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Name : () Class :



ST JOSEPH'S INSTITUTION
END-OF-YEAR EXAMINATION
(SECONDARY 2)

LOWER SECONDARY SCIENCE
PAPER 2

5 OCTOBER 2016
1 hour 45 minutes
0800 – 0945 hrs

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

1. Answer all the questions in the spaces provided on the question paper.
2. Write in dark blue or black pen. You may use a soft pencil for any diagrams, graphs or rough working.
3. Use pi (π) value preprogrammed in calculator.
4. Express your final answer in 3 significant figures where appropriate, show all working, and include units in all your working.
5. Do not use staples, paper clips, highlighters, glue or correction fluid/tape.

Section A									
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10

Section B		
B1	B2	B3

For Markers Use	
Section A	/40
Section B	/30
Total	/70

This document consists of **19** printed pages.

[Turn over]

Group									
I	II	III	IV	V	VI	VII	0		
1								1	
2								2	
3	4							3	
4	5							4	
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60	61							60	
61	62							61	

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

2

Section A (40 marks)

Answer *all* questions in the spaces provided.

- A1** A student comes up with the hypothesis that the more weight a toy car has, the faster it will move down a slope. He makes use of the set up shown in **Figure A1** below to test his hypothesis.

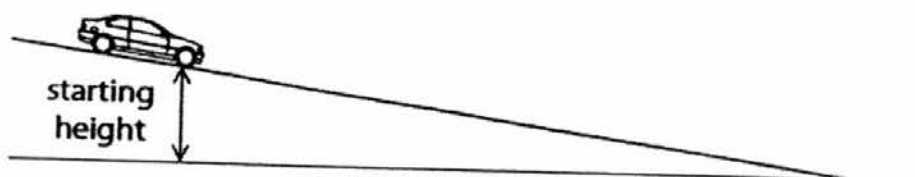


Figure A1

- a. Based on his hypothesis, state the [2]
- i. dependent variable;
.....
 - ii. independent variable;
.....
- b. State one control variable in the experiment. [1]
.....
- c. Briefly describe the steps the student should carry out in order to test his hypothesis. [2]
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- A2** A golf ball at rest on a rough surface is given a light push and it rolls in the direction shown in **Figure A2**.

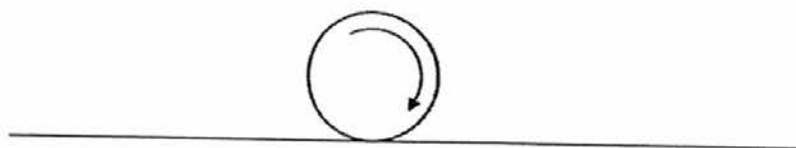


Figure A2

- On the diagram, **draw** and **label** one vertical force and one horizontal acting on the golf ball. [2]
- Explain why the golf ball comes to a stop eventually. [1]

.....

.....

- A3** Figure A3 shows an electric circuit and the conventional current flow.

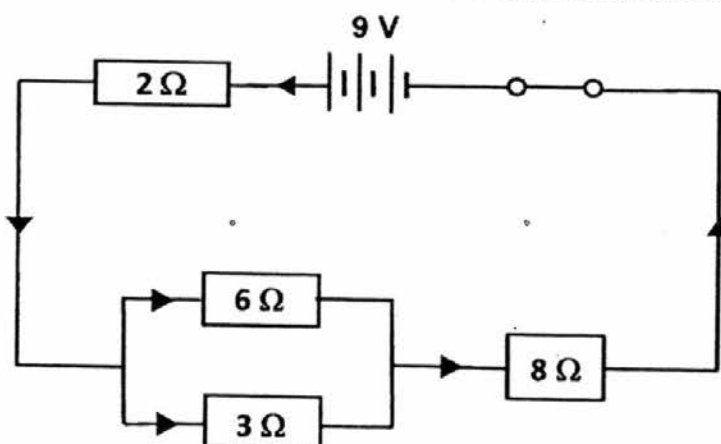


Figure A3

- Calculate the effective resistance of the circuit.

