

St. Patrick's School End-Of-Year Examinations 2022

SECTION A: [20 marks]

Each question is provided with **four** possible answers (A, B, C and D). Select the most appropriate answer and **shade** your choice on the **Optical Answer Sheet** provided.

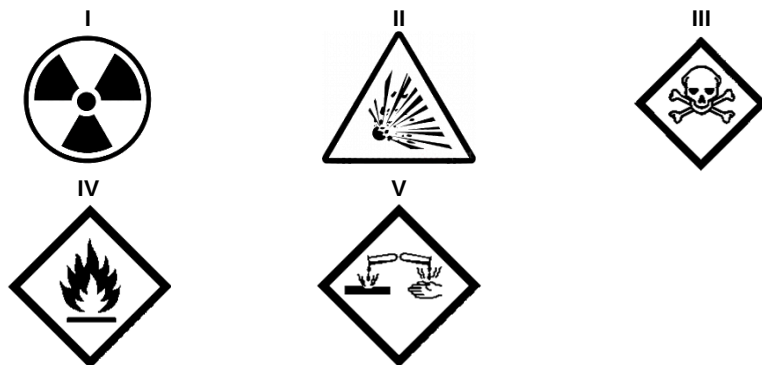
1 Which of the following is a precautionary step to take when heating a test tube of water?

- A Put on safety goggles before heating the test tube
- B Fill the test tube completely with water before heating.
- C Hold the test tube of water with bare hands when heating.
- D Point the mouth of the test tube towards yourself when heating.

2 Three bottles of chemicals with descriptions were found in the laboratory.

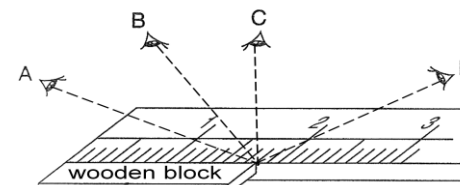


Which row shows the correct hazard symbol to be pasted on each bottle?



	ethanol	mercury	sulfuric acid
A	II	III	V
B	IV	III	V
C	IV	I	II
D	II	I	IV

3 A student wants to use a ruler to measure the length of a wooden block. At which position (A, B, C or D) should the student be at to view the reading on the ruler accurately?



4 Which statement is true about a 10 g piece of iron and a 10 g bag of feathers? Given: density of iron is 7.9 g/cm^3 ; density of feathers is 0.0025 g/cm^3

- A The piece of iron is lighter than the bag of feathers.
- B The piece of iron is heavier than the bag of feathers.
- C The iron has a smaller volume than the bag of feathers.
- D The iron takes up a larger space than the bag of feathers.

5 The following shows some information about 4 materials.

- W is left with a mark when it is scratched by X.
- Y can be scratched by all the other three materials.
- Z can scratch the other 3 materials, W, X and Y.

Which row shows the order of hardness of materials W, X, Y and Z, starting from the softest material?

	softest	hardest		
A	W	X	Y	Z
B	W	Z	Y	X
C	Y	W	X	Z
D	Z	X	W	Y

6 Which option correctly completes the statement below?

_____ **Space 1** _____ can be beaten into sheets because it is _____ **Space 2** _____.

	Space 1	Space 2
A	Aluminium	ductile
B	Brass	malleable
C	Copper	ductile
D	Ceramic	malleable

7 Carbon dioxide is **NOT** found in the Periodic Table because it _____.

- A is impure
- B is a mixture
- C is a molecule of compound
- D is a gas at room temperature

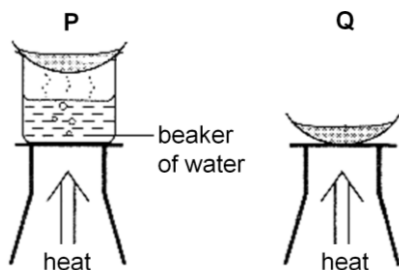
8 What do elements in the same group of the Periodic Table have in common?

- A They are all metals.
- B They are all non-metals.
- C They have similar chemical properties.
- D They all burn in air to form compounds.

9 An element **X** exists as a silvery liquid. **X** is also a good conductor of heat and electricity. What could element **X** be?

- | | |
|-------------|-------------|
| A aluminium | B magnesium |
| C mercury | D tungsten |

10 Which statement regarding the set-ups is true?



- A Solute can be removed in **P**, but not in **Q**.
- B The solution used in **P** may be flammable in nature.
- C **Q** is used to separate an insoluble solid from a liquid.
- D **P** and **Q** can be used to separate a mixture of two liquids.

