Class	Full Name	Index Number

bowen SECONDARY

I believe, therefore I am

MID YEAR EXAMINATION 2022

Exp

SCIENCE
Secondary 2 Express

11 May 2022 **1 h 30 minutes**

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black ink.
You may use pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
There are **twenty** questions in this section. 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 separate OTAS Sheet provided.

Section B & C
Answer **all** questions in the spaces provided on the question paper.
A copy of the Periodic Table is provided on page 23.

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

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

	For Examiner's Use
Section A	20
Section B	30
Section C	20
Total	70

This document consists of **23** printed pages.

Setters: Secondary 2 Science Teachers

2

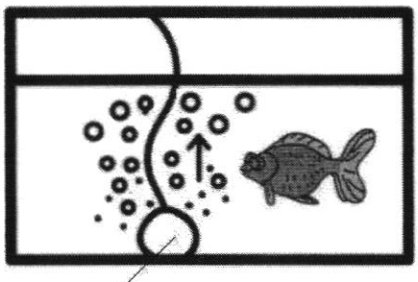
Section A

Answer **all** questions. Record your answers on the separate OTAS Sheet provided.
The total mark for this section is 20.

1 Which comparison between mass and weight is correct?

	Mass	Weight
A	Measured in N	Measured in kg
B	Measured in N	Measured in g
C	Measured using an electronic balance	Measured using a spring balance
D	Measured using a spring balance	Measured using an electronic balance

2 As Wilson was staring at his fish one day, he noticed that the air bubbles produced by the aerator increase in size as they rise up the tank.

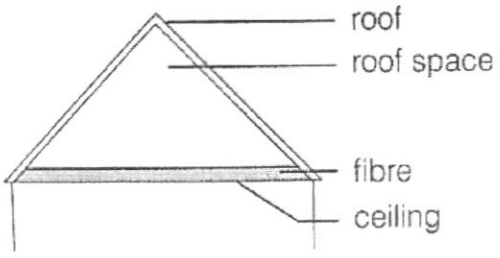


Which statement correctly explains why?

A The bubbles expand because the temperature of air reduces.
B The buubles expand because the temperature of air increases.
C The bubbles expand because the pressure they experience reduces.
D The bubbles expand because the pressure they experience increases.

3

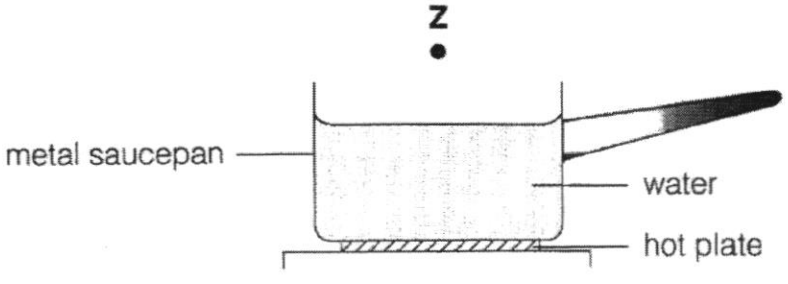
3 Fibre is used for home insulation as shown below.



How does fibre prevent heat from passing easily through the ceiling?

A Fibre is warm.
B Fibre traps air.
C Fibre is tightly packed.
D Fibre allows air to pass through easily.

4 The diagram below shows a metal saucepan containing water. It is placed on a hot plate. After some time, the air at point **Z** also becomes hot.

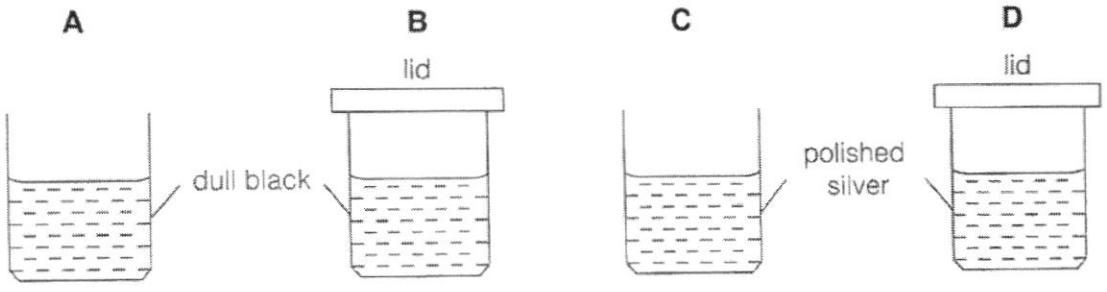


What are the main ways by which heat travels from the hot plate through the base of the metal saucepan, through the water and through the air to point **Z**?