Effective resistance = [2]

- b. Calculate the potential difference across (i) $2\ \Omega$ resistor, and (ii) $8\ \Omega$ resistor.

i. Potential difference across $2\ \Omega$ resistor =

ii. Potential difference across $8\ \Omega$ resistor = [1]

- A4** The table below shows the number of protons, neutrons and electrons of five particles represented by the letters **L** to **P**. The particles are atoms or ions. The letters representing the particles are not the symbols of the elements.

Particle	Electrons	Protons	Neutrons
L	6	6	6
M	1	1	0
N	12	12	12
O	10	12	12
P	18	16	8

Use the letters **L** to **P** to answer the following questions.

- a. Which of the above particles is a metal? Use the electronic structure of the particle to support your answer. [2]

.....

- b. Particles **L** and **M** are involved in bonding to form a particle with the chemical formula of **LM₄**.

- i. Write down the electronic structure of particles **L** and **M** below. [1]

L:

M:

- ii. Hence, state the type of bonding between particles **L** and **M**, [2]
giving a reason for your choice.

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- A5** Peter was conducting an experiment using aqueous sulfuric acid and aqueous sodium hydroxide shown in **Figure A5** below. Both are colourless solutions.

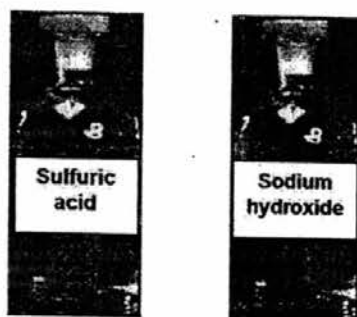


Figure A5

- a. Write down the chemical formula for the solutions. [2]
- i. Sulfuric acid :
- ii. Sodium hydroxide :
- b. Peter filled three beakers with sulfuric acid, sodium hydroxide and water respectively. However, he did not label the beakers and thus he had difficulty identifying the solutions as all of them are colourless.

Describe a simple test that Peter can conduct to identify the beaker containing sulfuric acid from the rest. [2]

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A6

Figure A6 below shows the cross-section of plant organs that are involved in the movement of substances in a green plant.

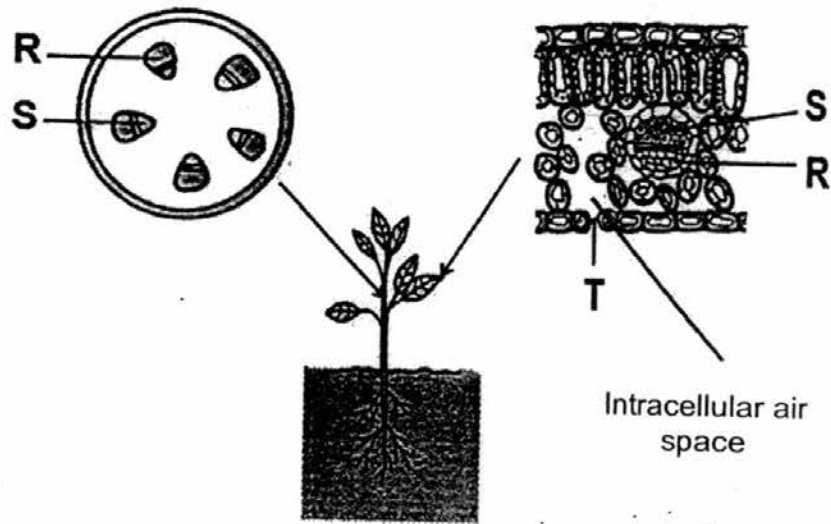


Figure A6

- a. Identify the parts labelled; [1]

R:

S:

- b. Identify T and name the cells that control the opening of T. [1]

.....