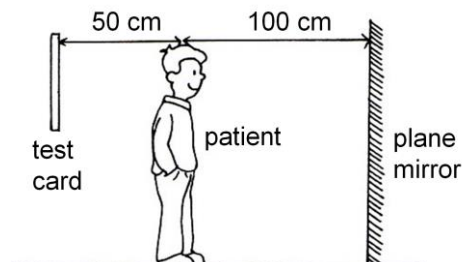
11 A paper chromatography experiment was performed to identify the dyes present in a food colouring. The following results were obtained.



The dyes present in the food colouring were _____.

- | | |
|---------------------|-----------------------|
| A III and IV only | B II, III and IV only |
| C I, II and IV only | D I, III and IV only |

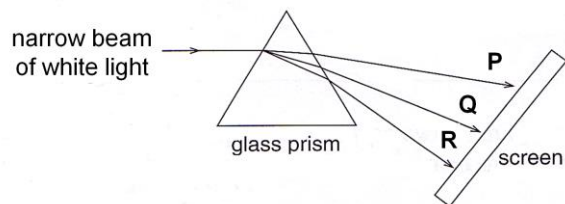
12 An optician holds a test card 50 cm behind a patient. The patient then looks in the plane mirror which is 100 cm away.



What is the distance from the patient's eyes to the image of the test card?

- | | |
|----------|----------|
| A 100 cm | B 150 cm |
| C 200 cm | D 250 cm |

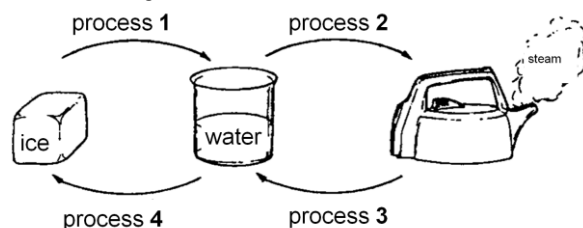
- 13 A narrow beam of white light is passed through a glass prism.



Which row shows the correct order of colours emerging from the glass prism?

	P	Q	R
A	blue	green	red
B	blue	red	green
C	red	blue	green
D	red	green	blue

- 14 The diagram shows the changes of state for water.



What are the names of the processes labelled 1 to 4?

	Processes			
	1	2	3	4
A	condensation	freezing	melting	boiling
B	boiling	melting	boiling	freezing
C	melting	condensation	freezing	boiling
D	melting	boiling	condensation	freezing

- 15 Which statement(s) correctly describe(s) boiling?

- I Particles gain energy.
- II Particles move further apart.
- III The forces of attraction between the particles decrease.

- A I only
B I and II only
C II and III only
D I, II and III

- 16 Which statement explains why a liquid can take the shape of any container?

- A Liquid particles are orderly arranged.
- B Liquid particles can slide past each other.
- C The forces of attraction between liquid particles are negligible.
- D Liquid particles are not as closely packed as particles in a solid.

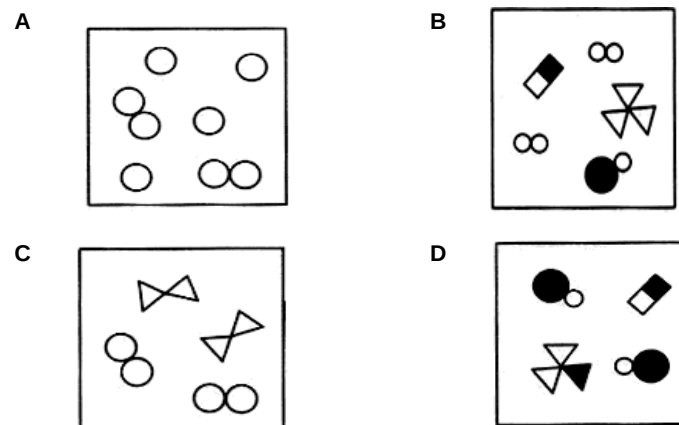
- 17 Which statement is true regarding atoms and the sub-atomic particles of an atom?

- A Electrons have same mass as neutrons.
- B Atoms are the smallest particles of an element.
- C There are the same number of protons and neutrons in an atom.
- D Atoms are electrically neutral as the nucleus has neutrons which have no charge.

- 18 Which particle has no electrical charge?

- A electron
B neutron
C nucleon
D proton

- 19 Which diagram contains only compounds?



- 20 Which chemical formula represents a compound containing 3 atoms?

- A CuSO_4
B K_2O
C LiF
D H_2CO_3

SECTION B: [30 marks]

Answer **ALL** questions in this section. Show your working and write your answers in the space provided.

- 1 Patrick wondered whether the height of dough would increase more if there was a change in the temperature of the surroundings and decided to carry out an experiment. Fig. 1.1 shows his experimental setup using the same initial height of dough each.