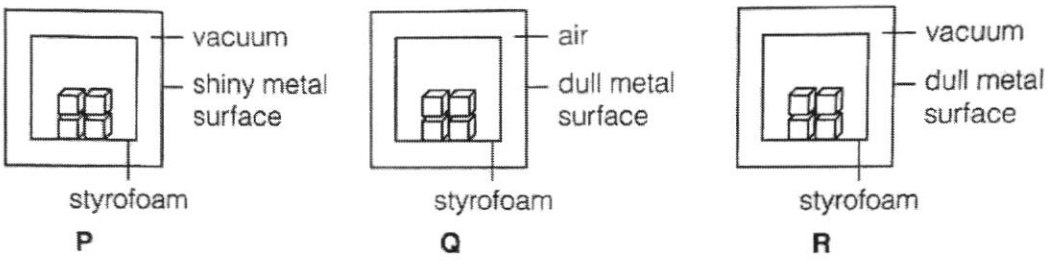
	Through the base of the saucepan	**Through the water**	**Through the air**
A	Conduction	Convection	Convection
B	Conduction	Radiation	Convection
C	Convection	Convection	Conduction
D	Radiation	Convection	Conduction

5 The diagram below shows four similar cans. At the initial stage, each can contains the same volume of water at 80 °C. After five minutes, which can will contain the coolest water?

4



6 Some ice cubes are placed inside three containers as shown below. The temperature of the surroundings is 60 °C.



What is the order in which the ice cubes melt, from fastest to slowest?

A P, Q, R
B Q, P, R
C Q, R, P
D R, Q, P

7 The table below gives information about three indicators.

indicator	colour change	pH at which colour changes
methyl orange	red □ yellow	4.0
bromothymol blue	yellow □ blue	6.4
phenolphthalein	colourless □ pink	9.0

If equal volumes of these indicators were mixed, at which pH would the colour of the mixture be yellow?

A 3
B 5
C 7
D 10

8 Which of the following would **not** cause decomposition to occur?

A electric current

5

B exposure to light
C heat
D mixing

9 Which of the following is/are chemical change(s)?

I. Breaking of glass
II. Whitening of teeth
III. Passing electricity through a copper wire

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

10 Which of the following options correctly matches the term to its definition?

	Term	Definition
A	Population	refers to different groups of plant and animal living together in a given place
B	Habitat	refers to one group of organisms of the same kind found in a given place
C	Community	refers to the environment where plants and animals live in.
D	Ecosystem	refers to the interactions between the organisms and the physical environment

11 Which of the following is **not** a possible consequence due to climate change?

A Increase in number of flash floods in tropical countries
B Increase in turtles entangled by plastic wrappings
C Decrease in food availability due to longer droughts
D Decrease in number of Adelie penguins in Antartica

6

12 The Wright brothers are known to debate with each other frequently when designing [1][2]and trialling their first flyer. They questioned their design and wondered if their flyer was scientifically sound.

Using only the information given above, which of the following attitudes did the Wright brothers demonstrate?

I. Curiosity
II. Open-mindedness
III. Integrity
IV. Perseverance

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

13 Studies have shown that a combination of COVID-19 vaccines may result in increased immunity against the infection.

After studying the results in the table below, a man decided to that he should take the Pfizer-Pfizer-Moderna combination as it is most effective.

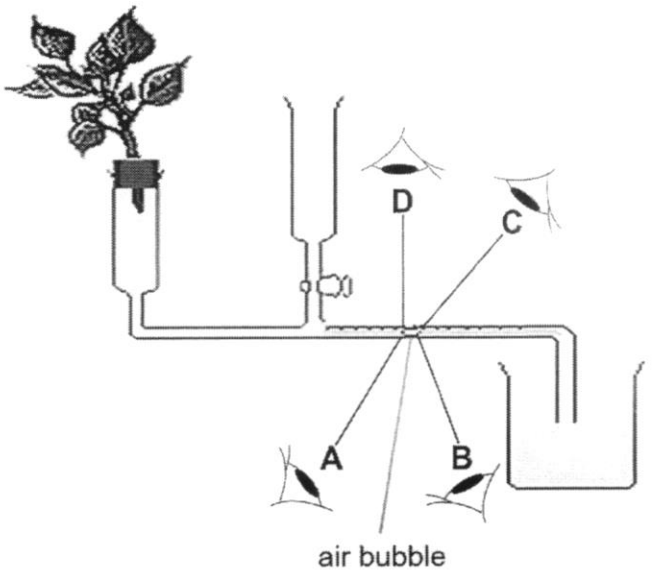
1st dose	2nd dose	Booster	What studies have found
Pfizer	Pfizer	Pfizer	62% reduction of infection risk
Pfizer	Pfizer	Moderna	72% reduction of infection risk
Moderna	Moderna	Moderna	results not shown in study

What is his decision an example of?