- c. State and define the process which is responsible for the movement of water molecules from the intracellular air space to the surrounding environment via T. [2]

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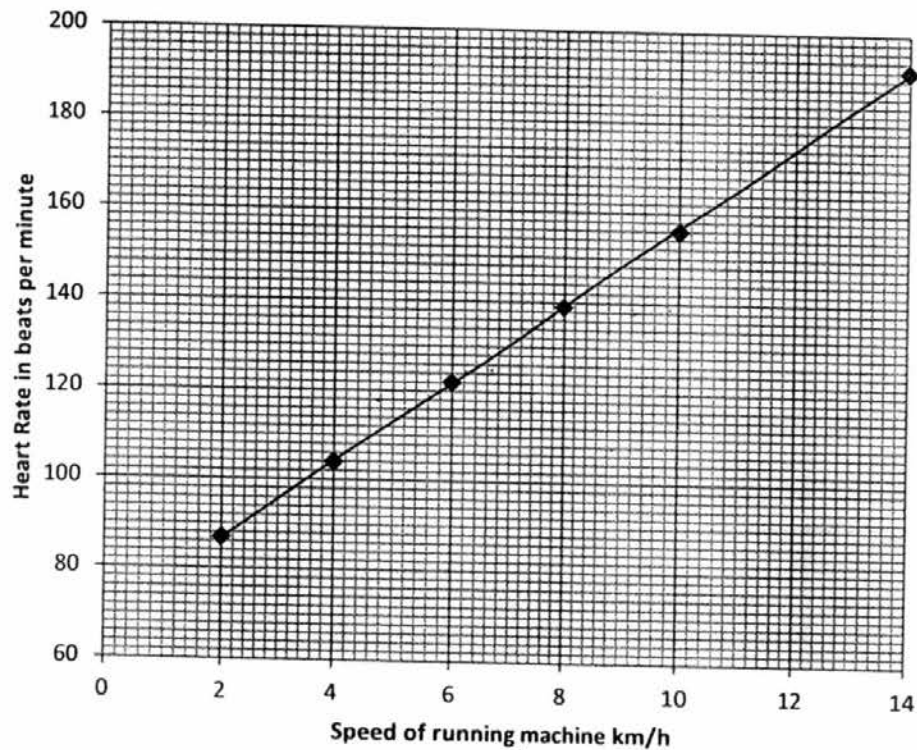
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A7

A scientist monitors the heart rate of an athlete exercising on a running machine. Results of her experiment are shown in the table and plotted graph below.

speed of running machine in km / h	2	4	6	8	10	14
heart rate in beats / minute	87	104	122	139	156	192



- a. Use your graph to state the heart rate of this athlete when he is running at a speed of 12 km / h. [1]

.....

- b. Use ideas about aerobic respiration to explain the shape of the graph. [3]

.....

.....

.....

.....

.....

c. The heart pumps blood around the body. This supplies oxygen for aerobic respiration in the body cells.

i. How is oxygen carried in the blood?

[1]

.....

ii Arteries are blood vessels that may carry oxygenated and deoxygenated blood. Name one artery that carries deoxygenated blood and explain why.

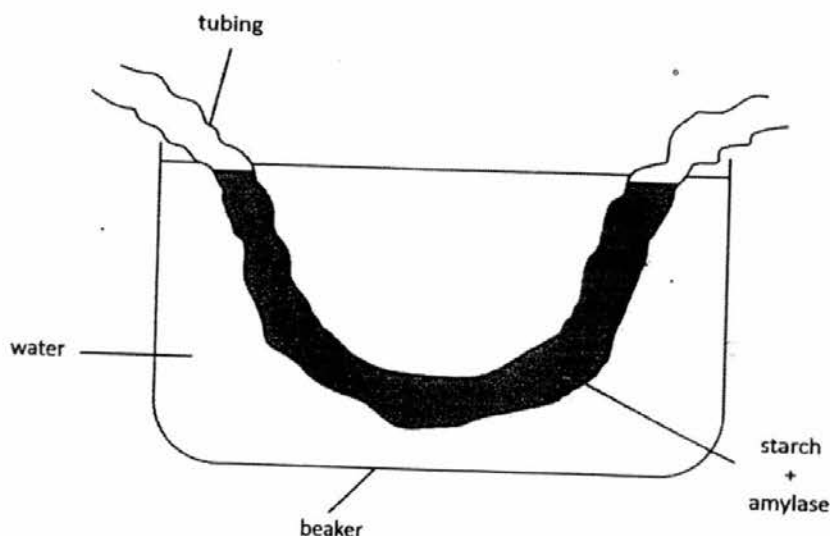
[2]

Name of artery:

Explanation:

.....