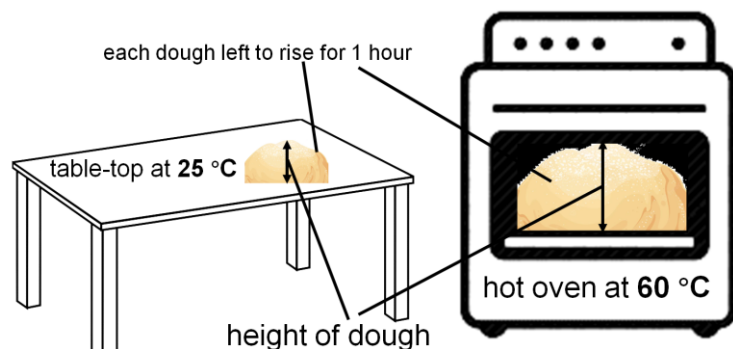


Fig. 1.1

- (a) State a hypothesis for his experiment.

.....

[1]

- (b) Identify the following for his experiment.

- (i) independent variable:

.....

[1]

- (ii) dependent variable:

.....

[1]

- (iii) controlled variable:

.....

[1]

- 2 Table 2.1 shows information about liquids **A**, **B** and **C**.

- (a) Complete Table 2.1.

Table 2.1

liquid	mass (g)	volume (cm ³)	density (g/cm ³)
A	150		1.5
B		80	1.25

[1]

- (b) Liquids **A**, **B** and **C** were added into a test tube.

Liquid **C** has a density of 0.8 g/cm³.

- (i) Label liquids **A**, **B** and **C** in the correct order of density in Fig. 2.1.

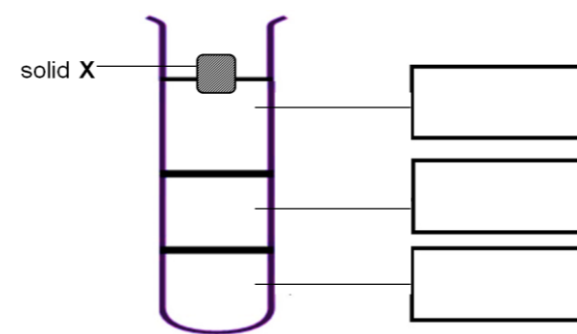


Fig. 2.1

[1]

- (ii) Using your answer in (b)(i), suggest the density of solid **X**.

..... g/cm³ [1]

- (iii) Solid **X** is now cut into half. Predict whether the density of each half will increase, decrease, or remain unchanged. Explain your answer.

.....

.....

..... [2]

3 Solid iodine is soluble in water, whereas solid substance **X** is insoluble in water.

(a) John added solid iodine and solid substance **X** to water. He noticed that a suspension is formed.

(i) State a difference between a solution and a suspension.

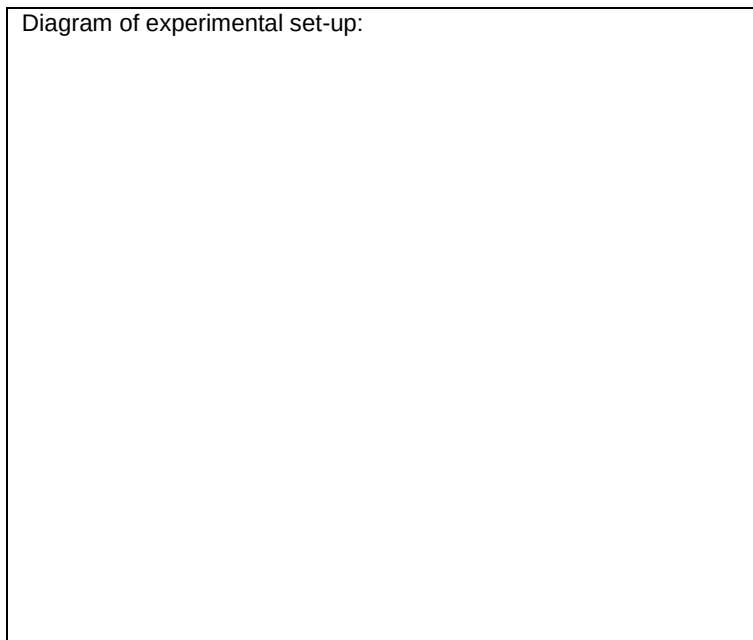
.....

[1]

(ii) In the box below, draw a fully labelled experimental set-up to obtain solid substance **X** from the suspension in (a).

In your diagram, label all your apparatus, iodine and substance **X**.

