Candidate Name _____ Class _____ Register No. _____

PEIRCE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2021
SECONDARY 2 EXPRESS

SCIENCE **28 September 2021**
2 hours

Additional Materials:
Optical Answer Sheet (OAS)
Periodic Table of Elements

INSTRUCTIONS TO CANDIDATES
Write your name, class and register number in the spaces provided at the top of this page, on page **13** of Section B and **23** of Section C.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.

Section A: Multiple Choice Questions [30 marks]
There are **thirty** 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 shade your choice on the OAS provided.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Section B: Physics Structured Questions [35 marks]
Answer **all** questions.

Section C: Chemistry and Biology Structured Questions [35 marks]
Answer **all** questions.

The number of marks is given in brackets [ ] at the end of each question or part question.
The use of a scientific calculator is allowed.

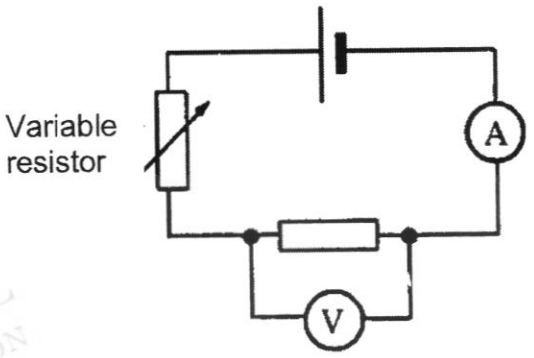
PARENT'S SIGNATURE

For Examiner's Use	
Section A	
Section B	
Section C	
Total	/100

Section A: Multiple Choice Questions [30 marks]

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

1 How will the readings on the meters be affected as the resistance of the variable resistor is decreased?



	ammeter reading	voltmeter reading
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

2 Which of the following is considered a safety hazard?

I Exposing bare wires in damaged insulation
II Overloading power sockets
III Touching a switch with wet hands
IV Using a plastic-cased hair dryer without an earth wire

A I and II only
B III and IV only
C I, II and III only
D All of the above

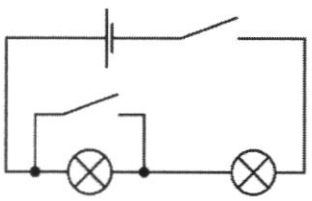
3 The table shows the voltage and current ratings for four electric heaters, **J**, **K**, **L** and **M**.

Which heater has the **least** resistance?

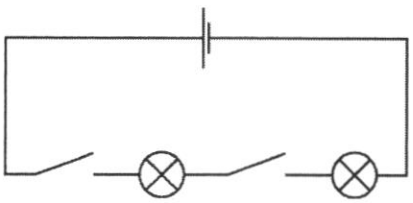
	heater	voltage / V	current / A
A	**J**	110	5.0
B	**K**	110	10
C	**L**	230	5.0
D	**M**	230	10

4 Which circuit allows the lamps to be switched on and off separately?

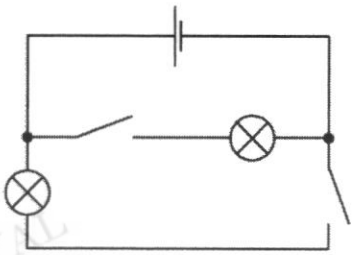
A



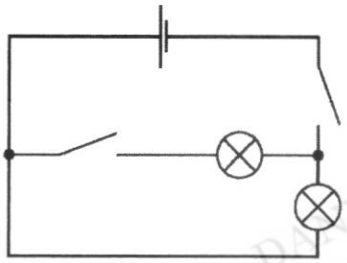
B



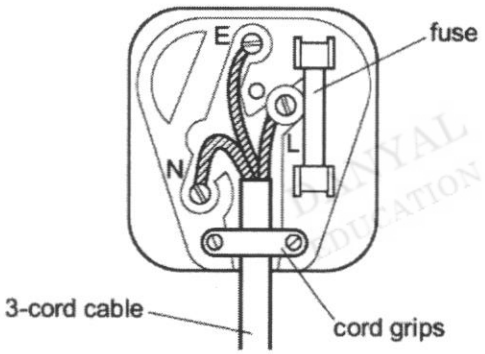
C



D



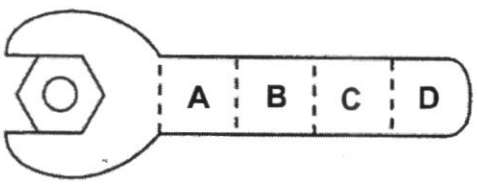
5 The diagram shows a standard 3-pin plug.



What are the correct colours for the wires?

	Neutral wire	Earth wire	Live wire
A	blue	brown	green and yellow
B	blue	green and yellow	brown
C	brown	green and yellow	blue
D	green and yellow	brown	blue

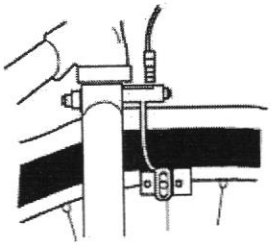
6 A plumber uses a spanner to turn a nut in a clockwise direction.
Which section of the spanner requires the **smallest** force to turn the nut?



7 The diagram below shows two different events.

a parachutist reaching constant speed

brakes slowing down a bicycle



What is the cause behind the two events?

A heat
B gravity
C friction
D radiation

8 Which statement is **not** true?

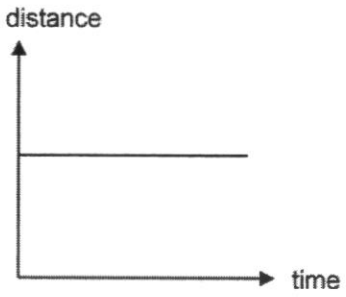
A Skis with a larger surface area enable the skier to slide on the snow easily.
B The sharp edge of a knife exerts more pressure than a blunt edge of a knife when the same force is applied through them.
C A lady wearing a pair of high-heel shoes exerts more pressure when standing on the floor than wearing a pair of sports shoes with flat soles.
D An iron bar that weighs 10 N always exerts the same amount of pressure as a stone that weighs 10 N when resting on a floor.

9 An astronaut has a mass of 60 kg on Earth. He can jump 0.5 m on the surface of Earth.
Which statement regarding the distance he can jump on the Moon and the corresponding reason is correct?

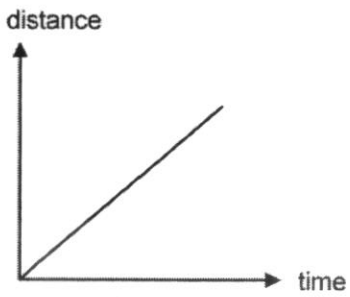
	distance jumped on moon	reason
A	higher than 0.5 m	His mass on Moon is less than on Earth.
B	lower than 0.5 m	His mass on Moon is greater than on Earth.
C	higher than 0.5 m	The Moon's gravity is lower than the Earth's.
D	lower than 0.5 m	The Moon's gravity is greater than the Earth's.

10 The following graphs show the distance travelled by an object from a fixed point. Which graph correctly shows that the object is **not** moving?