A8 Figure A8 shows a model of digestion and absorption in the alimentary canal. This model comprises of a beaker containing water. A tubing containing starch solution and amylase is immersed in the water. The tubing is permeable to water and sugars but not starch.



In this model, what represents,

a. the small intestine: [1]

b. the blood: [1]

c. the food: [1]

A9 The female reproductive system is shown in **Figure A9**.

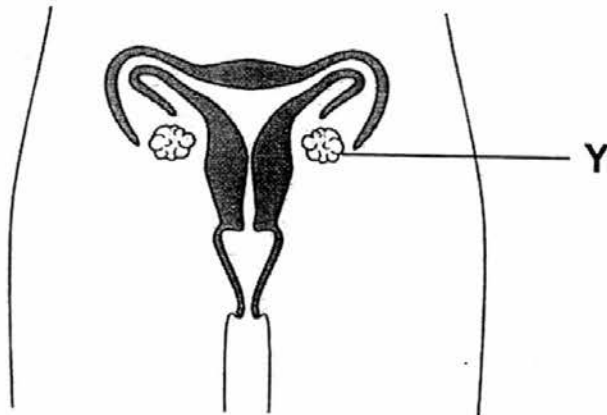


Figure A9

- a. On **Figure A9**, mark the oviducts with the letter **X**. [1]
- b. State the process that occurs at **Y**? [1]

.....

A10 **Figure A10** shows the number of adults with HIV/AIDS in sub-Saharan Africa between 1985 and 2005.

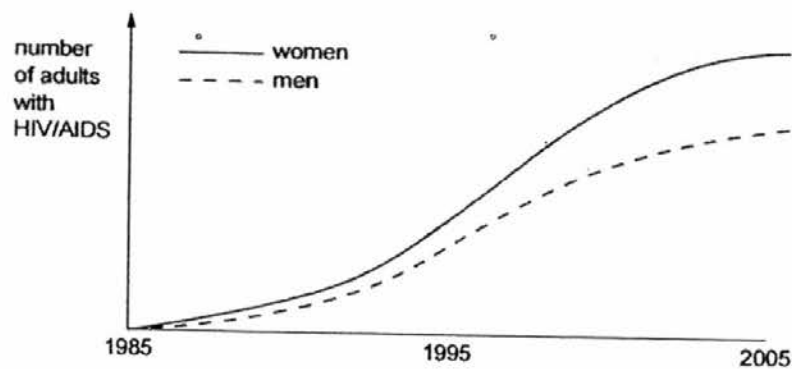


Figure A10

- a. State two trends shown by the graph. [2]

- i.
- ii.

b. Suggest two ways by which the spread of HIV/AIDS may be reduced. [2]

i.

.....

ii.

.....

Section B (30 marks)

Answer all question in the spaces provided on the question paper.

B1 Figures B1(i) and B1(ii) show a 3-pin fused plug and an exposed power cable.

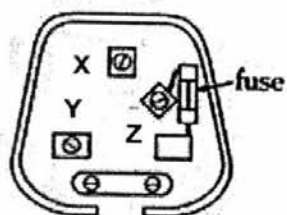


Figure B1(i)



Figure B1(ii)

a. Complete **Table B1** by:

[3]

- Using the letters **X**, **Y** and **Z** for the terminals, and
- Identifying the corresponding colour of the wires connected to the terminals.

Terminals of 3-pin plug	Terminals of 3-pin plug	Colour of wires
	Earth	
	Neutral	
	Live	

Table B1

b. What is the purpose of the earth wire?

[1]

.....

.....

.....

.....

- c. The 3-pin plug is connected to an electrical appliance which has an operating current of 8 A.

	Fuse 1	Fuse 2	Fuse 3
Current rating	8 A	10 A	13 A

Which of the following three fuses **1**, **2** or **3** shown above is most suitable to be used in the plug? Explain your choice. [1]

.....

.....

.....

- d. The power rating of the appliance is 90 W and it is switched on for 30 minutes each day.

