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St. Gabriel's Secondary School 2023 End-of-Year Examination

Subject	:	Lower Secondary Science
Level/Stream	:	Sec 1 Express / Sec 1 Normal Academic (SBB)
Duration	:	1 hour 45 minutes
Date	:	6 October 2023
Setter	:	Ms Pang Seok Mun

Additional material: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class in the spaces above. You may use a soft pencil for any rough working. Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **ALL** the questions using the Multiple Choice Answer Sheet provided. Four suggested answers are given for each question. Choose the best answer and use a **soft pencil** to shade the corresponding circle on the answer sheet clearly. Each question carries one mark. The total marks for this section is 25 marks. Submit your Multiple Choice Answer Sheet **separately**.

Section **B**

Answer **ALL** the questions in the spaces provided. The total marks for this section is 35 marks.

Section C

Answer **ALL** the questions in the spaces provided. The total marks for this section is 20 marks.

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

A copy of the Periodic Table is provided on page **24**.



This question paper consists of **24** printed pages including this cover page.

Section A: Multiple Choice Questions [25 marks]

1 The diagram shows a hazard symbol on a chemical bottle in the science laboratory.



What would be the harmful effect if a person is not careful when handling the chemical?

- **A** The chemical may cause an explosion when heated.
- **B** The chemical may cause damage to body parts when in contact.
- **C** The chemical may cause damage to one's health when breathed in.
- **D** The chemical may cause death when it is absorbed through the skin.
- 2 The air-hole of a Bunsen burner can be opened or closed to obtain two types of flame.



with air-hole opened



with air-hole closed

Which row shows the correct colours of region X and Y?

	Х	Y
Α	blue	orange
В	blue	blue
С	orange	blue
D	orange	orange

"When the current increases, the filament in the bulb turns from red to orange."

Which step of the scientific method is the student carrying out?

- A asking a research question
- **B** constructing a hypothesis
- **C** drawing a conclusion
- **D** making an observation
- 4 What is the volume of the liquid in the measuring cylinder?



Α	22 ml	В	23 ml	С	24 ml	D	25 ml
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5 Two physical properties of four substances, E, F, G and H are shown in the table.

aubatanaa	malting naint / 00	electrical conductivity	
Substance		in solid	in liquid
E	1100	yes	yes
F	900	no	no
G	2500	no	yes
Н	- 250	no	no

Which substance is most likely a metal?

- A substance E
- **B** substance F
- **C** substance G
- **D** substance H

6 Solids A, B, C and D have a mass of 1 kg each.

Which solid has the highest density?



- 7 Which pair of substances consists of non-metals only?
 - **A** calcium and nitrogen
 - **B** magnesium and titanium
 - **C** phosphorus and bromine
 - D potassium and oxygen
- 8 The diagram shows how sand is removed from a mixture of salt and sand.



The substances in beaker 1 are stirred together before being poured through the funnel into beaker 2. At the end of the experiment, what can be found in beaker 2?

- **A** a mixture of an element and compound
- **B** a mixture of two compounds
- **C** one element only
- **D** one compound only

9 A magnet was placed over the cover of a Petri dish containing a black-yellow powder. The black powder was observed to move towards the magnet while the yellow powder remained at the base of the dish.

What can be concluded based on the observations made?

- A The black powder and yellow powder are not chemically combined.
- **B** The black powder and yellow powder are present in a fixed ratio.
- **C** The black powder and yellow powder are two different compounds.
- **D** The black powder and yellow powder have fixed melting points.
- **10** A mixture containing substances X and Y is placed in two different solvents, water and alcohol. The mixture is then filtered using filter paper. The results are shown below.



Based on the results of the experiment, which statement is correct?

- A Substance X dissolves in alcohol to form a suspension.
- **B** Substance X is soluble in water only.
- **C** Substance Y is insoluble in both water and alcohol.
- **D** Substance Y is soluble in alcohol only.
- **11** The table shows the solubilities of two salts.

salt	maximum mass of salt that can dissolve in 100 ml of water at 30 °C	
copper chloride	72 g	
potassium chloride	34 g	

At 30 °C, which of the following will form a suspension?