Diagram of experimental set-up:



[2]

(b) An experiment was carried out to investigate the solubility of iodine in water and ethanol. At different temperatures, iodine was added separately to two different beakers, one containing 100 cm³ of water and another containing 100 cm³ of ethanol. The results obtained are shown in Fig. 3.1.

solubility of iodine

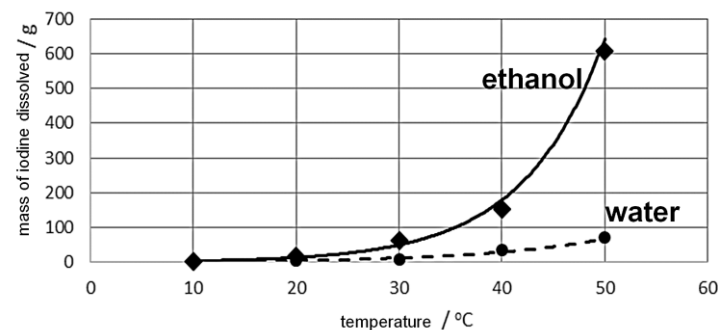


Fig. 3.1

(i) Identify the solute in the experiment.

.....

[1]

(ii) From Fig. 3.1, identify two factors which can affect solubility.

Factor 1:

Factor 2:

[2]

(iii) Martina spilled some brown iodine onto her dress. She soaked her dress in hot water but was unable to remove the stain.

Using information from Fig. 3.1, explain why this is so and suggest what can be done instead.

Explain:

.....

Suggest:

.....

[2]

- 4 Fig. 4.1 shows ray of light as it enters the glass prism at side YZ. XYZ is a right-angled glass prism.

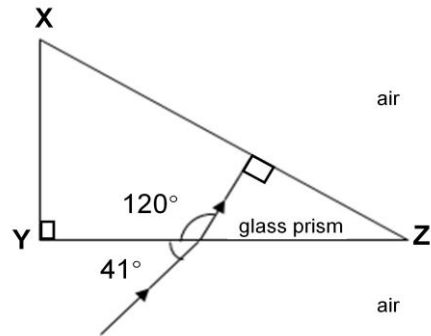


Fig. 4.1

- (a)** Based on Fig. 4.1, calculate the angle of incidence at side YZ.

angle of incidence: ° **[1]**

- (b)** Calculate the angle of refraction at side YZ.

angle of refraction: ° **[1]**

- (c) Explain why the light ray bends in the manner shown in Fig. 4.1 as it enters the glass prism from air at side **YZ**.

.....

.....

.....

- (d)** Light ray in glass prism meets surface **XZ** at 90° .

On Fig. 4.1, **complete the path** of the light ray as the ray exits from the glass prism into the air from side **XZ**. [1]

- 5** Substance **Z** melts at 1400 °C and boils at 4000 °C.

- (a) Draw the arrangements of particles to represent substance **Z** at 400 °C and at 4531 °C in the boxes.

400 °C	4531 °C

[2]

- (b) (i)** Substance **Z** expands in size after it has been heated for sometime. Circle the word(s) that correctly describe(s) the mass of **Z** after **Z** has expanded in size.

increases remains the same [1]

- (ii) Explain your answer in (b)(i) using the **particulate nature of matter**.

.....

.....

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

6 Fig. 3.1 shows the arrangement of the sub-atomic particles in atom P.

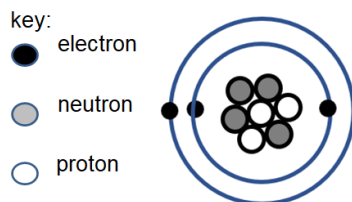


Fig. 3.1

- (a) Use the Periodic Table on page 17 to identify atom P.

..... [1]

- (b) State the atomic mass of atom P.

..... [1]

- (c) With reference to the number of sub-atomic particles, explain why atom P is electrically neutral.

..... [2]

- (d) Another unknown atom Q was found to contain the same number of protons but different number of neutrons from atom P.

Suggest whether atom Q is the same element as atom P.

..... [1]

SECTION C: [30 marks]

Answer **ALL** questions in this section. Show your working and write your answers in the space provided.

- 7 A student wanted to use simple distillation to remove salt from sea water and proceeded to set up the following diagram as shown as shown in Fig. 1.1.

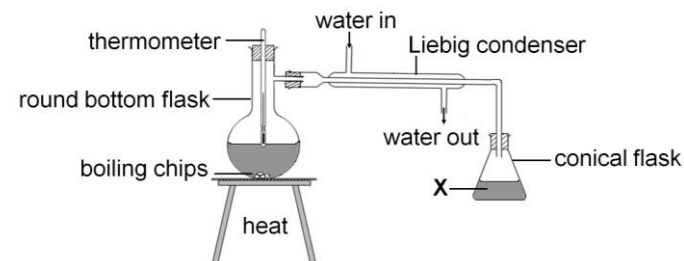


Fig. 1.1

- (a) (i) An improvement that can be made to the above experimental set-up is to tilt the Liebig condenser slanting downwards towards the conical flask, instead of positioning it horizontally straight as in Fig. 1.1. Suggest why this improvement should be made.