- i. Calculate the amount of electrical energy, in kWh, used by the appliance in a week.

Electrical energy used by appliance in a week = [2]

- ii. Given that 1kWh costs 27 cents, calculate the cost of using the appliance for a month.

Cost of using the appliance = [1]

- e. Describe one electrical hazard in household electrical circuits. [2]

.....

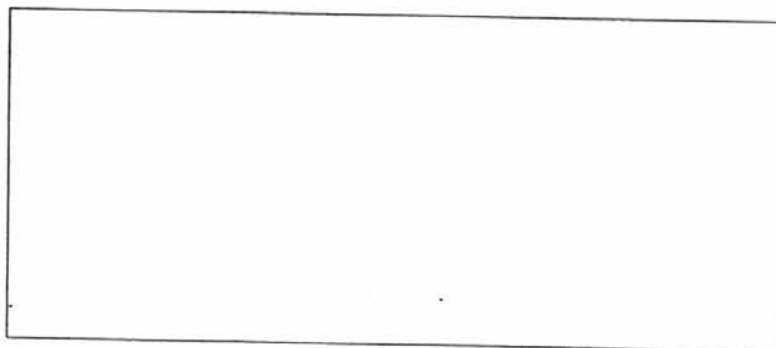
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B2 Since the beginning of the industrial revolution in the early 1800s, fossil fuel-powered machines have driven an unprecedented burst of human industry and advancement. The unfortunate consequence, however, has been the emission of billions of tonnes of carbon dioxide and other greenhouse gases into Earth's atmosphere.

- a. Draw a dot and cross diagram of a carbon dioxide molecule showing only valence electrons in the space provided below. [2]



- b. Carbon dioxide in the atmosphere can be absorbed by the ocean water. This helps to reduce the amount of carbon dioxide in the air. When carbon dioxide dissolved in the ocean, it reacts with water according to the flow chart shown in **Figure B2b(i)**.

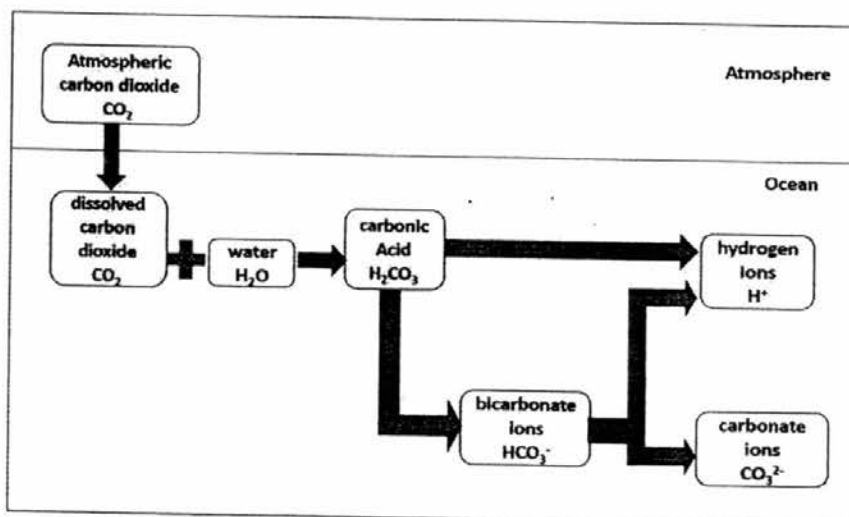


Figure B2b(i)

Figure B2b(ii) below shows how the concentration of carbon dioxide affects the acidity of the ocean water.