A A conclusion
B A hypothesis
C An observation
D A prediction

7

14 A student measured the amount of water lost from a plant using the instrument shown in the diagram below. The amount of water lost is indicated by the position of the air bubble.



From which position should he take the reading to avoid parallax error?

15 The table below shows some information about the solubilities of three solids, **X, Y** and **Z**, in water and ethanol.

solid	solubility in water	solubility in ethanol
X	insoluble	soluble
Y	soluble	insoluble
Z	insoluble	insoluble

All three solids are mixed together.
Which one shows the order of the steps that would allow solid **Y** to be obtained form the mixture?

I. filter
II. add water and stir
III. add ethanol and stir
IV. evaporate filtrate to dryness

A I □ II □ IV
B II □ I □ IV
C III □ I □ II
D IV □ II □ I

16 Which is/are application(s) of distillation?

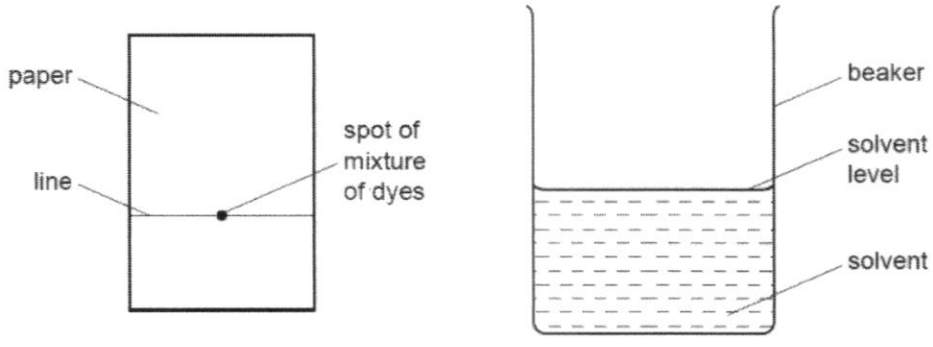
I. making perfumes

8

II. testing for illegal substances in food samples
III. obtaining drinking water from seawater

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

17 An experiment is carried out to separate a mixture of two dyes. A line is drawn on a piece of chromatography paper and a spot of the dye mixture placed on it. The paper is dipped into a solvent and left for several minutes.

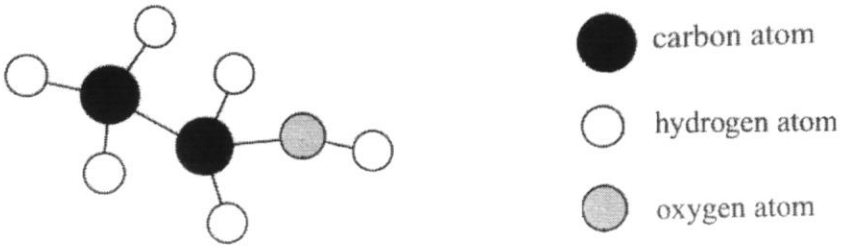


Which statement about this experiment is correct?

A The dyes must differ in their boiling points.
B The dyes must different in their solubilities in the solvent.
C The line must be drawn in ink.
D The line must be placed below the level of the solvent.

18 The diagram shows a model of a molecule **X**.

9



What is the molecular formula of molecule **X**?

A CH_2OH
B C_2H_5OH
C HCOOH
D CH_3COOH

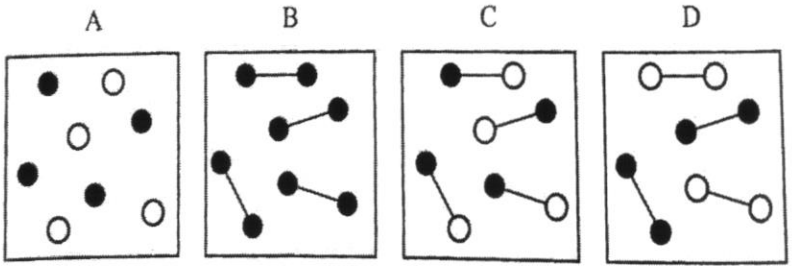
19 2 atoms are shown below:

$^{15}_{7}N$ $^{14}_{6}C$

Which statement about both atoms is correct?