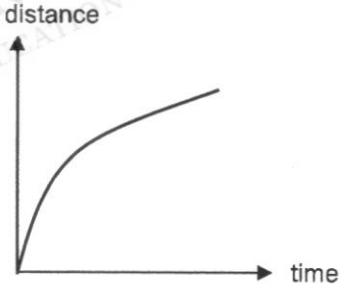
A



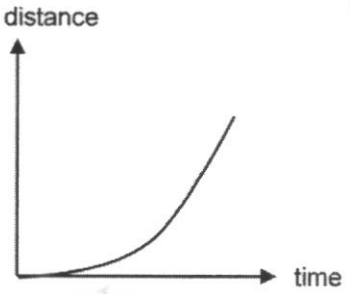
B



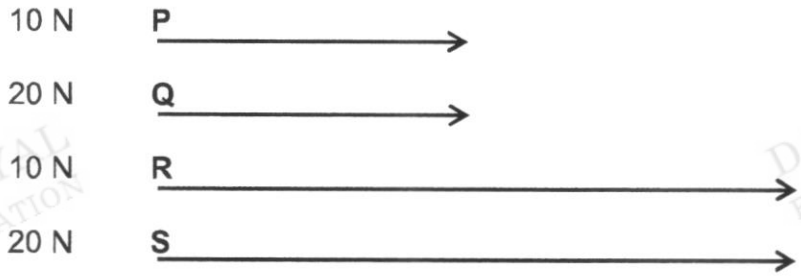
C



D



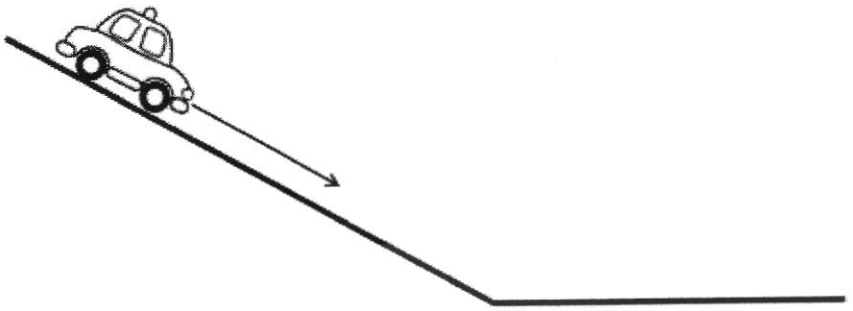
11 Forces of 10 N and 20 N are used to move various objects **P**, **Q**, **R** and **S** over the distances indicated by the length of the arrows respectively.



Which statement correctly describes the work done by the forces?

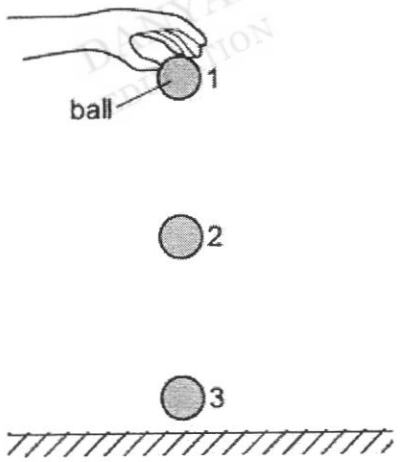
A The most work is done to move **R**.
B The most work is done to move **S**.
C The same amount of work is done to move **P** and **Q**.
D The same amount of work is done to move **Q** and **S**.

12 When a car is accelerating down a slope as shown in the diagram below, it _____ .



A gains both kinetic energy and potential energy
B gains kinetic energy but loses potential energy
C loses kinetic energy but gains potential energy
D loses both kinetic energy and potential energy

13 A ball drops from a height as shown in the diagram below.



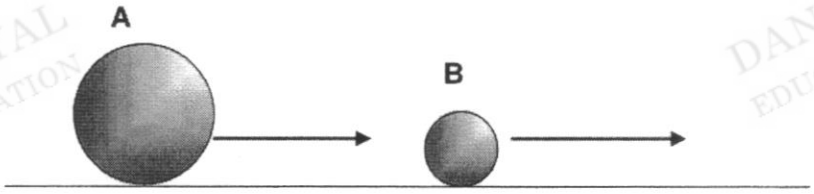
Ignoring air resistance, the total energy of the ball is _____ .

A greatest at point 1
B greatest at point 2
C greatest at point 3
D the same at all points

14 Which of the following **best** describes the difference between biomass and fossil fuels?

A Biomass fuels are renewable but fossil fuels are not.
B Biomass fuels generate more energy than fossil fuels.
C Biomass fuels generate more pollution than fossil fuels.
D Biomass fuels originate from both plants and animals but fossil fuels originate from plants only.

15 Two metals balls, **A** and **B**, are moving on the floor at different speeds in the same direction as shown in the diagram below. Metal ball **A** moves at a faster speed than metal ball **B**.



What will likely to happen to balls **A** and **B** after collision?

A **A** will slow down and **B** will increase in speed as **B** will transfer some of its kinetic energy to **A**.
B **A** will slow down and **B** will increase in speed as **A** will transfer some of its kinetic energy to **B**.
C **B** will slow down and **A** will increase in speed as **A** will transfer some of its kinetic energy to **B**.
D **B** will slow down and **A** will increase in speed as **B** will transfer some of its kinetic energy to **A**.

16 Helium exists as two isotopes He-3 and He-4.
Which statement about the two isotopes is true?

A They are able to form positive ions.
B They have different mass numbers.
C They have different number of electrons.
D They have different number of electron shells.

17 Which statement is correct about an atom of an element?

A The atom can gain 3 electrons to form a positive ion.
B The atom can lose 2 protons to form a negative ion.
C The atom is electrically neutral when it becomes an ion.
D The atom cannot lose electrons if its atomic number is 18.

18 An ion of an element X has 18 electrons, 20 protons and 19 neutrons.
Element X has another isotope. An atom of this isotope may have _____ .

A 18 protons, 22 neutrons and 20 electrons
B 20 protons, 19 neutrons and 20 electrons
C 18 protons, 22 neutrons and 18 electrons
D 20 protons, 22 neutrons and 20 electrons

19 The table shows some information about atoms L and M.

atom	number of protons	number of neutrons	electronic structure
L	12	12	2.8.2
M	18	22	2.8.8

Which statement is correct about atoms L and M?

A They are atoms of noble gases.
B They are in the same group of the Periodic Table.
C They are in the same period of the Periodic Table.
D They have achieved a stable configuration.

20 Which of the statements are true when a chemical reaction occurs?

1 The atoms in the reactants rearrange to form the products.
2 The mass of the reactants is the same as the mass of the products.
3 Atoms are destroyed so that new substances can be created.
4 The number of atoms remains the same at the end of the reaction.

A 1 and 2 only
B 1, 2 and 4
C 2 and 3 only
D 2, 3 and 4

21 Refer to the list of reactions below.

I. carbon + oxygen → carbon dioxide
II. calcium carbonate → calcium oxide + carbon dioxide
III. glucose + oxygen → carbon dioxide + water + energy
IV. sugar → carbon + water

Which of the reactions represent examples of decomposition reactions?

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

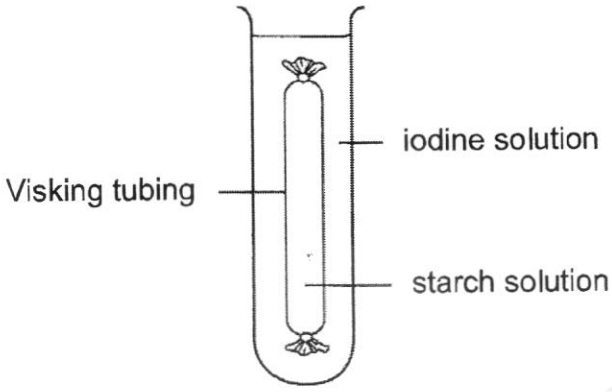
22 Which of the following results in a chemical change?