..... [1]

- (ii) Complete the following table by stating two **other** improvements that can be made to the above experimental set-up and explain why each improvement should be made.

Improvement	Reason why improvement should be made
1.	
2.	

[4]

- (b) State the purpose of the boiling chips in the round bottom flask.

..... [1]

(c) (i) Name substance **X**, the liquid distillate, collected in the conical flask.
 [1]

(ii) Suggest a method that can be used to determine if substance **X** is pure. Describe the corresponding observation from your method.

Method:

.....

.....

Observation:

.....

..... [2]

(d) Desalination of seawater to obtain substance **X** from sea water using distillation is not widely used as it is expensive and needs a lot of heat energy.

In recent years, Singapore has developed a two-stage process to obtain substance **X** from sewage water.

In stage 1, microfiltration removes small particles from the treated sewage water.

In stage 2, the filtered liquid from stage 1 is pumped through a special membrane to remove disease-causing micro-organisms and dissolved salts.

Name the process described in stage 2.

..... [1]

8 In Fig. 2.1, Alice was able to see the image of Bryan.

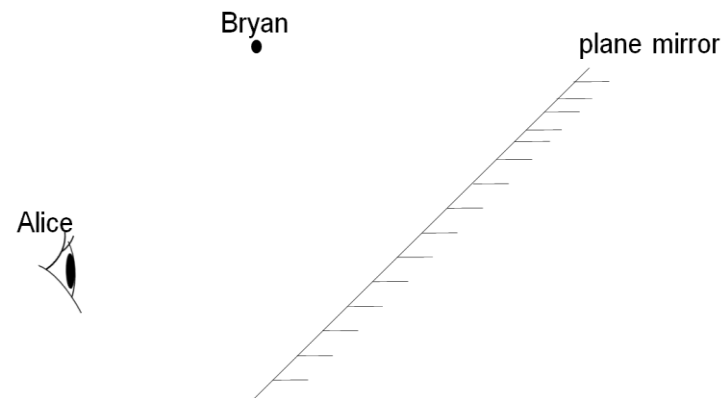


Fig. 2.1

(a) Measure the perpendicular distance from Bryan to the front of the mirror.

Perpendicular distance from Bryan to the mirror: cm [1]

(b) On Fig. 2.1,

(i) mark the position of the image of Bryan in the mirror. Label the image as "I". [1]

(ii) complete the ray diagram to show how light rays from Bryan enter Alice's eye. [2]

- (c) On Fig. 2.2, a ray from Bryan is incident at point **C**, which is the left edge of the mirror. The corresponding reflected ray is also drawn.

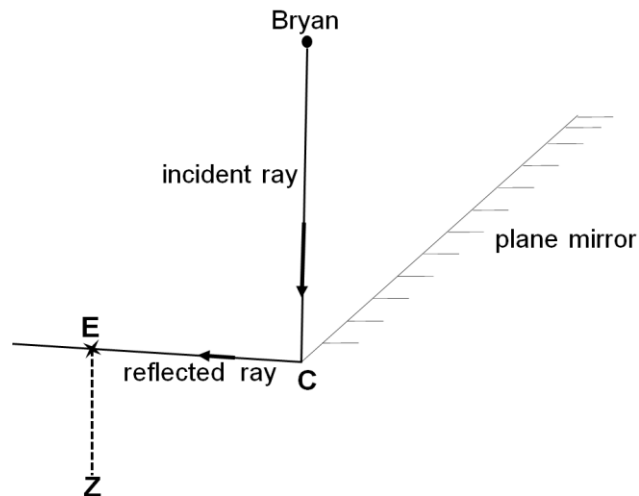


Fig. 2.2

- (i) On Fig. 2.2, at point **C** of the mirror, **draw** and **label** the
- normal, "**N**"
 - angle of incidence, "**i**" and
 - angle of reflection, "**r**".
- [1]
- (ii) A passerby, looking at the image of Bryan from point **E**, starts to move along the line **EZ**.
- Using your drawing in (c)(i), **circle** the option which correctly concludes whether the passerby is now able to see the image of Bryan, while moving towards **Z**.
- | | | |
|-----|----|-----|
| yes | no | [1] |
|-----|----|-----|
- (d) While looking at his image, Bryan remarked "The image formed on the plane mirror is real, inverted and upright."
- (i) State if you agree with Bryan that the image formed on the plane mirror is real, inverted and upright.
- [1]

- (ii) Explain your answer for (d)(i).
-
-
- [3]

- 9 (a) Fig. 3.1 shows a typical plant cell.

