 [2]

[Turn Over

(b) The table shows the melting and boiling points of some substances.

substance	melting point ($^{\circ}\text{C}$)	boiling point ($^{\circ}\text{C}$)
ammonia	-78	-33
bromine	-7	59
butane	-135	-0.5
ethanoic acid	17	118
pentane	-130	36

- (i) Which substances are liquid at room temperature?
 [1]
- (ii) Which substance remain liquid over the largest range?
 [1]
- (iii) Explain what happens to the density of bromine when it is heated from room temperature to 70°C .

 [2]

[Total: 10 marks]

- END OF PAPER -

[Turn Over

Lower Secondary Science 1 EXP SA2 Marker's Report

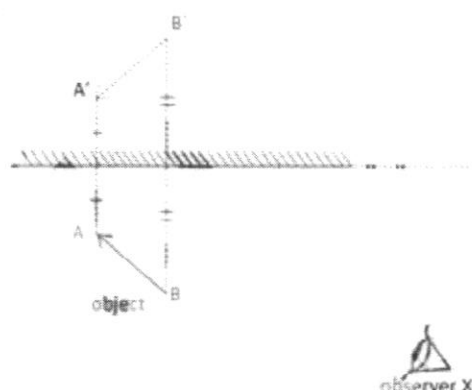
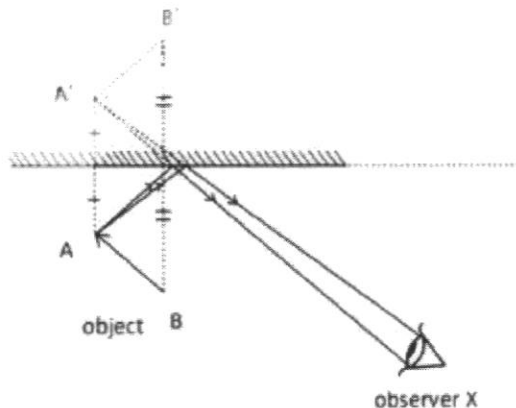
Section A (30 marks)

1	A	11	C	21	D
2	A	12	B	22	C
3	C	13	B	23	B
4	A	14	C	24	D
5	B	15	B	25	D
6	C	16	C	26	C
7	C	17	B	27	C
8	B	18	B	28	A
9	C	19	D	29	D
10	B	20	A	30	B

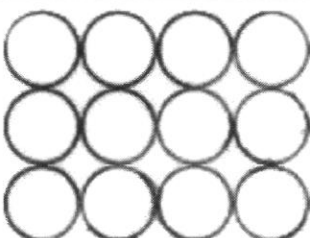
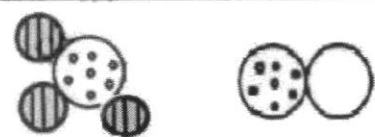
Section B (30 marks)

B1	(a)	- The plant with fertiliser R added has the greatest increase in average height after two weeks. [1] OR - The more expensive the fertiliser, the higher the crop plant will grow. [1]	Accept: if students talk about the type of fertiliser affecting the growth of plant Reject ambiguous and non-specific answers like "the better it will be", "works the best", "more effective" etc
		Remarks: - Hypothesis must include prediction (greatest / highest) as mention of independent & dependent variables - Most wrote about effectiveness of fertilisers / better fertilisers as dependent variable instead of height or growth rate - A: faster / better growth (rate), taller plant for R than other fertilisers, as price increases growth rate increases, higher height better fertiliser - R: affects growth, to find out... (aim of expt), wrong cause & effect - Poorly answered	
	(b)	- Quantitative [1] Remarks: - Many indicated qualitative instead	