A heating iodine crystals
B heating a mixture of iron and sulfur
C dissolving potassium nitrate in water
D magnetising a piece of iron with a magnet

23 Which compound would not form copper(II) sulfate by reaction with sulfuric acid?

A copper
B copper(II) oxide
C copper(II) carbonate
D copper(II) hydroxide

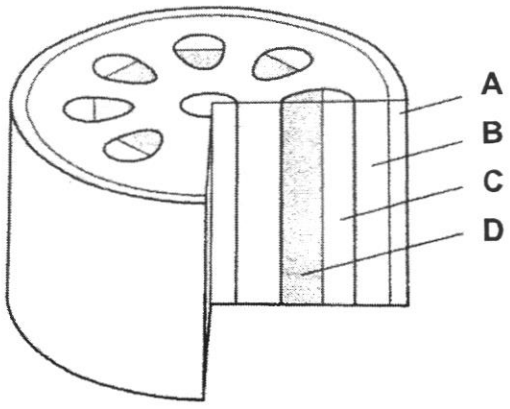
24 A Visking tubing filled with starch solution was placed in a boiling tube containing water. A few drops of iodine solution (made up of small molecules) was added to the boiling tube.



What will be the colour of the regions after a few minutes?

	boiling tube	Visking tubing
A	yellow	blue-black
B	blue-black	yellow
C	yellow	yellow
D	blue-black	blue-black

25 The diagram shows a section of a stem.
Which labelled tissue is responsible for transport of manufactured sugars?



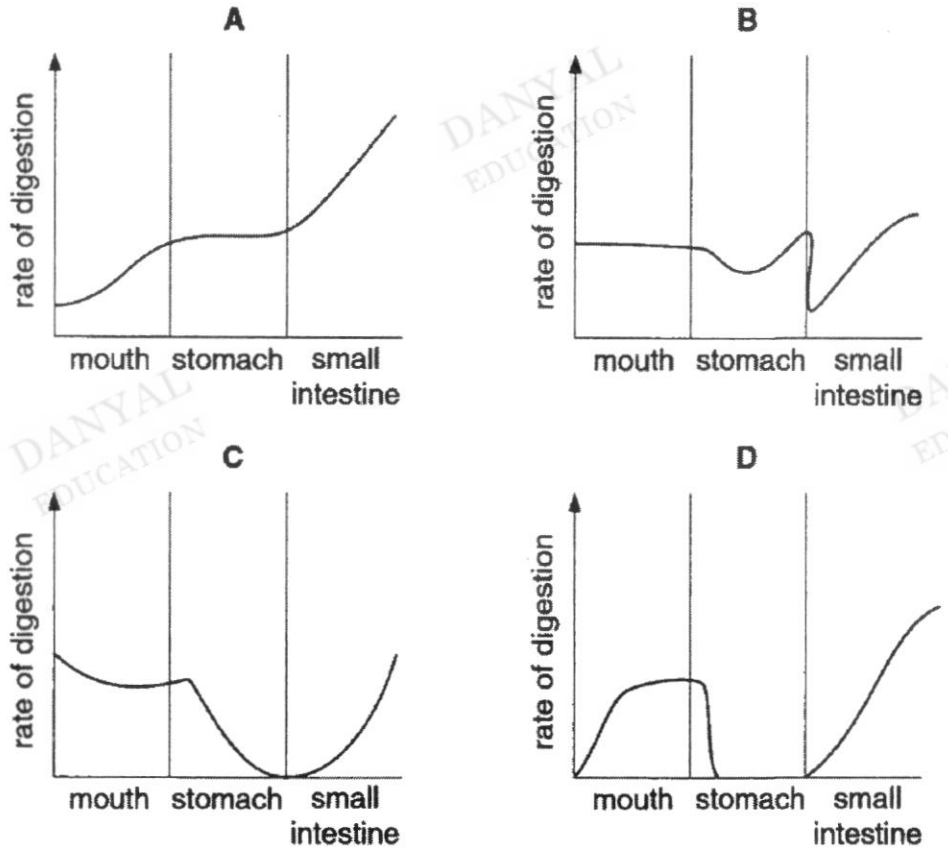
26 The following are steps in an experiment.

Various foods with carbohydrates, proteins and fats were ground.
Only protease and hydrochloric acid were added to the ground mixture.

Which part(s) of the digestive system do these two steps mimic and what products of digestion would be present in the mixture?

	part(s) of digestive system	products of digestion
A	stomach	simpler protein molecules
B	small intestine	glycerol and glucose
C	small intestine	fatty acids and glucose
D	oesophagus and large intestine	glucose

27 Which graph shows the rate of digestion of starch in the three parts of the alimentary canal?

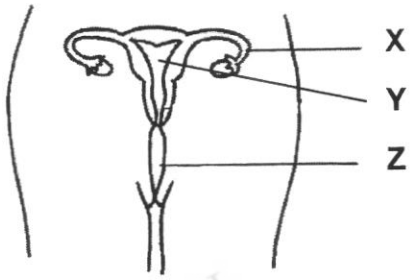


28 Which changes happen in both boys and girls during puberty?

1 growth spurt occurs
2 increased production of sex hormones
3 pubic hair grows
4 voice becomes deeper

A 1 and 4 only
B 2 and 3 only
C 1, 2 and 3 only
D 1, 2 and 4 only

29 The diagram shows the female reproductive system.



Which are the correct processes that occur at **X**, **Y** and **Z**?

	X	Y	Z
A	deposition of sperms	fertilisation of egg	implantation of embryo
B	fertilisation of egg	implantation of embryo	deposition of sperms
C	implantation of embryo	deposition of sperms	fertilisation of egg
D	implantation of embryo	fertilisation of egg	deposition of sperms

30 How is AIDS spread?

A being sneezed on by an infected person
B sharing of food with an infected person
C sharing of medical needles with an infected person
D resting on the same bed previously used by an infected person

Class Register No.

Candidate Name _____

Section B: Physics Structured Questions [25 marks]

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

1 Fig. 1.1 shows a circuit diagram connected with 5 identical lamps.

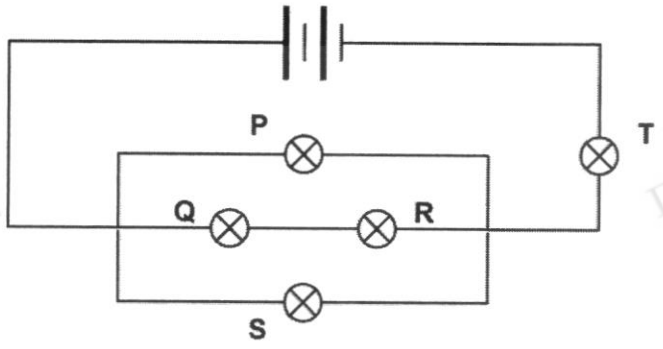


Fig. 1.1

(a) If lamp **P** is spoilt, will the rest of the lamps light up? Explain.

.....

..... [1]

(b) If lamp **Q** is spoilt, which lamp(s) will not light up?