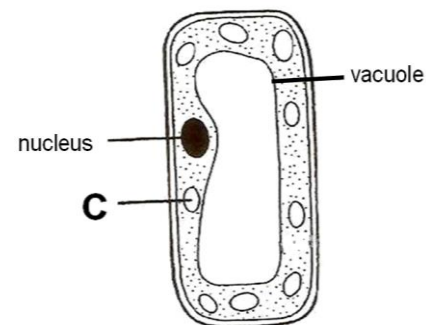


Fig. 3.1

State the function and name one substance that can be found **inside** each of the following organelles:

- (i) **nucleus**
- Function of nucleus:
-
- Name of one substance **inside**:
- [2]
- (ii) **vacuole**
- Function of vacuole:
-
- Name of one substance **inside**:
- [2]

- (iii) Organelle **C** contains a green pigment that is involved in making food for the plant. Name organelle **C**.

..... [1]

- (iv) On Fig. 3.1, label “cell membrane” and “cell wall”. [2]

- (v) State one difference between the cell membrane and the cell wall.

..... [1]

- (b) Fig. 3.2 shows a cell of a newly discovered organism by a biologist, Jane.

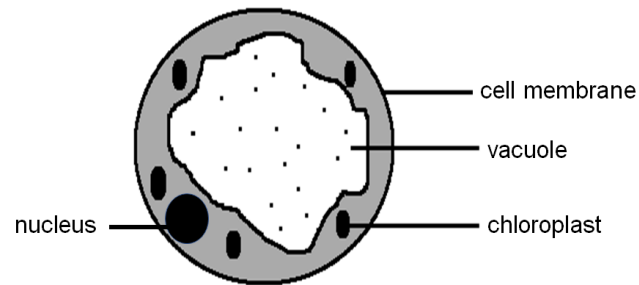


Fig. 3.2

- (i) Jane categorized the cell in Fig. 3.2 as a plant cell. Explain why Jane categorized it as a plant cell.

..... [1]

- (ii) Another biologist, Kate, disagreed and classified this cell as an animal cell. Explain why Kate thought that this cell could also be an animal cell.

..... [1]

END OF PAPER

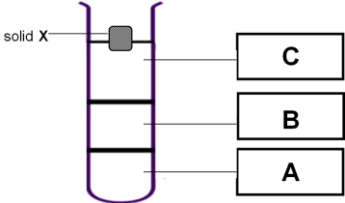
Mark scheme for End-of-Year 2022

SECTION A (20 MARKS)

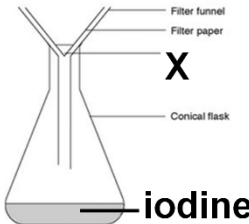
1	2	3	4	5	6	7	8	9	10
A	B	C	C	C	B	C	C	C	B
11	12	13	14	15	16	17	18	19	20
D	D	D	D	D	B	B	B	D	B

SECTION B (30 MARKS)

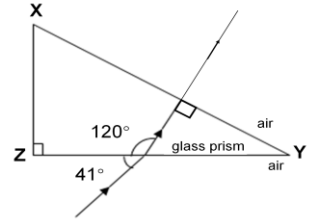
1	(a)	The higher the temperature of the environment, the more / faster the height of dough will increase by. <i>Reject: The dough in the oven will rise higher than the dough on the table-top. (Note: hypothesis is not a conclusion/result.)</i>	[1]	Ttl: 4m
	(b)(i)	Independent variable: Temperature of environment / surrounding <i>Reject: Temperature</i>	[1]	
	(b)(ii)	Dependent variable: The change in / final height/ volume/ mass of dough (after 1 hour) <i>AWW: Height of dough</i>	[1]	
	(b)(iii)	Controlled variable: any 1, 1 mark Initial starting mass/height/volume of dough OR Duration of experiment OR Type of dough used <i>Reject: mass/height/volume of dough</i>	[1]	

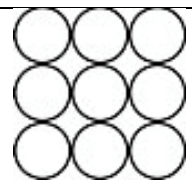
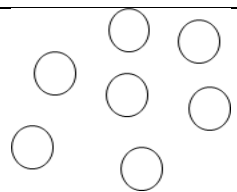
2	a	<table><tr><td>liquid</td><td>mass / g</td><td>volume / cm³</td><td>density / g / cm³</td></tr><tr><td>A</td><td>150</td><td><u>100</u></td><td>1.5</td></tr><tr><td>B</td><td><u>100</u></td><td>80</td><td>1.25</td></tr></table> 2 correct is 1 mark, 1 correct is 0 marks.	liquid	mass / g	volume / cm ³	density / g / cm ³	A	150	<u>100</u>	1.5	B	<u>100</u>	80	1.25	1	5
liquid	mass / g	volume / cm ³	density / g / cm ³													
A	150	<u>100</u>	1.5													
B	<u>100</u>	80	1.25													
	bi	 ALLOW ECF	1													
	bii	Any value lesser than 0.8	1													
	biii	Unchanged / same / same density [1] (<i>independent marking</i>)	2													