	(c)	- Mistake: Mass of fertiliser / types of plants used is not kept constant. [1] - Explanation: When more than one variable is changed, it cannot be concluded that the type of fertiliser used caused the changes in height / whether type of fertiliser affected height after 2 weeks.	
		Remarks: - Many wrote about results would be hindered / affected / unfair / incomparable without further elaboration that no conclusion can be drawn - A: Different plant / different mass results in different height - R: experiment would be more accurate / fair / reliable / fertilisers work only with certain plant species / should only have 1 changed variable	
B2	(a)	density of fresh egg $= \text{mass} / \text{volume}$ $= 66 / 60$ $= 1.1 \text{ g/cm}^3$ [1]	For (a) and (c), minus $[\frac{1}{2}]$ if the unit is missing.
		Remarks: $[\frac{1}{2}]$ for correct working (substitution of values / formula) - Generally well-answered with a few missing / incorrect units. - Remind students to include formula	
	(b)	- Density of salt water = 1.1 g/cm^3 / The fresh egg has the same density as the salt water. [1] - The egg neither sink nor floats in salt water. [1]	
		Remarks: - Some did not attempt this question / misinterpreted the question to write a method or attempted calculations (e.g. mass of water minus egg) - Others wrote that it has the same mass / density as pure water (salt did not add mass to water) or wrote that it has higher density without stating a value - R: higher density than pure water / lower than egg, heavier than pure water	
	(c)	density of fresh egg = density of salt solution = 1.1 g/cm^3 mass of salt solution = density x volume $= 1.1 \times 200$ $= 220 \text{ g}$ $[\frac{1}{2}]$ Given mass of water = 200 g mass of salt = $220 - 200$ $= 20 \text{ g}$ $[\frac{1}{2}]$	Alternative working: difference in density = 0.1 g/cm^3 $\text{mass} = \text{vol} \times \text{density} = 200 \times 0.1 = 20 \text{ g}$
		Remarks: - Many left question blank or wrote a value without showing working - ECF based on incorrect density - Common errors: not subtracting the mass of the water	
B3	(a)	- C [1] Strongest material that is able to hold a heavy load of books $[\frac{1}{2}]$ and hardest material that is not easily scratched $[\frac{1}{2}]$	
	(b)	B [1]	
		Remarks:	

		- Many did not state strongest material nor relate the data in the table to the physical property (strength, hardness) or reiterated 'scratch-resistant' - R: scratch-resistant without explanation - A few stated A as the softest material		
B4	(a)	(i)	Convex [1]	
		(ii)	Any 1: [1] Wider field of vision / Diminished size of image / Laterally inverted / Upright / Virtual	
	Remarks: - A: plane mirror, wider view - R: clear image, wider image, plain mirror - ECF for property / correct property with wrong mirror identified - Common error: concave mirror, convex mirror gives bigger images			
	(b)	(i)	image is laterally inverted, equidistant from object, same size AND drawn with dotted lines [1] 	Accept single ray Penalty of [$\frac{1}{2}$] if image / virtual ray is not drawn with dotted lines / no normal (not nec to draw normal if image is drawn accurately)
		(ii)	Incident and reflected rays drawn in solid lines with arrows, in correct direction, equal angles [1] virtual ray drawn in dotted lines, extended correctly from reflected ray [1] 	
Remarks:				

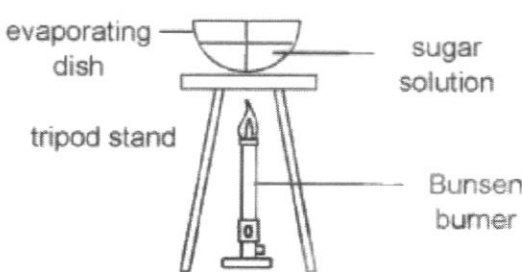
		- Image was not drawn well or missing (some thought A and B were the objects so A' and B' were marked out) - Drawing was not well done - Full credit if incident ray is drawn from A or B instead of from the arrow																	
B5	(a)	 Label cytoplasm as W [1]	Label anywhere inside cell as long as not nucleus and cell membrane																
	Remarks: - Some drew a line without writing the label name / labelled it as 'where cell activities occur in' - Common error: labelling nucleus - Remind students that label lines should not be drawn with an arrow																		
	(b)	W contains a nucleus <u>while</u> red blood cell does not. [1]																	
	Remarks: [½] W has a nucleus (without comparing that RBC does not) - Some wrote that W has a cell wall / no vacuoles while others compared the shape of the cells (circular vs wavy) - A: RBC is biconcave																		
	(c)	Allows different parts of the system / organism to perform various (different) functions in a coordinated way so that the system / organism can function efficiently [1]																	
	Remarks: Many were not able to explain that the system / organism would be more efficient and wrote about organelles (division of labour in a cell) or work properly / divide / cells reproduced / cell repair																		
	(d)	An organ is made up of different tissues that work together to perform a specific function. [1]																	
	Remarks: Many stated organ without defining it / high level / small / good / named an organ / system e.g. stomach or digestive system																		
B6	(a)	<table border="1"> <thead> <tr> <th>particle</th><th>protons</th><th>neutrons</th><th>electrons</th></tr> </thead> <tbody> <tr> <td>X</td><td>12</td><td>12</td><td>12</td></tr> <tr> <td>Y</td><td>19</td><td>20</td><td>18</td></tr> <tr> <td>Z</td><td>33</td><td>42</td><td>33</td></tr> </tbody> </table>	particle	protons	neutrons	electrons	X	12	12	12	Y	19	20	18	Z	33	42	33	[½] for each box
	particle	protons	neutrons	electrons															
X	12	12	12																
Y	19	20	18																
Z	33	42	33																
Remarks: Common error: 24 for neutrons																			