..... [1]

(c) If an additional lamp is added in parallel to lamp **S**, how will the brightness of lamp **T** be affected? Explain.

.....

..... [2]

(d) Which 2 lamps will have the least current?

..... [1]

2 (a) Fig 2.1 shows a trolley released from rest from the top of a smooth ramp. The trolley moves down the ramp and comes to a stop when it compresses a spring fixed at the bottom of the ramp.

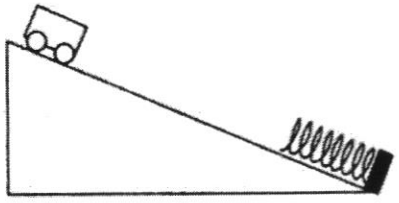


Fig. 2.1

In the boxes provided, state the energy transformation taking place

(i)	→ kinetic energy →	(ii)

[2]

(b) State two disadvantages of using fossil fuels.

..... [1]

..... [1]

(c) What do you understand by *renewable* sources of energy?

..... [1]

.....

3 Fig. 3.1 shows a concrete block with dimensions 20 cm x 40 cm x 80 cm.

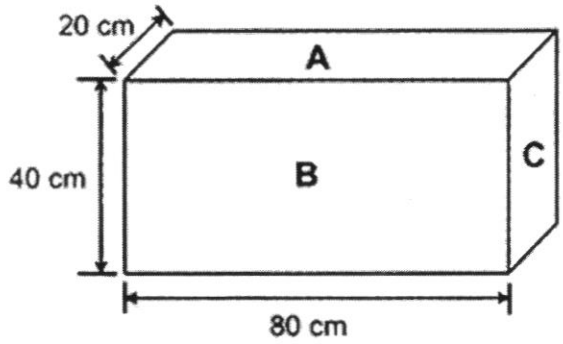


Fig. 3.1

(a) A construction worker wants to lay this piece of concrete block on a soft ground. On which surface, **A**, **B** or **C**, should he lay the concrete block on so that it is least likely to sink into the soft ground? Explain your answer.

.....

.....

.....

..... [2]

(b) Calculate the pressure exerted on the ground by the surface stated in **3(a)** if the mass of the block is 500 kg. (take g to be 10 N / kg)

pressure= .....N / m^2 [2]

(c) How will the pressure on the ground change if the block is made from styrofoam instead of concrete?

.....

..... [1]

4 (a) An oxygen tank weighing 300 N on Earth is brought to Moon. The gravitational field strength on Earth is 10 N / kg and that of Moon is 1.67 N / kg.

(i) Calculate the mass of the oxygen tank on Moon.

mass on Moon = ... kg [2]

(ii) Calculate the weight of the oxygen tank on Moon.

weight on Moon= .....N [2]

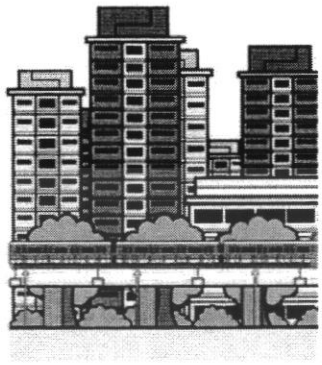
(b) State the difference between *mass* and *weight.*

.....

.....

..... [1]

5 MRT is a common mode of public transport in Singapore. They are electrically powered and run on train tracks.
A train without passengers has a mass of 38000 kg. 8000000 J of electrical energy is required for the stationary empty train to reach its service speed.



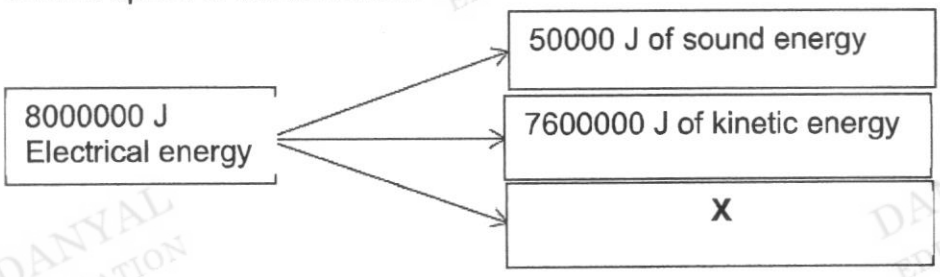
(a) State the *principle of conservation of energy*.

.....

.....

..... [1]

(b) The energy conversion when the stationary empty train speeds up to its service speed is shown below.



(i) State the type of energy **X**.

..... [1]

(ii) By using the principle of conservation of energy, determine the value of **X**. Give your answer in J.

X =..... J [1]

(iii) The service speed of the empty train is 20 m / s. Suggest whether more or less electrical energy is required for the train to reach its service speed when it is carrying passengers. Give a reason for your answer.

.....

.....

..... [2]

Physics Free Response Question [10 marks]
Answer the question in the spaces provided.

6 Fig. 6.1 shows an electrical circuit, made up of dry cells, copper wires and an iron nail. A pile of paper clips, which are made of iron, are placed near the iron nail.