- A 58 g of copper chloride dissolved in 100 ml of water
- **B** 96 g of copper chloride dissolved in 200 ml of water
- **C** 20 g of potassium chloride dissolved in 100 ml of water
- **D** 72 g of potassium chloride dissolved in 200 ml of water

12 Which row correctly states the most suitable separation techniques for obtaining a substance from different types of mixtures?

	insoluble solid from a solid-liquid mixture	soluble solid from a solid-liquid mixture	pure liquid from a liquid-liquid mixture
Α	evaporation	filtration	distillation
В	evaporation	filtration	filtration
С	filtration	distillation	evaporation
D	filtration	evaporation	distillation

13 The table shows the colour of four solid substances, W, X, Y and Z, and their solubilities in water.

substance	colour	solubility in water
W	green	insoluble
Х	green	soluble
Y	white	insoluble
Z	white	soluble

Water is added to a mixture containing two of the substances, stirred and filtered. A white filtrate and a green residue are obtained.

Which are the two substances present in the mixture?

- A W and X
- B W and Z
- **C** X and Y
- **D** Y and Z
- 14 Which mixture can be separated by magnetic attraction?
 - A aluminium foil and silver rings
 - **B** aluminium foil and steel nails
 - **C** iron fillings and steel nails
 - **D** nickel coin and iron fillings

15 While waiting for dinner to be served, Elton looked closely at his reflection on both sides of his metal spoon.



Which row correctly states the type of surface and the image formed on the inside and outside of the metal spoon?

	inside of metal spoon		outside of metal spoon	
	type of surface	image formed	type of surface	image formed
Α	concave	smaller	convex	larger
В	convex	smaller	concave	larger
С	concave	larger	convex	smaller
D	convex	larger	concave	smaller

16 A light ray is directed onto a mirror that is tilted at an angle of 25° from the surface of the table.



What is the angle of reflection?

- **A** 25°
- **B** 35°
- **C** 55°
- **D** 65°

17 A narrow beam of white light passes through a glass prism. The white light splits into several colours which are projected onto the screen.



Which row shows the correct order of the colour of lights emerging from the prism?

	Р	Q	R
Α	blue	green	red
В	blue	red	green
С	red	blue	green
D	red	green	blue

18 A light microscope is fitted with a standard eyepiece lens and a set of objective lenses of varying magnifications.

Which objective lens should be used to obtain a total magnification of 40x?

- **A** 4x
- **B** 10x
- **C** 40x
- **D** 100x
- **19** The diagram shows a light microscope.



Which statement correctly describes the function of X?

- A It allows the stage to be moved up to obtain a focused image of the specimen.
- **B** It allows small adjustment to obtain a sharp image of the specimen.
- **C** It controls the amount of light travelling towards the stage.
- **D** It provides light to illuminate the specimen.

20 The diagram shows four different structures in a human being with each representing a level of organisation.



Which row correctly identifies the level of organisation that these structures belong to?

	structure 1	structure 2	structure 3	structure 4
Α	organ	tissue	cell	organ system
В	organ system	cell	tissue	organ
С	organ	cell	tissue	organ system
D	organ system	tissue	cell	organ

21 A dented ping pong ball was able to regain its round shape when placed in a beaker of hot water.



Which of the following statement correctly explains the phenomenon?

- **A** The distance between the air particles in the dented ping pong ball increased.
- **B** The external surface of the ping pong ball became wider.
- **C** The external surface of the ping pong ball melted.
- **D** The size of the air particles in the dented ping pong ball became larger.
- 22 Which state of matter expands from the most to the least when heated?

	expands most —		 expands least
Α	gas	liquid	solid
В	gas	solid	liquid
С	solid	gas	liquid
D	solid	liquid	gas

substance	melting point / °C	boiling point / °C
М	-128	75
Ν	750	2650
0	-250	-8
Р	12	45

23 The table shows the melting and boiling points of four substances, M, N, O and P.

From the data above, which statement is correct?