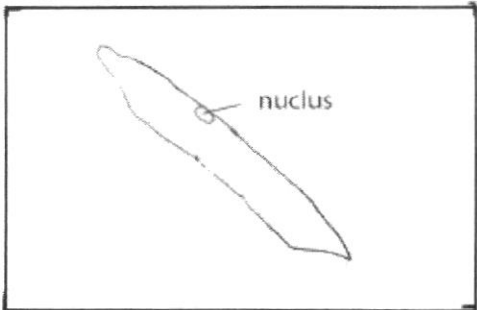
	(b)	(i)	• Particle Z [1]	
		(ii)	• Particle X [1]	
	Remarks:			
	• Well-answered			
	(c)	(i)	• Particle Y [1]	
(ii)		• The number of protons does not equal the number of electrons . [1]		
Remarks:				
• A few chose X or Z • A 19p and 18e so particle has positive charge / more protons than electrons • Common error: choosing the particle with the highest number of protons / comparing number of protons and neutrons • A ECF if proton number was incorrect				
(d)				<i>minimal gaps and overlap at one glance</i> Solid. Distinct and consistent no. of row and column
Remarks:				
• well-drawn with only a few drawing particles in the liquid state • Remind students to draw in the box given not to draw additional box				
B7	(a)	(i)	N_2H_4 [1]	accept any variations as long as the types and number of atoms are correct
		(ii)	HNO_3 [1]	
	Remarks:			
• Elements and numbers of each atom was well understood • common error O instead of H for N_2H_4, N_3 for HNO_3 • R: if numbers are written superscript				
(b)				
		[1] correct type and number of atoms of each molecule [1] 2 molecules not touching one another		
Remarks:				
• Common error: joining all different types of atoms together [0] • Some drew molecules separated by a line [0]				

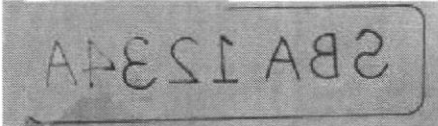
Section C (40 marks)

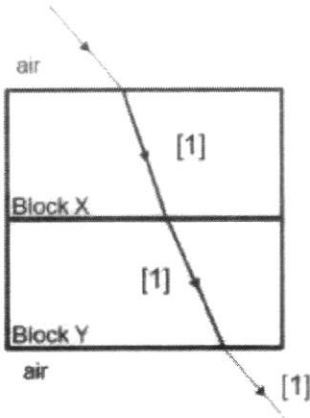
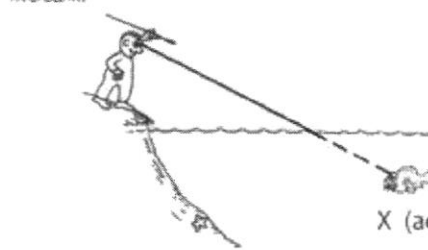
C1	(a)	(i)	• Compound [1]	
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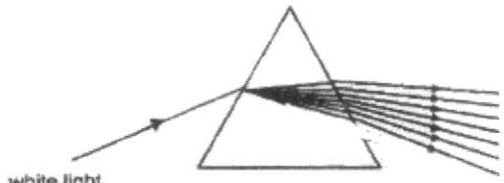
		Vanillin is made up of hydrogen, carbon and oxygen / more than one element [$\frac{1}{2}$] chemically combined / in fixed composition / named percentages [$\frac{1}{2}$]	
		Remarks: - Most students left out the point on fixed composition - A few suggested it was a mixture that had elements chemically combined	
	(ii)	No residue would be observed on the filter paper [1] - Vanillin has dissolved in water / is soluble in water to form a solution [1]	
		Remarks: - A: nothing observed - Some students wrote that a residue would be formed even though they identified vanillin as soluble in water (each point marked separately) - Remind students to indicate that a solution is formed	
	(iii)	1. Add water to the mixture and stir [1] 2. Filter the mixture and collect the residue (iron filings) and the filtrate (Vanillin) [1] OR 1. Place a magnet over the solid mixture / magnetic attraction [1] 2. The iron filings would be attracted to the magnet and leaving behind the Vanillin powder. [1]	
		Remarks: - well- answered with many indicating the use of the magnet - Those who wrote about filtration did not mention what mixture was filtered or identified the filtrate & residue separately	
(b)	(i)	Diagram of either a beaker or conical flask. [1]	
		Remarks: - A: beaker with marking / salt or solution within - A few drew a test tube / electronic scale	
	(ii)	Any 2: [2] 1. Use hot water / warm the water [1] 2. Stir / mix the mixture faster [1] 3. Use fine table salt instead of coarse table salt [1]	
		Remarks: [$\frac{1}{2}$] each for stating factor e.g. speed or rate of stirring / temperature - Many stated a factor instead of how salt can be dissolved faster - Common error: add more water - A: stir / mix (regardless of rate)	
	(ii)	This is a saturated solution / maximum amount of solute that has been dissolved. [1]	
		Remarks:	