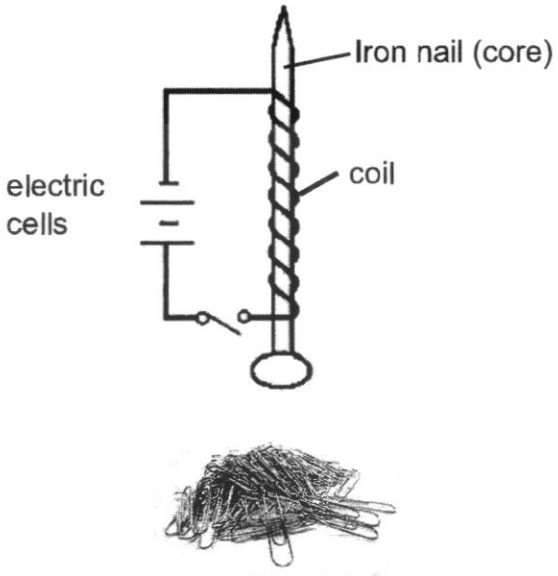


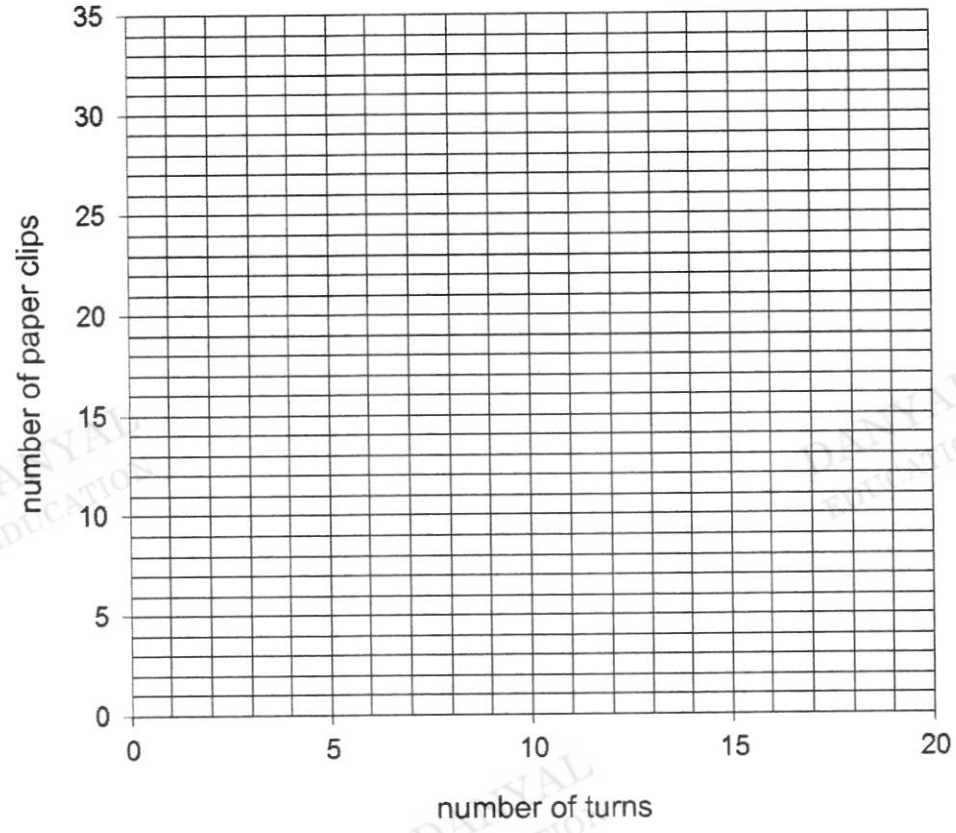
Fig. 6.1

In an experiment, a student gradually increases the number of turns in the coil on the nail and records the number of paper clips the nail is able to attract. He records the data from his experiment in the Table 6.2.

Table 6.2

Number of turns	4	6	8	10	12	14	16
Number of paper clips	2	6	10	12	18	22	26

(a) Complete the graph in Fig. 6.3 using the data from the Table 6.2. Draw the line of best fit.



[2]

Fig. 6.3

(b) What does your graph show and what conclusion can you make from it?

.....

..... [2]

(c) Other than increasing the number of turns in the coil on the nail, state one other way to make a stronger electromagnet.

.....

..... [1]

(d) Fig. 6.4 shows two dry cells of 5 V each , three resistors of 1Ω each and a bulb of 2Ω resistance. The diagram below shows the circuit set up.

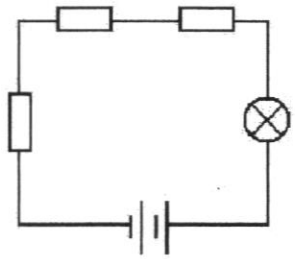


Fig. 6.4

(i) Calculate the voltage across the two dry cells.

voltage =..... V [1]

(ii) Calculate the current flowing through the bulb.

current = ... A [2]

(iii) **Without adding or removing** any electrical components from the circuit, redraw the circuit diagram such that the total resistance of the circuit is less than **that of individual components**.

[2]

End of Section B

Class	Register No.

Candidate Name _____

Section C: Chemistry and Biology Structured Questions [25 marks]

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

1 Table 1 shows research about Particles **A** to **F**.
Particles **A**, **C**, **D** and **F** are atoms.
Particles **B**, **D** and **E** have the same number of electrons.

Table 1

particle	atomic number	nucleon number	number of protons	number of electrons	number of neutrons
A	7	14			
B	8	16			
C	9	19			
D	10	20			
E	11	23			
F	12	24			

(a) With the given information about Particles **A** to **F**, complete the table above. [2]

(b) State the period which contains **exactly two** of the elements in Table 1.

.....[1]

(c) Draw the 'dot' and 'cross' diagram for the ions formed by particles **(i) B** and **(ii) E**.

(i) ion of particle **B**	**(ii)** ion of particle **E**

[2]

(d) The compound formed by Particle **B** and **E** is electrically neutral.
Suggest the ratio of ion **B** to ion **E** in this electrically compound.

.....[1]

[Total: 6 marks]

2 Fig. 2.1 shows an experimental setup using a potato cube.
The potato cube was tied to a plastic rod and suspended in solution **X**.

After two hours, the plastic rod was bent slightly.

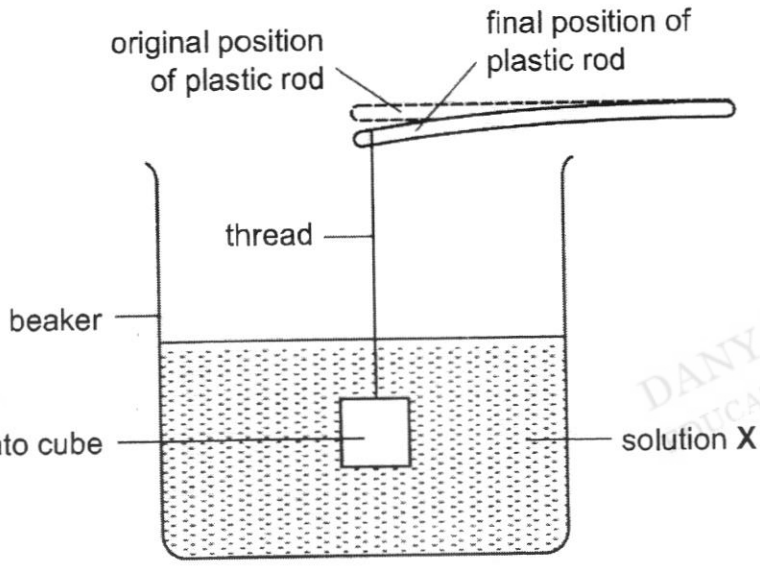


Fig. 2.1

(a) Explain the final position of the rod after two hours, with reference to a process in living things.

.....

.....

..... [2]

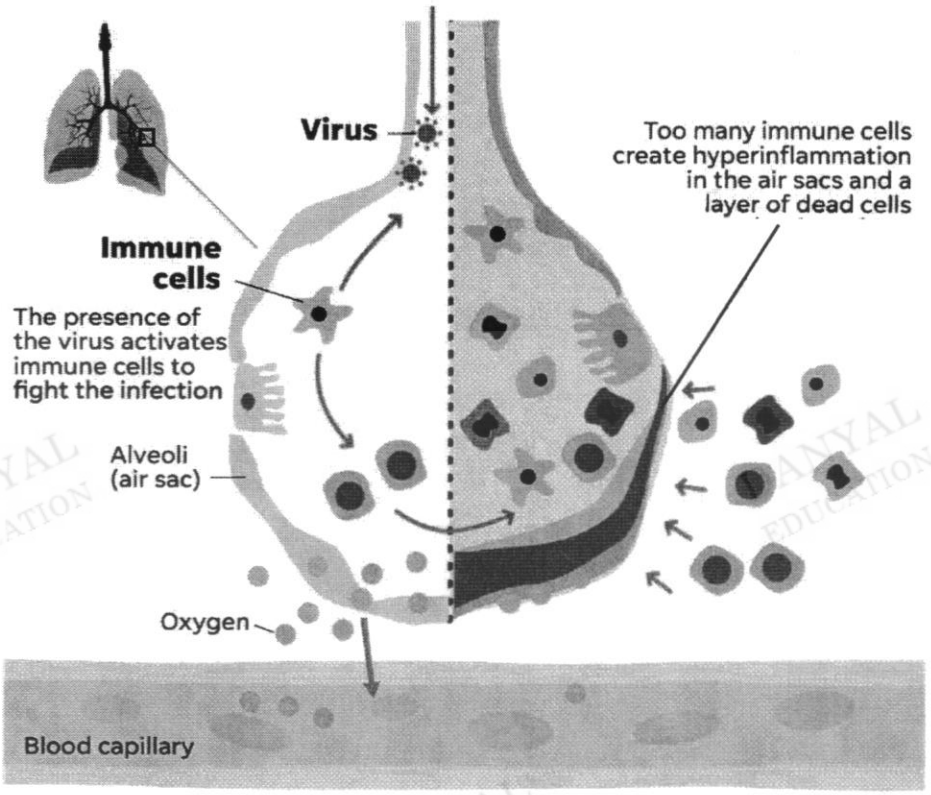
(b) When solution **X** was replaced by 1% sugar solution, the position of the plastic rod did not change after two hours.