		Any one: [1] Same substance , so no change in density. OR The density of a substance is mass per unit volume, when mass is halved, volume is halved too.		
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3	(a)(i)	Any 1, 1 mark A solution is a homogeneous mixture, while a suspension is not a homogeneous mixture. OR Light can pass through a solution completely, while light cannot pass through a suspension completely. OR The solids dissolved in a solution cannot be separated out by filtration, while the solids in suspension can be separated out by filtration. OR The solute in a solution does not settle out when left to stand, however, the particles in the suspension settle out when left to stand. OR Solution is clear/ transparent while suspension is cloudy/ opaque. Substances/solute dissolve completely in solvent in a solution, while the substances/solute do not dissolve in solvent a suspension. <i>Reject: Solid soluble in water in solution while solid is not soluble in water in suspension. (Note: already stated in the question)</i>	[1]	Ttl: 8m
	(a)(ii)	 A.W.W: filter funnel floating above the conical flask 1 mark: correct drawing and labelling of filtration setup (conical flask, filter paper & filter funnel) <i>Note: beaker or measuring cylinder can be used to replace conical flask</i> 1 mark: Correct labelling of - residue as "X" "iodine" in filtrate	[2]	
	(b)(i)	iodine	[1]	
	(b)(ii)	Temperature [1] Nature/type of solvent [1]	[2]	
	(b)(iii)	Explain: Ethanol can dissolve more iodine than water at the same temperature./ iodine cannot dissolve in water./ Less than 100g of iodine can dissolve in water at 50°C. [1]	[2]	

		Suggest: She should soak the dress in ethanol./ Use ethanol to dissolve iodine. [1]		
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4	(a)	$90^\circ - 41^\circ = 49^\circ$ <i>Award 1 or 0 marks</i>	[1]	Ttl: 5m
	(b)	$120^\circ - 90^\circ = 30^\circ$ <i>Award 1 or 0 marks</i>	[1]	
	(c)	When light ray travels from air to glass, 1) from an optically less dense medium to an optically denser medium OR from a medium of lower optical density to a medium of higher optical density, 2) speed of light decreases / light slows down 3) the light ray bends towards the normal / refracts towards the normal (no marks for just "refract" or "bend" because this is just a repetition of the question.) OR angle of refraction smaller than angle of incidence. 3 points – 2 marks 2 points – 1 marks 1,0 points, blank answer – 0 marks	[2]	
	(d)	 <i>Award 1 or 0 marks</i> <i>Emergent light ray should continue undeflected.</i> <i>No need to penalize for no arrow on emergent light ray.</i>	[1]	

5	(a)	(i) 400 °C (solid)	(ii) 4531 °C (gas)		Ttl: 4m
		 [1]	 [1]	[2]	
	(b)(i)	Remains the same		[1]	

	(b)(ii)	when heated Only the distance between particles increase when heated. [1] OR Mass of matter is conserved as the type, size and number of particles remain the same.	[1]	
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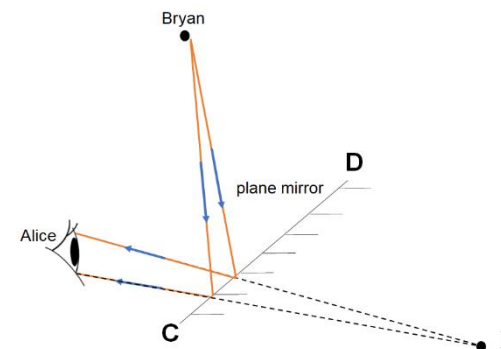
6	a	Name: lithium	1	4
	b	7	1	
	c	There are equal number of (3) protons and (3) electrons OR Number of positive equal number of negative charges OR Same number of (3) positive and (3) negative charges	1	
	d	Same (explanation not required) (further explanation for student's understanding) ONLY number of protons determine the name of the element.	1	

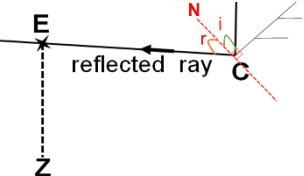
Section C [30 Marks]