- **A** M is a liquid at 100 °C.
- **B** N is a solid at 100 °C.
- **C** O is a liquid at 25 °C.
- **D** P is a gas at 25 °C.
- 24 Which row correctly identifies the number of atoms and elements in the molecule?

	molecule	number of atoms	number of elements
Α	C_6H_{14}	20	20
В	$C_3H_6O_2$	3	11
С	H ₂ SO ₄	7	3
D	NaHCO₃	7	5

- 25 Which statement is **incorrect** about the sub-atomic particles of an atom?
 - **A** The number of protons is unique for each element in the Periodic Table.
 - **B** The proton is positively charged while the neutron is negatively charged.
 - **C** The protons and neutrons make up the mass of an atom.
 - **D** The relative mass of a proton is equal to the relative mass of a neutron.

Section B: Structured Questions [35 marks]

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

1 A student investigates the effect of changing light intensity on the rate of photosynthesis. The experimental set-up is as shown in Fig. 1.1.





During photosynthesis, carbon dioxide gas is taken in by plants while oxygen gas is released. The rate of photosynthesis is measured by counting the number of bubbles of oxygen produced in one minute when the lamp is placed at different distances from the water plant in the beaker. Table 1.1 shows the results of the investigation.

Table 1.1

distance between the water plant and lamp / cm	5	10	15	20	25
number of bubbles produced in one minute	30	24	17	9	3

(a) State the variable to be measured in this investigation.

.....[1]

(b) State two variables that were kept constant during this investigation.

constant variable 1:	[1]
constant variable 2:	[1]

(c) Based on Table 1.1, describe a possible conclusion of the investigation.

......[1]

[Total: 4]

2 The masses and volumes of three liquids **A**, **B** and **C** are shown in Table 2.1.

liquid	mass / g	volume / cm ³
А	180	36
В	80	50
С	140	40

Table 2.1

(a) Liquids A and B do not mix with each other. They are poured into the same container. Identify the layers of the liquids that will be formed in Fig. 2.1.



[1]

(b) Liquids A and C are mixed with each other to form a mixture. Use the formula to calculate the density of the mixture.

doncita of the mixture -	total mass of components
uensity of the mixture =	total volume of components

Show your working, leaving your answer in three significant figures.

(c) The mixture formed in (b) was frozen into a piece of solid, D. The solid D is then cut into three equal pieces, X, Y and Z.



Compare the density of the cut piece X to solid D.

......[1]

(d) Table 2.2 shows some physical properties of three materials, K, L and M.

material	strength	hardness on Mohs scale	melting point / °C
К	middle	7.5	1250
L	middle	2.0	800
М	high	8.8	65

Table 2.2

By comparing the physical properties of materials K, L and M, state and explain which material is the most suitable for making the following objects:

(i) body weighing scale

material:	[1]
reason:	
	[1]

(ii) scratch-resistant boiling tube

material:	[1]
reason:	
	[1]
	[Total: 8]

3 To celebrate his mother's birthday, Bryan decided to attend a baking lesson to learn how to make chocolate brownies and vanilla ice-cream.

To make chocolate brownies, some of the ingredients required are:

- 1. 1 cup of pure white sugar
- 2. 2¹/₂ cups of mixed **flour** (2 cups of all-purpose flour, ¹/₂ cup of self-rising flour)
- 3. 1 teaspoon of salt
- 4. ¹/₂ teaspoon of **baking soda**
- 5. 1 cup of fresh milk

To make vanilla ice-cream, some of the ingredients required are:

- 1. 3 cups of condensed **milk**
- 2. 1 litre of liquid **nitrogen**
- (a) Based on the recipes, classify the six ingredients into the Table 3.1 below:

sugar, flour, salt, baking soda, milk and nitrogen

element	compound	mixture
		[3]

Table 3.1

(b) In Fig. 3.1, diagrams **E**, **F**, **G**, and **H** represent the particles in some substances.



Based on Fig. 3.1, write down the letter (**E**, **F**, **G** or **H**) corresponding to the diagram that fits the following description:

(i)	a mixture of two different elements:	[1]
(ii)	a mixture of one element and one compound:	[1]

(c) During the baking lesson, Bryan decided to investigate one of the factors that affect the rate of dissolving pure white sugar in milk.



Based on Fig. 3.2, in which set-up will the pure white sugar dissolve the fastest? Explain your answer.