Suggest a conclusion about the potato cube from this observation.

..... [1]

[Total: 3 marks]

3 Fig. 3.1 shows an infographic about how the lungs and its associated blood capillaries are affected by a coronavirus infection.



Extracted from https://www.usatoday.com/in-depth/news/2020/04/15/coronavirus-risk-90-patients-had-underlying-conditions/2962721001/

Fig. 3.1

(a) Fig. 3.1 uses the term 'immune cells' to describe the cells activated by the presence of the virus.

Using structural evidence from Fig. 3.1, suggest the identity of the 'immune cells'.

.....

.....

..... [2]

(b) Using information from Fig. 3.1, suggest how this infection leads to breathlessness and the need for oxygen tank by patients.

.....

.....

..... [2]

[Total: 4 marks]

4 Fig. 4.1 shows a diagram of part of the human alimentary canal and associated organs.

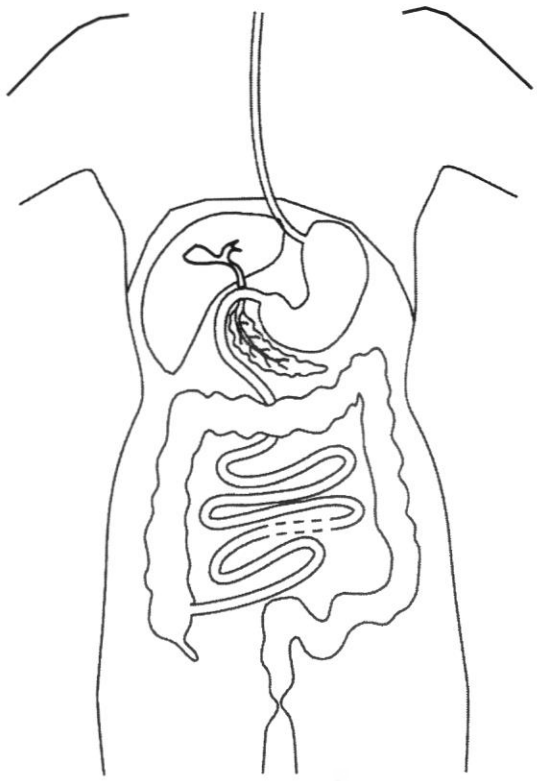


Fig. 4.1

(a) On Fig. 4.1, draw label lines with letters to show:

A where bile is stored
B where egestion occurs. [1]

(b) Mechanically digested food travels from the mouth to the stomach.
The gastric juice in the stomach contains hydrochloric acid, providing a low pH environment.

Explain why it is important to have a low pH in the stomach.

.....

.....

..... [1]

(c) A student investigated the digestion of fats by an enzyme from the small intestine. He found that as the fats were digested, the pH of the solution changed from pH 8 to pH 6.

Explain why the digestion of fats changed the pH of the solution.

.....

.....

.....

..... [2]

(d) Patients with diabetes are unable to produce a protein, insulin, to regulate their blood glucose concentration.

Explain why it is recommended that insulin be injected directly into the bloodstream of the patient instead of being taken in tablet form orally.

.....

.....

.....

..... [2]

[Total: 6 marks]

5 Fig. 5.1 shows the reproductive organs of a man and Fig. 5.2 shows the reproductive organs of a woman.

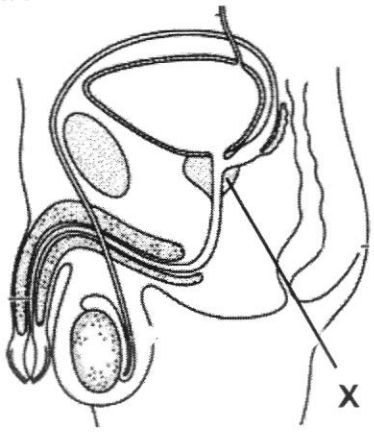


Fig. 5.1

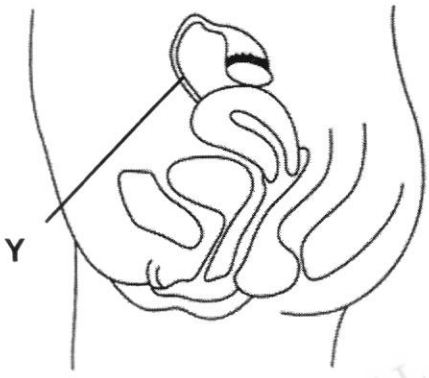


Fig. 5.2

(a) Label and draw a line in both Fig. 5.1 and Fig. 5.2, to indicate the organ(s) responsible for the production of sex hormones in a man and woman. [1]

(b) State the function of organ **X** in the male reproductive system.

.....

..... [1]

(c) Patient **S** has a condition that causes abnormal growth in structure **Y**.
This causes structure **Y** to be partially blocked.
Explain how this condition can affect her ability to become pregnant.

.....

.....

..... [2]

(d) Patient **T** is pregnant and is considering an abortion due to health risks of carrying a foetus to full term.
However, her doctor informed her that abortion carries risks as well.
Describe two risks that patient **T** might face in going through an abortion.

.....

.....

..... [2]

[Total: 6 marks]

Free Response Question [10 marks]

Answer the question in the spaces provided.

6 The shell of an egg is made up of calcium carbonate.

When an egg is submerged in hydrochloric acid, effervescence is observed around the shell.

After a few days, it was observed that the egg shell had totally dissolved and a calcium compound was found dissolved in the solution.

(a) Describe a test to confirm the identity of the gas released.

test: .....

result: ..... [2]

(b) Write the word equation for the reaction between the egg shell and hydrochloric acid.

..... [2]

(c) Describe one physical property of hydrochloric acid.

.....

..... [1]

Question continues on the next page.

An experiment was carried out to compare the acidity of some fruit juices.
An alkali, sodium hydroxide solution was used to react with 25.0 cm^3 of each fruit juice.

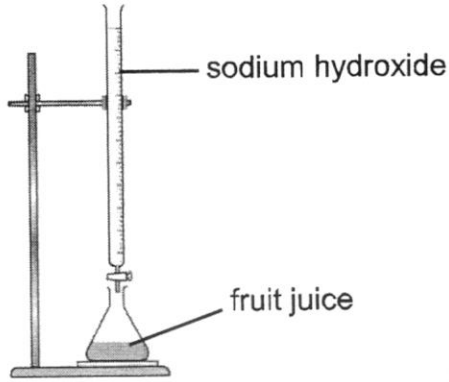


Fig. 6.1

Sodium hydroxide was added to the fruit juice until the mixture was neutral in pH.
The results are shown in Table 6.