A They have the same number of electrons.
B They have the same number of protons.
C They have the same number of neutrons.
D They have the same mass number.

20 4 different arrangements of atoms are shown below.



Identify the arrangement (**A**, **B**, **C** or **D**) that shows a compound.

10

Section B

There are **7** questions in this section. Answer **all** questions in the spaces provided below.
The total mark for this section is 30.

B1 Fig. 1.1a shows the internal structure of a refrigerator, and Fig. 1.1b shows the back view of the refrigerator. [3]

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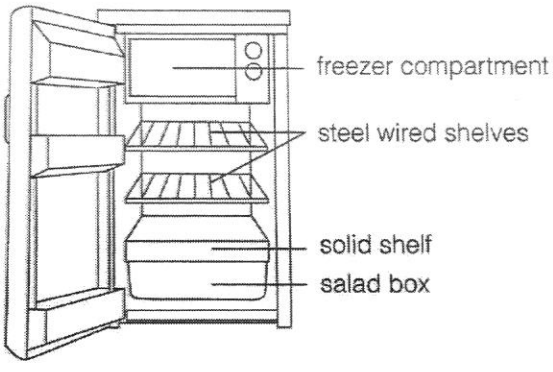

Fig. 1.1a

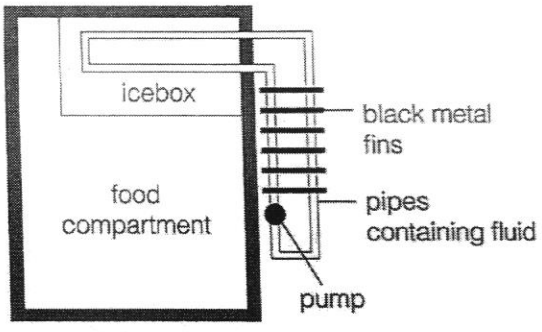

Fig. 1.1b

A fluid pumped through the pipes takes thermal energy out of the ice box. This energy passes into the air at the back of the refrigerator through the black metal fins.

a) **i)** Describe how the ice box at the top of the refrigerator keeps the whole of the food compartment cool.

.....

.....

.....

.....

..... [2]

ii) Provide a reason why the metal fins at the back of the refrigerator are painted black.

.....

..... [1]

iii) Suggest why it is not advisable to keep the door of the refrigerator open for long periods of time.

.....

.....

..... [2]

b) Suggest a reason why wired shelves rather than solid shelves are used in the centre of the refrigerator.

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.....

..... [1]

11

c) The refrigerator walls are insulated using expanded polystyrene as shown in Fig. 1.2.

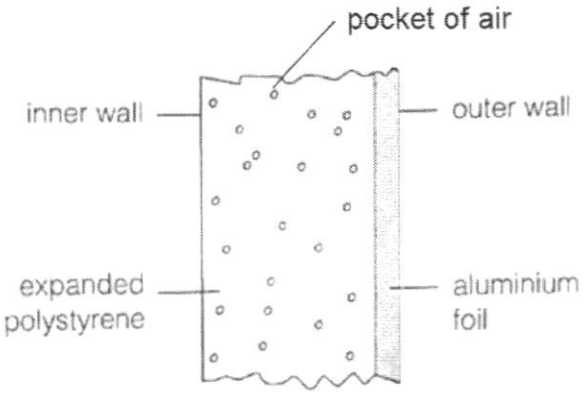

Fig. 1.2

Explain how expanded polystyrene reduce the amount of thermal energy entering the refrigerator.

.....

..... [1]

[Total: 7]

12

B2 Some zinc powder is added to dilute sulfuric acid in a test tube. A colourless salt solution is formed and a gas is given off.

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When more zinc is added, the reaction continues for a while and then stops, leaving some zinc powder in the test tube.

When a flame is placed at the mouth of the test tube, the gas burns with a squeaky pop.

a) Identify the gas produced.

..... [1]

b) Suggest why the reaction stops.

..... [1]

c) State the name of the colourless salt solution.

..... [1]

d) Suggest another reactant, other than zinc metal, which can react with dilute sulfuric acid to produce the same salt solution in (c).

..... [1]

[Total: 4]

B3 In some fireworks, magnesium powder reacts quickly with oxygen gas in the air to produce magnesium oxide powder.

The equation for the reaction is

$$\text{.....Mg} + \text{.....} O_2 \square \text{.....} MgO$$

a) Complete the equation by inserting

(i) numbers to balance the equation, [1]

(ii) explain why chemical equation must be balanced.