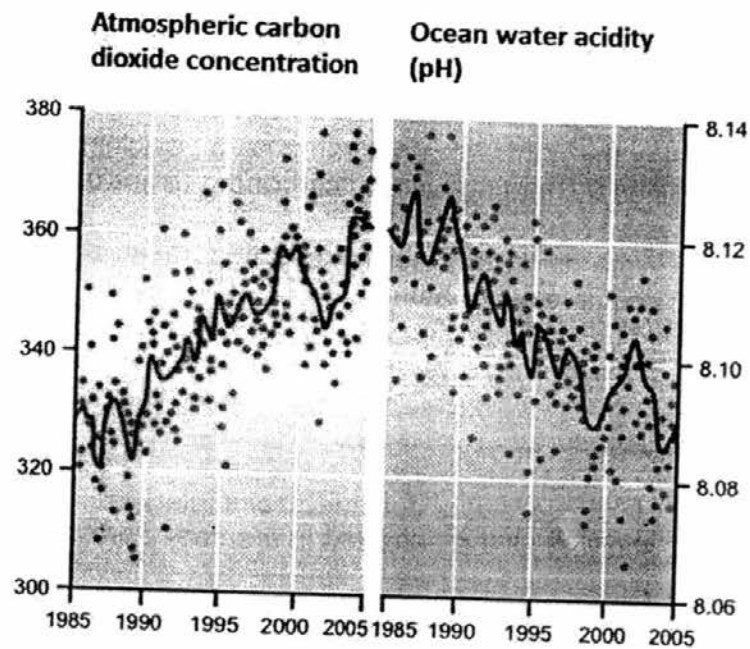


Figure B2b(ii)

- i. Explain in terms of hydrogen ions, why there is a general decrease in ocean pH from 1985 to 2005. [2]

.....

.....

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.....

- ii. The key component in the shells and skeletons of many marine species is calcium carbonate (CaCO_3). Laboratory studies were made on a marine species pteropod's shell. The shell when placed in sea water with pH levels projected for the year 2100, slowly dissolves after 45 days.

Explain why the pteropod's shell dissolve in the sea water. [1]

.....

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.....

- c. Scientists say they have found a workable way of reducing carbon dioxide levels in the atmosphere by adding lime to seawater. And they think it has the potential to dramatically reverse carbon dioxide accumulation in the atmosphere. (Cath O'Driscoll in *SCI's Chemistry & Industry magazine*)

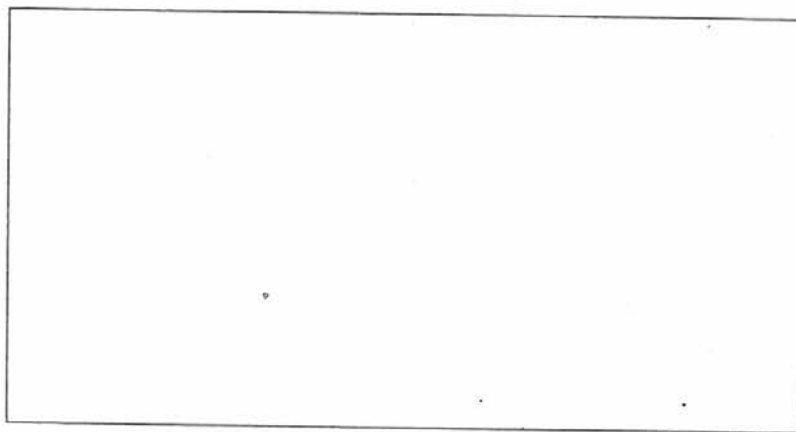
Lime is the name of a natural mineral, calcium oxide. It can be obtained by heating calcium carbonate (limestone).

- i. Write down the electronic configuration of a calcium atom and an oxygen atom. [1]

Calcium:

Oxygen:

- ii. Hence, draw a dot and cross diagram of calcium oxide showing all the electrons in the space provided below. [2]



- iii. Describe with the help of a word equation, how lime (calcium oxide) can help reduce the ocean's acidity (carbonic acid). [1]

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- iv. Suggest another way to help reduce the ocean's acidity level. [1]

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- B3** a. **Figure B3a** below shows the various organs in the human digestive system.

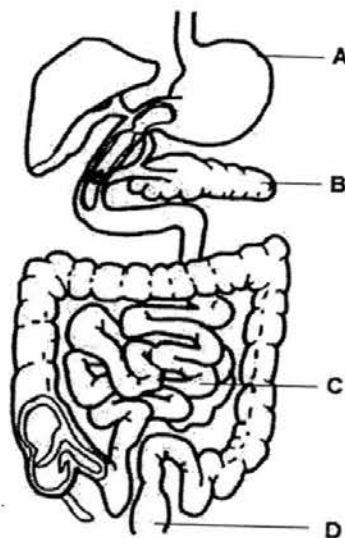


Figure B3a

- i. Identify the following parts. [2]

A: C:

B: D:
- ii. Amylase is an enzyme that helps digest carbohydrates. [1]

Name the two organs where amylase is produced.