Table 6

fruit juice	volume of sodium hydroxide solution/cm^3
apple	10
lemon	16
pineapple	6
grapefruit	14
lime	12

(d) Using the information from Table 6, identify which fruit juice has the lowest pH.
Explain your answer.

.....

.....

..... [2]

Question continues on the next page.

(e) A few drops of Universal Indicator were added into the lime juice before adding the 12 cm^3 of sodium hydroxide.

State the colour change of the indicator when it was added to the lime juice.

.....[1]

(f) Describe and explain the difference in observation when an equal mass of sodium carbonate is added to grapefruit juice and pineapple juice separately.

.....

.....

.....

.....[2]

[Total: 10 marks]

End of Section C

End of Paper

PEIRCE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2021
SECONDARY TWO EXPRESS
Combined Marking Scheme/Report

Section A: Multiple Choice Questions [30 marks]

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

Section B: Physics Structured Questions [25+10 marks]

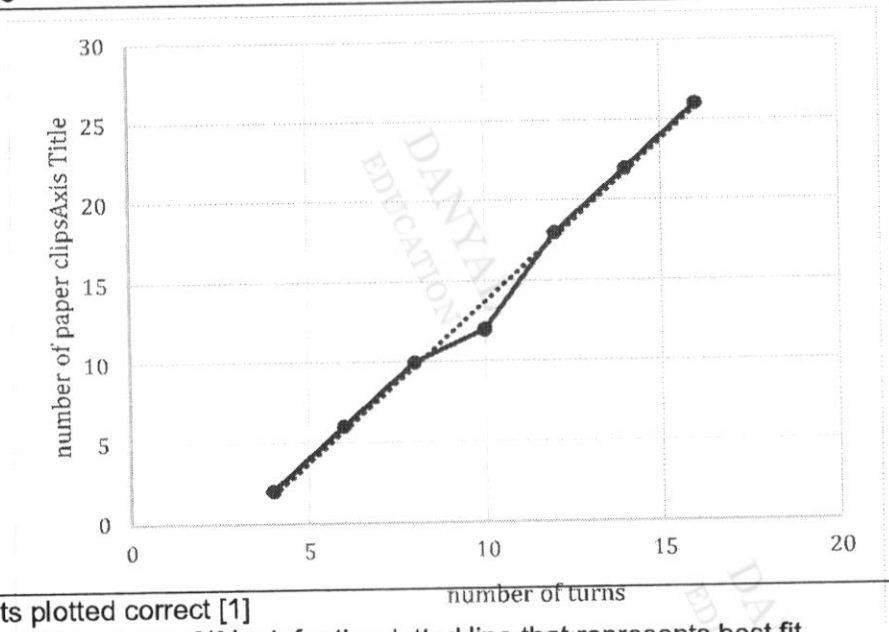
Q	Answers	Remarks	
1(a)	Yes. There are alternative pathways for the electrons / electricity to flow through. [1]	1 m 1 m	
1(b)	lamp **R** [1]	1 m	
1(c)	The brightness of **T** increases. [1] As the effective resistance of the circuit decreases, the current Increases [1]. Hence, the brightness of **T** increases.	1 m	
1(d)	Lamps **Q** and **R** (both must be correct)	1 m	
	Total	5 marks	

Q	Answers	Remarks	
2(a)	(i) gravitational potential energy [1] (ii) elastic potential energy [1]	2 m [2]	
2(b)	Burning of fossil fuels will cause air pollution. [1] There is a limited supply of fossil fuels. [1] Extensive mining has negative impact on the ecosystem around the mine[1] (any 2 reasonable answer)	2 m	
2(c)	Energy source that can be replenished naturally that does not go into depletion in time.	1 m	
	Total	5 marks	

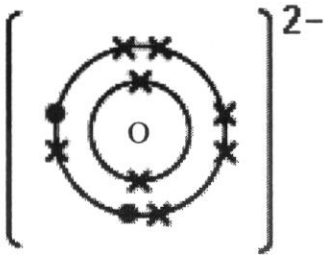
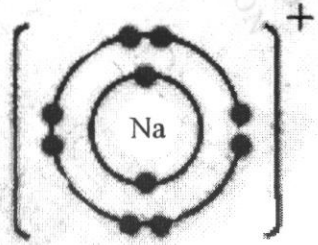
Q	Answers	Remarks	
3(a)	B [1] It has the largest contact area so the pressure exerted on the ground will be the smallest [1]	2 m	
3(b)	M= 500 kg , force exerted F = weight = m x g = 500 x 10 = 5000 N Area of surface B = 40 / 100 m x 80 /100 m = 0.40 x 0.80 = 0.32 m Pressure = $\frac{\text{Force}}{\text{Area}}$ = 5 000 / (0.40 x 0.80) = 5 000 / 0.32 [1] = 15 625 N / m^2 (3sf) [1] Allow for ecf from 3(a)	2 m	
3(c)	Pressure will be lower [1]	1 m	
	Total	5 marks	

Q	Answers	Remarks	
4(a)	(i) Mass of oxygen tank on Moon is same as mass on Earth m = W / g = 300/10 [1] = 30 kg [1]	2 m	
4(a)	(ii) Weight of oxygen tank on Moon = m x g = 30 x 1.67 [1] = 50.1 N [1]	2 m	
4(b)	The main difference is , mass is the **amount of matter** in a body and weight is the amount of **gravitational pull exerted by Earth** on a body. [1] (gravitational force of the body)	1 m	
	Total	5 marks	

Q	Answers	Remarks	
5(a)	Energy cannot be created or destroyed It can only be converted/changed/transformed from one form to another [1] OR Energy cannot be created or destroyed. It can only be converted/changed/transformed into other forms of energy [1]	1 m	
5(b)	(i) Heat energy / Heat / thermal energy [1]	1 m	
5(b)	(ii) X = 8000 000 – (50000 + 7600000) = 350000 J [1]	1 m	
5(b)	(iii) More electrical energy [1] because more work is done by the train/ higher K.E. of the train due to higher mass. [1]	2 m	
	Total	5 marks	

Q	Answers	Remarks	
6(a)			
	All points plotted correct [1] The best fit line drawn [1] look for the dotted line that represents best fit	2 m	
6(b)	The **higher the number of turns in the coil** around the nail, the **more paperclips** it attracts [1] The **magnetic effect of electricity is stronger** with more turns in the coil [1]	2 m	
6(c)	Increasing the number of electric cells (e.m.f of the battery) or make the current stronger (by reducing resistance). Do not accept adding a soft iron core as the nail already serves as core.	1 m	
6(d)	(i) V = 10V	1 m	
6(d)	(ii) I = V / R =10 / 5 [1] = 2 A [1]	2 m	
6(d)	(iii) All components drawn in parallel – 2 marks (Partially drawn parallel circuit = 1m)	2 m	
	Total	10 marks	