..... [1]

b) Name the type of this reaction.

..... [1]

[Total: 3]

B4 Fig 4.1 shows an evaporating dish half-filled with sodium chloride solution. The solution was heated with a Bunsen flame to obtain the solute. The mass of the solute was subsequently measured.

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13

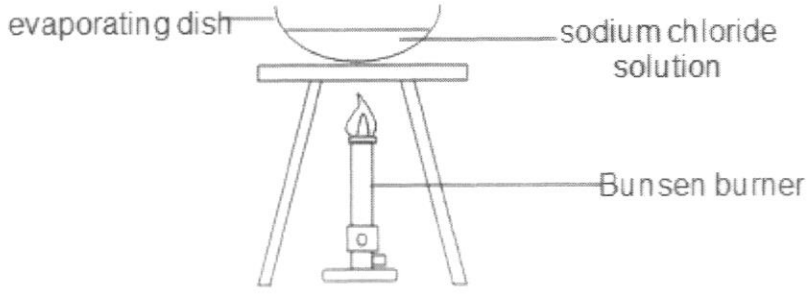

Fig. 4.1

a) State, with reason, the type of Bunsen flame that should be used so that water from the sodium chloride solution can evaporate in a shorter time. [4]

.....

..... [2]

b) State **one** precaution that should be taken to ensure that the mass of the solute measured is accurate. Explain how this step affects the results obtained.

precaution .....

.....

explain .....

..... [2]

[Total: 4]

B5 Inez accidentally dropped a mixture containing chalk, iron fillings and salt into a bowl of water. She has been tasked to obtain two main components from the mixture:

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1) iron fillings
2) pure dry sample of salt

List down the steps needed for her to obtain the two components from the mixture.

14

.....

.....

.....

.....

..... [3]

[Total: 3]

B6 Aidan has decided to use the separation technique show in **Fig. 6.1** to separate a mixture of three liquids shown in **Table 6.2**.

For Examiner's Use

15

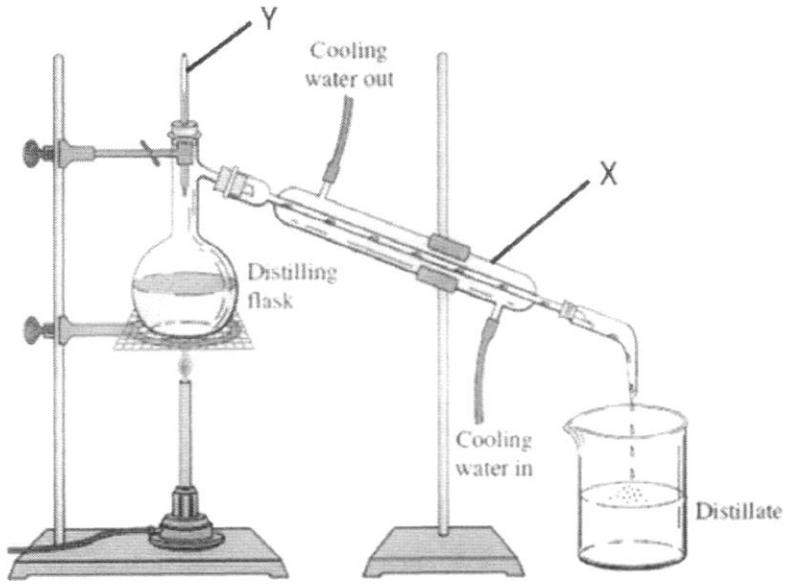

Fig. 6.1

liquid	boiling point (°C)
carbonic acid	182
aniline	182
nitric acid	120

Table 6.2

a) Label the part **X** and **Y**.

X: .....

Y: ..... [1]

b) Hidayat told Aidan that the separation technique above will **not** be able to separate all three liquids.

Do you agree? Explain your answer.

.....

..... [2]

B7 **a)** Scientists have used many different models to represent an atom. One of the models of an atom is shown below in **Fig. 7.1**.

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16

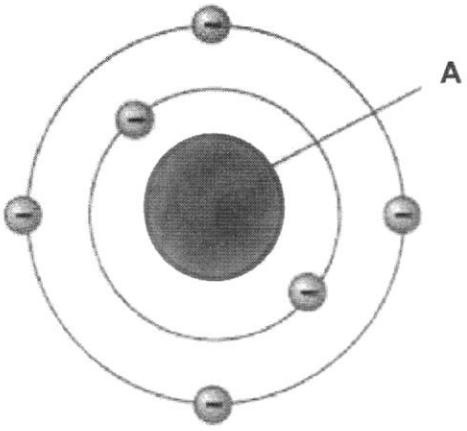

Fig. 7.1

i) Name the sub-atomic particles found in part **A.**

..... [1]

ii) Ashlynn claimed that the atom above has 5 protons.
State whether Ashlynn is right or wrong and explain your answer.