- [Total: 7]
- **4** Fig. 4.1 shows a single-celled organism, *Chlamydomonas*, as seen under the light microscope.





(a) Based on Fig. 4.1, identify the following cell structures:

(i)	W :	
(ii)	X :	
(iii)	Y :	
(iv)	Z :	

[2]

(b) State the respective function of cell structures **X** and **Y** in the box below.

structure	function
х	
Y	
	[2]

- (c) Scientists are unable to decide whether Chlamydomonas is an animal or plant cell.
 - (i) With reference to Fig. 4.1, describe **two** structures and their functions that suggest *Chlamydomonas* is an animal cell.

(ii) With reference to Fig. 4.1, describe **one** structure and its function that suggests *Chlamydomonas* is a plant cell.

......[1]

(d) Suggest why division of labour exists in a single-celled organism, *Chlamydomonas*.

.....[1]

[Total: 8]

Fig. 5.1 shows the heating curve of substance **X**.



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(d) Explain why the temperature of substance X remains constant between S and T.
 [2]
 (e) Suggest what happens to the density of substance X when it is heated from 18 °C to 96 °C.
 [1]
 [1]

Section C: Free Response Questions [20 marks]

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

6 The rear-view mirror is a plane mirror that helps drivers to see objects behind their vehicles. Fig. 6.1 shows a car and a motorcycle on the road.

The distance between the car driver and the motorcyclist is 1.6 m and the distance between the driver and the rear-view mirror is 0.4 m.



(a) Calculate the distance between the car driver and the image of the motorcyclist in the rear-view mirror of the car.



Fig. 6.2 shows the position of the motorcyclist and the position of the car driver in front of the rear-view mirror in the car.





- (b) On Fig. 6.2,
 - (i) Mark the position of the image of the motorcyclist in the rear-view mirror of the car with a cross (X). Label the image as "I". [1]
 - (ii) Draw a light ray to show how the car driver sees the image of the motorcyclist in the rear-view mirror. [1]
 - (ii) Complete the diagram to show how the car driver sees the motorcyclist. [1]

(c) Fig. 6.3 shows the rear-view mirror in the car as seen by the car driver.



Fig. 6.3

The motorcycle behind the car has a vehicle plate as shown.



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



[2]

(d) Apart from using plane mirror, the rear-view mirror can be made with another type of mirror. The following statement was made with regards to the type of mirror that should be used.

"Rear-view mirror should be made with concave mirror instead of convex mirror".

State and explain whether you agree with the statement.

......[2]

(e) Table 6.1 shows the refractive index of air, block **M** and block **N**.

medium	refractive index
air	1.00
block M	1.85
block N	1.30

Table 6.1

Fig. 6.4 and Fig. 6.5 show how a light ray strikes block **M** and block **N** respectively.

- (i) On Fig. 6.4, draw the light ray that passes into block **M** from air. [1]
- (ii) On Fig. 6.5, draw the light ray that passes into block **N** from block **M**. [1]









[Total: 10]

7 Athletes X, Y and Z are suspected of using illegal performance-enhancing drugs to boost their running speeds during the actual marathon.

Using paper chromatography, the urine sample of the three athletes were analysed and compared to five different known illegal performance-enhancing drugs **A**, **B**, **C**, **D** and **E**.

Fig. 7.1 shows the paper chromatogram of the urine samples and known drugs.





(a) The starting line is drawn with a pencil. Explain why the starting line should **not** be drawn with a pen.

.....[1]

(b) Drug **B** remains on the starting line after the investigation. Explain why.

- (c) (i) How many types of performance-enhancing drugs did athlete X consume?
 - (ii) Did athlete Z consume any known illegal performance-enhancing drug?

(d) Athlete Y confessed to consuming performance-enhancing drug A and E.

- On Fig. 7.1, complete the chromatogram of the urine sample for athlete **Y**. [1]
- (e) The investigator claimed that performance-enhancing drug **C** is a pure substance. Do you agree with the claim? Explain your answer.

.....[1]

(f) Fig. 7.2 shows an experimental set-up for a separation technique.





END OF PAPER

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