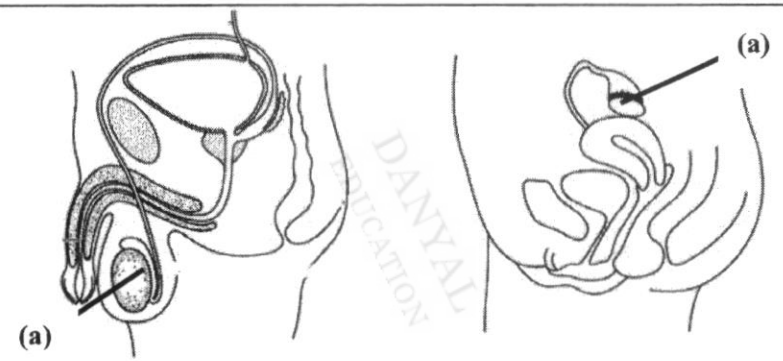
Section C: Chemistry & Biology Structured Questions [25+10 marks]

Qn	Answer	Marks	Markers' Remarks
1a	<table><tr><th>particle</th><th>atomic number</th><th>nucleon number</th><th>no. of protons</th><th>no.of electrons</th><th>no.of neutrons</th></tr><tr><td>A</td><td>7</td><td>14</td><td>7</td><td>7</td><td>7</td></tr><tr><td>B</td><td>8</td><td>16</td><td>8</td><td>10</td><td>8</td></tr><tr><td>C</td><td>9</td><td>19</td><td>9</td><td>9</td><td>10</td></tr><tr><td>D</td><td>10</td><td>20</td><td>10</td><td>10</td><td>10</td></tr><tr><td>E</td><td>11</td><td>23</td><td>11</td><td>10</td><td>12</td></tr><tr><td>F</td><td>12</td><td>24</td><td>12</td><td>12</td><td>12</td></tr></table>	Marked by rows: 0-2 =0m 3-5 =1m 6 =2m	*A number of students did not read the question stem with care - marks were lost for particles B and E due to the number of electrons.* **A** BOD if student wrote electronic configuration in no. of electrons (provided no. is correct)
1b	Period 3 ; **R** usage of any other notation e.g. III	1m CAO	**R** third period
1c	<table><tr><th>oxide ion (Particle B)</th><th>sodium ion (Particle E)</th></tr><tr><td>  </td><td>  </td></tr></table> 1. 1m for correct total number of electrons (for both) 2. 1m for correct representation of ion (charges & bracket for both, balancing of charges not required) award 1m if marking points 1 and 2 are correct for one ion	1m each, 2m CAO	**A** pairing of both electrons gained by O atom **A** nucleus represented by B/E **R** same electron symbols for O (mark not awarded for electron mark) **R** if the charge is written as -2
1d	Ratio of particle B:particle E = 1:2 ;	1m CAO **ORA**	**R** 2:1 ratio unless specified by student to be E:B
	Total	6 marks	

Qn	Answer	Marks	Markers' Remarks
2a	• There was a **lower water potential** in the cell sap of the **potato cells** than in Liquid **X** / ora ; • Hence, water molecules move into the potato cells by **osmosis** ; • The potato cube **gained mass due to water entering the cells**, causing rod to dip ;	1m each, 2m max 1m max if no mention of osmosis	**R** gained mass due to diffusion of Solution X into the potato *Students did not read the scenario in question stem clearly and thought the experiment lasted 2 + 2 hours in total, thus describing what happens in the additional 2 hours without reference to osmosis.*
2b	The **water potential** of the cell sap is the **same** as the 1% sugar solution ;	1m CAO OWTTE	**A** concentration is the same **R** constant
	Total	3 marks	

Qn	Answer	Marks	Markers' Remarks
3a	Identity: white blood cell ; Evidence: it is **irregular in shape / has a nucleus ;**	1m each, 2m max	**R** help to fight infection *Students generally refer to the function of WBC without understanding the demand of the question on **structural evidence**.*
3b	Information from Fig. 3.1: The **layer of dead cells** in the alveoli / air sac ; **A** hyperinflammation in air sacs Suggest/link: cause **diffusion of oxygen to slow down / stop** ; **A** is harder **A** less oxygen breathed in as dead cells take up space	1m each, 2m max OWTTE AVP	**R** oxygen cannot pass through/into the lungs (without mention of blood or body) **R** cannot breathe properly (vague + diffusion≠breathing)
	Total	4 marks	

Qn	Answer	Marks	Markers' Remarks
4a	**A** gall bladder **B** anus (R: rectum)	1m for both CAO	**R** label B between legs (not anus)
4b	• The acidic environment **kills bacteria** to prevent infections ; • It provides an acidic environment for **proteases/enzymes** in the stomach to work ;	1m max, AVP & OWTTE	**R** break down food (w/o enzyme) **R** dissolve protein/food (misconception) **R** helps digest food better
4c	• Fats are **broken down to give fatty acids** (and glycerol) ; • The **fatty acids produced lowers the pH** of the solution ;	1m each, 2m max	*Common misconception/assumption that lipases are acidic in nature.*
4d	• Insulin will be **broken down/digested by proteases** into polypeptides/amino acids; • in the **stomach** and **small intestine** (both must be mentioned for 1 mark) ;	1m each, 2m max	**R** slower than injection (not possible to be in the body even if taken orally)
	Total	6 marks	

Qn	Answer	Marks	Markers' Remarks
5a		1m for both CAO	Ignore wrong or missing label if label lines are right *Question is missed out or unattempted by some students.*
5b	provide the **nutrients** required for sperm cells to survive in the semen ;	1m CAO	**A** nourish **R** activates sperm https://www.nih.gov/news-events/nih-research-matters/how-sperm-are-activated *Students who did not see the label carefully assumed it was pointed to the sperm duct without clarifying during the exam.*
5c	• The lining of structure Y is then **unable to allow for fertilisation of the ovum ;** • Hence, **prevent the formation of the zygote** for a successful pregnancy ; **R** sperm is unable to *meet* the ovum	1m each, 2m total	**A** egg **R** embryo have difficulty moving to uterus
5d	Any 2 of the following: • infection of uterus and fallopian tubes leading to infertility ; • accidental puncturing of uterus leading to excessive bleeding ; • cervix & uterus weakened leading to miscarriage ; • increased risk of ectopic pregnancy ;	1m each, 2m max AVP	**A** cannot have another child / unable to get pregnant **A** depression **R** death (unqualified) **R** infection of reproductive organs/ damage to reproductive system **R** loss of blood
	Total	6 marks	

Qn	Answer	Marks	Markers' Remarks
6a	Test: bubble the gas through **limewater/calcium hydroxide** ; Observation: **white precipitate** formed in limewater/calcium hydroxide ;	1m each, 2m max	R limewater turns cloudy/milky
6b	calcium carbonate + hydrochloric acid **calcium chloride** + carbon dioxide + **water** 1m for products (**both** calcium chloride & water) 1m for correct word equation representation (reactants products), **R** equal sign	1m each, 2m max	
6c	Any of the following: • sour taste ; • turns blue litmus paper red ; • conduct electricity when dissolved in water ;	1m max	**R** corrosive
6d	Identify: **lemon juice** ; Explain: It required the **most / highest volume of sodium hydroxide** to neutralise ;	1m each, 2m max OWTTE	**R** *contains* the highest amount of sodium hydroxide
6e	It changed **from red to green** in colour ;	1m CAO	**R** green **A** orange to green **A** green to red (for initial change)
6f	D: **more effervescence / bubbles** would be observed for the **grapefruit juice** ; (**A** reaction is completed in a shorter time for grapefruit juice) E: grapefruit juice is **more acidic / lower in pH** than pineapple juice from the data ;	1m each, 2m total **ORA**	R pineapple juice is more alkaline than grapefruit juice
	Total	10 marks	