.....

..... [1]

b) **Table 7.2** contains information on the structures of **one atom**.

Atom	Element	Proton number	Mass number	Number of		
				protons	neutrons	electrons
A		19	39			

Table 7.2

i) With reference to the Periodic Table, complete **Table 7.2.** [1]

ii) In the space below, draw diagram to show how the electrons are arranged in an atom of **A**. [1]

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17

c) i) Give one similarity between an iodine atom and an iodine molecule.

.....

..... [1]

ii) Give one difference between an iodine atom and an iodine molecule.

.....

..... [1]

[Total: 9]

18

Section C

There are 2 questions in this section. Answer the question in the spaces provided below.
The total mark for this section is 20.

C1 **Fig. 8.1** shows a sky-diver falling vertically.

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Fig. 8.1

a) State two forces acting on the sky-diver as he falls.

1. .....

2. .....

[2]

b) The sky-diver jumped out of the plane when it was at an altitude of 2.14 km above sea-level.

Given that the mass of the sky-diver is 68.0 kg and that the gravitational field strength on Earth is taken to be 10 N/kg, calculate

i) the weight of the sky-diver, and

weight = ... [1]

ii) the gravitational potential energy the sky-diver possessed just before he made the jump.

gravitational potential energy = ... [2]

c) Assuming motion in a straight line, the sky-diver released his parachute midway into his dive and the speed of the sky-diver just before he reached the ground was 7.50 m/s.

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i) Calculate the kinetic energy of the sky-diver just before he reached the ground.

19

kinetic energy = ... [1]

ii) Suggest why the kinetic energy calculated above is different from the value of gravitational potential energy calculated in **(b)(ii)**.

.....

.....

..... [1]

d) Landing with high speeds makes sky-divers prone to injuries.
Hence, parachutes must be designed with great care to ensure that landing speeds are within the safety range.

i) Suggest how parachutes help sky-divers reach lower speeds so that they can land safely.

.....

.....

..... [1]

ii) **Fig. 8.2** shows three sky-divers of different masses falling from the same height. They have identical canopies (parachutes).

For Examiner's Use

Fig. 8.2

Which sky-diver will land first? Provide a reason for your answer.

.....

.....

20

.....

..... [2]

[Total: 10]

C2 a) **Fig. 9.1** shows the image of a human activity that took place Kranji in February 2021.

For Examiner's Use

21

Fig 9.1

i) State the human activity that took place in **Fig. 9.1**.

..... [1]

ii) It is known that human activity in **Fig. 9.1** leads to a reduction in biodiversity, suggest two reasons why [7]conserving biodiversity is important to mankind?

.....

.....

.....

..... [2]

iii) State one specific way in which conservation can be done to help preserve biodiversity across the world.

.....

..... [1]

b) **Fig. 9.2** shows the organisms living in and around a pond.