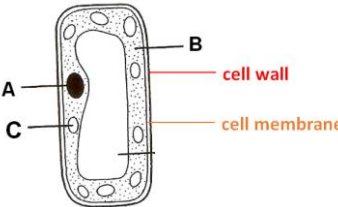
7	(a)(i)	allow gravity to move the liquid distillate to the conical flask / receiver / allow liquid to flow down more easily / allow condensed vapour to flow into conical flask faster	[1]	[10]						
	(a)(ii)	ANY 2: [1 mark each box] <table><tr><th>Improvement</th><th>Reason why improvement should be made</th></tr><tr><td>Bulb of thermometer should be placed near the mouth/entrance of condenser/ next to the spout of the round bottom flask. <i>A.W.W: "bulb" not indicated</i></td><td>Checks the temperature of vapour entering the condenser OR identifies the substance leaving the distillation flask</td></tr><tr><td>The water supply should enter from the lower opening and exit from the upper opening / water in and out should exchange positions / swap</td><td>condenser is always filled with cold water <i>Reject: to fill the condenser with water</i> OR most vapours are condensed into liquid distillate before entering the receiver OR for maximum cooling efficiency.</td></tr></table>	Improvement	Reason why improvement should be made	Bulb of thermometer should be placed near the mouth/entrance of condenser / next to the spout of the round bottom flask. <i>A.W.W: "bulb" not indicated</i>	Checks the temperature of vapour entering the condenser OR identifies the substance leaving the distillation flask	The water supply should enter from the lower opening and exit from the upper opening / water in and out should exchange positions / swap	condenser is always filled with cold water <i>Reject: to fill the condenser with water</i> OR most vapours are condensed into liquid distillate before entering the receiver OR for maximum cooling efficiency.	[4]	
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		The conical flask should not be stoppered To allow excess vapour to escape OR No pressure build-up from distillate vapour		
	(b)	Ensures smooth/even/stable boiling	[1]	
	(c)(i)	X is pure water OR distilled water OR water	[1]	
	(c)(ii)	Method: OR Method: <u>Boil</u> substance X Observation: Boils at a <u>fixed</u> temperature of 100 °C OR Method: Use <u>Chromatography</u> with substance X as a solute. Observation: Pure water leaves only <u>1 spot</u> on chromatogram when chromatography is performed on it. <i>Reject: If not pure, there will be multiple spot on the chromatogram. (note: cannot use negative language i.e. use "if pure, xxxxxx is observed", rather than "if not pure, xxxxx is observed." Because the possible range of consequences for the "other side" is very wide, not possible to cover all in answer.)</i> OR method: measure <u>density</u> of X Observation: density is <u>1g / cm³</u> <i>Reject: chemical vs physical method because question specifically ask for pure vs impure, not compounds vs mixtures.</i>	[2]	
	(d)	Reverse osmosis	[1]	

2	(a)	4.3 cm ± 0.3 cm	[1]	[10]
	(b)(i)	[1]: Image + label "I"	[1]	
	(b)(ii)	[1]: 2 light rays from image to eye (virtual + real) [1]: 2 light rays from object to mirror (real) <i>Penalize 1 mark for missing arrow</i>	[2]	



	(c)(i)	Award 1 mark or 0 marks: 0 mark for no label - Normal (dotted line) is at C and perpendicular - correct angle of incidence between incident ray and normal - correct angle of reflection between reflected ray and normal 	[1]	
	(c)(ii)	No	[1]	
	(d)(i)	No	[1]	
	(d)(ii)	"Real" is wrong, should be "virtual" [1] "inverted" is wrong, should be "laterally inverted". [1] Remains same / unchanged / no change "upright". [1] If answers for (d)(i) is wrong, no marks for (d)(ii).	[3]	

3	(a)(i)	Function of nucleus: pass down genetic information to offspring. [1] OR Controls cell activities (eg. repair of worn-out parts) OR Responsible for cell reproduction / cell division Inside nucleus: Chromosomes [1] Reject Name of A: <i>nucleus</i>.	[2]	[10]
	(a)(ii)	Function of vacuole: stores cell sap OR <u>stores</u> water and dissolved minerals [AWW: water/dissolved minerals] OR nourish the cell. [1] Inside vacuole: Water/food/nutrients/minerals/glucose/cell sap [1] Reject Name of B: <i>vacuole</i>.	[2]	
	(a)(iii)	C: chloroplast Reject: Chlorophyll	[1]	
	(a)(iv)	 [1 mark each] for correct labelling of cell wall and cell membrane.	[2]	
	(a)(v)	Any 1 difference , [1 mark]: Cell wall is fully permeable while the cell membrane is partially permeable. [reject: semi permeable] OR	[1]	

		Cell wall supports, protects and gives shape to the cell, however cell membrane is not able to. OR Cell wall is Made up of cellulose however, cell membrane is not. OR Cell wall is unable to control the substances <u>entering and leaving</u> the cell, however, cell membrane can. OR Cell wall does not serve as a boundary between the cell and external environment; however, cell membrane is able to. Reject: cell wall found in plant cells, cell membrane is found in both plant and animal cells AWW: state functional differences		
	(b)(i)	Any 1, [1 mark] absence of small numerous vacuoles OR presence of a large (central) vacuole OR contains chloroplasts	[1]	
	(b)(ii)	Any 1 [1 mark] does not have a cell wall OR no fixed shape	[1]	