		- Not well-answered - not enough water, no more space to dissolve salt, salt already dissolved, too much salt, salt not soluble in salt solution - A: solubility of salt not high enough for fixed volume of solvent, salt concentration too high, too much salt for water to dissolve, solute reached capacity, not enough water to dissolve salt		
C2	(a)	(i)	evaporating dish sugar solution tripod stand Bunsen burner  evaporating dish [1] tripod stand [1]	Accept beaker in place of evaporating dish
		Remarks: [½] drawing, [½] label - Common errors 3D drawing/ single line without thickness for tripod stand missing tripod stand/ test tube for heating /missing labels - Beaker was commonly drawn in place of evaporating dish		
		(ii)	Close the airhole fully [½] before [½] lighting the Bunsen burner.	
		Remarks: - Many did not indicate when airhole should be closed /wrote it should be closed - A: close hole - R: when or upon ignition		
		(iii)	Do not leave the flame unattended / Wear safety goggles / protective eye equipment [1]	Accept other logical answer.
		Remarks: - A: tie up hair / do not put flammable substances near the flame - R: wear gloves		
		(iv)	- Perseverance and continue to try other alternative methods to obtain pure white sugar crystal (accept: resilience / try one more time) - Curiosity and find out reasons for the results / research to find alternative ways to obtain white sugar crystals	(accept: creativity) scientific attitude [½] + relevant explanation [½]
		Remarks: - A: honesty to not change the result / not giving up (in place of perseverance) / open-mindedness to do further research - A few did not state the scientific attitude or wrote about mistakes she may have made to obtain the black solid - Remind students that repeating without making changes may not always be useful		

	(b)	(i)	Pencil lead is used as it does not dissolve / not soluble in the solvent and will not interfere with / affect the result.	
			Remarks: - A: components in pencil cannot be separated - R: no smudging / smearing / spread / erasable / imaginary and not real / explaining why pen cannot be used - Many wrote about the insolubility but not about the interference with results	
		(ii)	- Patient X - Substance: Troponin [1] - Patient Y - Substances: CK-MB and Myoglobin [1] (both substances must be identified)	(Both patient and substances must be correct = 1 mark)
			Remarks: Common error: missing one component for patient Y / identifying patient Z with myoglobin	
C3	(a)	(iii)	- No. [1] - CK-MB travelled further on the chromatogram paper compared to Myoglobin, thus CK-MB is more soluble [1]	
			Remarks: - A: CK-MB is higher than myoglobin - A few agreed with the statement - Remind students not to phrase answer beginning with 'if' but to state what was shown on the chromatogram	
			 Clear outlines without shading [1] Accurate (proportionate, correct shape) - contain <u>both</u> cell wall and nucleus [1] Label: nucleus [1]	
			Remarks: - Remind students of common error: cell membrane not seen clearly and should not be drawn / shading of nucleus - Some labelled all structures such that credit for (a)(ii) could not be awarded - Remind students that drawing should be large and occupy more than half the space given	