For Examiner's Use

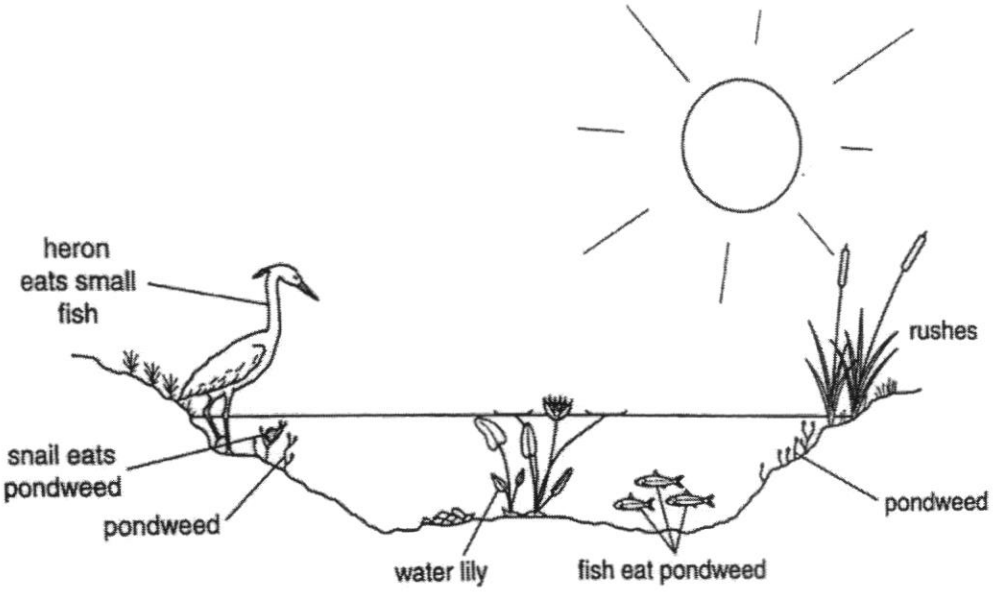


Fig. 9.2

i) Using the information found in **Fig. 9.2**, construct a food web of the organisms found in the above habitat.

22

[2]

ii) State the relationship between fish and pondweed.

..... [1]

iii) Explain the possible short-term and long-term effects on the populations of the organisms in the pond if the only heron in the habitat dies.

.....

.....

.....

..... [3]

[Total: 10]

- End of Paper -

2022 Sec 2 Exp Science TA2 Exam Solution

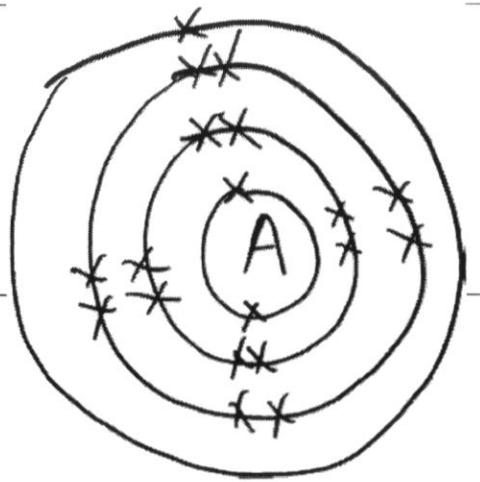
Section A – 20 Marks

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	C	B	A	A	C	B	D	A	D
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
B	A	A	D	B	B	B	B	C	C

Section B 30 Marks

B1ai	**Warn** air from the bottom is less dence and rise up and is cooled by the freezer. The cool air is denser and sinks down to reolace the warm air that rises This sets up a convection current that cools down the air in the refrigerator	[1] [1]	
B1aii	Black surfaces are good emitters of thermal enetgy + thermal energy can be radiated away at a faster rate from the fins	[1]	marks not awarded if both emitter and absorber is stated
B1aiii	Cool air is lost to the surroundings/reolaced with warm air This disrupts the convection currebts present / wastes electricity as more electricity is required to keep the refrigerator cool / food will spoil	[1] [1]	
	To allow convection currents to flow throughout the refrigerator unimpepeded / to allow cold air to reach the bottom of the fridge easily	[1]	

B1c	Pockets of <u>air trapped</u> in the polystyrene is a <u>poor conductor of heat</u>, reduce the loss of thermal energy by conduction.	[1]	
B2a	Hydrogen	[1]	
B2b	Sulfuric acid has been reacted / acid has been used up / no more acid	[1]	
B2c	Zinc sulfate	[1]	
B2d	Zinc oxide / zinc hydroxide / zinc carbonate	[1]	
B3a	…2….Mg + …*…. O_2 ⍰ …2….. MgO *Accept either blank or '1' for O_2 (i) Correct numbers (accept correct multiples of 2:1:2, such as 4:2:4) (ii) Atoms are neither created nor destroyed during a chemical reaction.	 [1] [1]	
B3b	combustion / oxidation / burning	[1]	
B4a	Non-luminous flame ; hotter *OWTTE* ;	[1] [1]	A : higher thermal energy/ higher temp R : stronger flame
B4b	Heat to (complete) dryness / No Zero Error / ensure the fan is switched off during the experiment/ tare the electronic balance to obtain pure sodium chloride / compound / substance/ ; ora (accept any reasonable answer to precaution)	[1] [1]	R : subtract weight of evaporating dish / take repeated readings/
B5	1) Use a <u>magnet to attract all iron fillings</u> using magnetic attraction 2) Run the <u>leftover mixture through filtration</u>	[1] [1] [1]	A: filtration and then magnetic attraction.