	(b)	(i)	Both contain cell walls. [1]	
		(ii)	Any 2: [2] - Plant cells have chloroplasts, <u>while</u> bacterial cells do not. - Plant cells have nucleus, <u>while</u> bacterial cells do not. - Bacterial cells have pili <u>while</u> plant cells do not.	
		Remarks: - max [1] if both cells are not compared for the same structure - A: plant cells have large central vacuole while bacterial cells do not - Common error: plant cell does not contain chromosomes / bacteria cell does not have vacuoles / comparing fungal cell		
	(c)		To support bacterial cell/ give bacterial cell a regular shape/ protect the cell from physical damage [1]	
		Remarks: A: give shape / protect it		
	(d)	(i)	24 [1]	
		Remarks: Some indicated the number of types of atoms or miscalculated the number as 19 or 23		
		(ii)	An element is the basic building block of matter that Cannot be broken down into simpler substances by chemical processes [1]	
		Remarks: - Not well learnt with many indicating chemical combination or that it is an atom / constituent of an atom - R: cannot be separated		
		(iii)	Chitin contains nitrogen (N) while β-glucose does not [1]	
		Remarks: - R : different number of elements - Common error : referring to NH or CH₃ as an element [½] for stating nitrogen without comparison		
C4	(a)	 [1] laterally inverted for individual characters [1] laterally inverted for whole object		
		Remarks: Common errors: no lateral inversion of letters / beginning with S		

(b)	 Light ray in X bends towards the normal as it enters Block X as it is optically more dense than air. [1] Light ray in Y bends away from the normal as it enters block Y as it is optically less dense than block X. [1] Light ray coming out of Y will bend away from the normal as air is optically less dense than Block Y, and must be parallel to the incident ray. [1]	minus [$\frac{1}{2}$] for whole question if arrows / normals are not drawn
Remarks:	Common error : missing normals/ missing ray out of block Y	
(c) (i)	- Due to <i>refraction</i> of light [$\frac{1}{4}$], the light ray bends away from normal when it enters the air. [$\frac{1}{4}$] - Thus, the image of the fish is closer to the water surface than it actually is. [1]	
Remarks:	'Apparent depth' is not the same as real depth / not seeing the actual position of the fish / aiming at image of the fish - A few has the misconception that the brain perceives the light travelling in a straight line as per the diagram shown) or wrote about reflection	
(ii)	 X (actual position) Directly below the position of the image. [1]	
Remarks:	Many students drew it on same level but to the left of the fish or missed out the question	

	(d)	 white light Third ray from bottom. [1]		
Remarks:				
Well-answered				
	(e)	<i>Speed of light</i> in material P is slower than in material M [1]		
Remarks:				
- A number stated that speed is faster in P - R: material is different				
C5	(a)	(i)	- The helium particles are far apart and are arranged in a disorderly manner. [1] - The helium particles are moving at high speed in random directions. [1]	
	Remarks:			
	- A: no fixed pattern instead of disorderly/fast in different directions - R: high speed without indicating random/far apart without indicating disorderly			
		(ii)	- There is a net movement of helium particles from a region of higher concentration in the balloon to a region of lower concentration outside the balloon. [1] - Helium particles are small enough to diffuse through the <i>porous surface</i> of the balloon. [1]	[1] compare concentration [1] small enough to diffuse
	Remarks:			
	- Many described the appearance or the slower / closer movement of the particles or mentioned heat loss and contraction / particles stopped moving / no air inside the balloon - A few wrote about the inflation of the balloon due to the heat - R: helium escaped			
		(iii)	- Balloon will shrink / deflate / become smaller. [1] - Upon cooling, the particles lose energy / heat and move slower and closer to each other. [1]	
Remarks:				
- Some did not mention the observation of the balloon or that the shape would not change - Many did not mention the loss of energy resulting in the change in movement - Common error: particles contracting / freezing				
	(b)	(i)	Bromine, ethanoic acid, pentane [1]	2 correct: [½]
		(ii)	Pentane [1]	
		(iii)	Density of bromine will decrease. [1]	

		Bromine will start to boil at 59°C, hence the <i>same number of particles</i> become further apart / more spaces between particles / occupy a larger volume. [1]	
		Remarks: - Common error: ammonia for (i), ethanoic acid or butane for (ii) - Explanation was not based on particulate nature of matter but stating that it is a gas / writing that density increases or would not change	