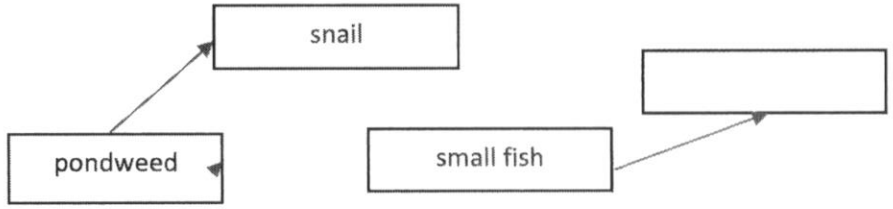
	3) Evaporate the filtrate/ salt solution till dry salt sample is left on the evaporating dish		
B6a	X: Condenser Reject cooling tube Accept: condensing tube *(coz answer indicated its function)* Y: Thermometer	[1]	No 0.5 m, need to get both right for 1 m
B6b	Yes agree As carbonic acid and aniline are having same boiling points. Hence, they cannot be separate as distillation works by separating them by differ boiling points.	[1] [1]	
B7ai	protons and neutrons; both must be correct to score 1m	[1]	Reject: Neuclon (Too close to nucleon)
B7aii	Wrong + Atom has 6 electrons and number of protons should be the same as number of electrons;	[1]	
B7bi	potassium / 19 / 20 / 19;	[1]	
B7bii		[1]	

B7ci	Both are made up solely of iodine;	[1]	R : both consist of at least one iodine atom / have iodine atom in them/ have same number of protons
B7cii	The iodine atom is a single atom. The iodine molecule, however, is made up of more than one iodine atoms;	[1]	A : iodine molecule more stable than iodine atom / mass of molecule more than atom R : atom smaller than molecule

Section C – 20 Marks

C1a	1. Weight Accept: gravity / gravitational force Reject: gravitational potential energy 2. Air resistance Accept: friction / frictional force / Drag	[1] [1]	
C1b	**(i)** W = mg = 68 x 10 = **680 N** **(ii)** Height = 2.14 km = **2140 m** GPE = mgh = 68 x 10 x 2140 = 1455200 ≈ **1460 000 J**	[1] [1] Convert to m [1] Final ans to 3 sf	No working no marks
C1c	**(i)** KE = ½ m v^2 = ½ x 68 x 7.5^2 = 1912.5 ≈ **1910 J** **(ii)** Energy was used to overcome air resistance. OR Energy dissipated as thermal energy and sound energy.	[1] Final ans to 3 sf [1] Reject: Because parachutes increase contact area with air. *(The effect of this increased contact must be made more explicit.)* Reject: • Coz they have weight which pulls them down • heavier so more gravity acts on it Effect of weight (greater downwards pull) must be stated.	Reject: GPE converted to other forms of energy. *(type of energy not specified)*

		Reject: • More mass, more KE Needs to explain where the KE came from	
C1d	**(i)** Opened parachutes offer a very large surface area in contact with the air and this increases the value of air resistance. Accept: Air resistance opposes motion, causing loss of KE **(ii)** Sky-diver C will land first. He has the greatest mass, and hence the greatest weight. He has the greatest force pulling him towards the ground / greater kinetic energy converted from GPE, hence faster speed.	[1] [1] [1]	
C2ai	Deforestation / clearing of land Accepted: habitat destruction R: Construction	[1]	
C2aii	Reduces global warming and disruption to natural cycles Provides resources such as food/raw materials/oxygen Provides research for advancement Prevent fertile land from turning barren Any 2 Reject: prevent climate change	[2]	Poorly done because many students only stated points with reference to resources. A significant proportion did not link the benefits to mankind
C2aii i	Regulate sewage discharge into the sea Set aside forests as nature reserves Prohibit fishing in various areas Any 1	[1]	Student write individual actions rather than larger impact actions (across the world)

	Answers accepted as long as it sounds like it is beyond an individual effort (at least corporate level) R: reduce,reuse,recycle Reject answers that does not provide concrete actions: R: reducing cutting down trees/to not pollute the sea (how can it be done?)		
C2bi	 2 correct arrow, one mark All correct, two marks Penalize one mark if sun is included in foodchain	[2]	Students draw links but missing arrows. Sun is not part of the food chain
C2bii	Predator-prey relationship	[1]	Many students wrote mutualism
C2bii i	**Short term:** 1. Increase population of small fishes due to absence ~~t~~ of predator [compulsory 1 mark] **Long term:** 2. Decrease population of pondweed, because of increased number of small fishes feeding 3. Decrease population of snails due to shortage of pondweed as **food**	[1] [2]	Many student did not clearly state the how the population size changes OR did not provide clear link of relationships between organisms

	4. Eventually <u>decrease</u> population of small fishes due to <u>shortage of pondweed as **food**</u> [any other 2] **Each marking point should include: increase/decrease/more/less of population + clear reason**		