.....

.....
- iii. Give the word equation for any one of the enzymatic action [1]

named in (a)(ii).

.....

.....

- b. Enzymes are affected by changes in pH. In general, enzymes have an optimum pH.

However, the optimum is not the same for each enzyme. The following procedure demonstrates the effect of pH on the activity of the enzyme trypsin.

1. 10 ml of a protein solution is added to each of five numbered test tubes.
2. The pH of each of the test tubes is maintained.
3. An equal mass of trypsin solution is added to each test tube.
4. The temperature is kept constant at 37°C.
5. The results are recorded at the end of the three hours in the table below.

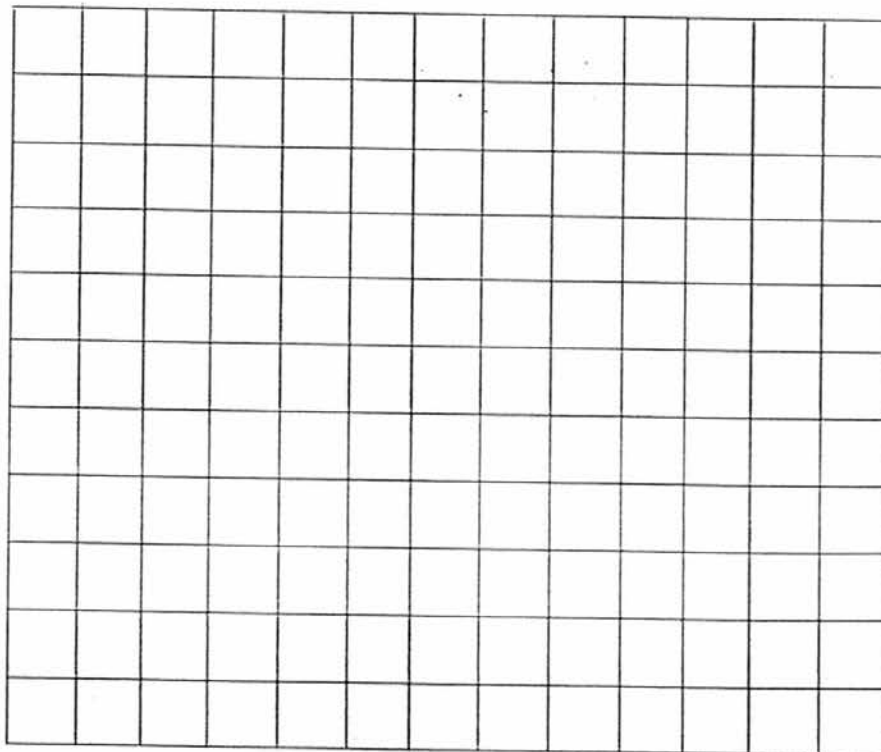
Test Tube	pH	Mass of Product / g
1	2.0	0.3
2	3.5	0.8
3	7.0	1.7
4	8.5	3.5
5	10.0	2.1

- i. Using the data from the table, draw a line graph of the "Mass of Product vs. pH" (plot the pH on the x-axis). [3]

Scale

X-axis: use 1 square = 1 unit

Y-axis: use 1 square = 0.5 gram



- ii. Explain why a smaller mass of product is found in test tubes 1 and 2 than in others. [2]

.....

.....

.....

.....

- iii. Describe the relationship between pH and the mass of product formed. [1]

.....

.....

End of paper

Answers to LSS Sec 2 – Paper 2

End-of-Year Examination 2016



Section A

A1	a.	Based on his hypothesis, state the		[2]
		i.	dependent variable; Time taken	
	ii.	independent variable. Weight of toy car		
	b.	Control variable		
		Height from which toy car is released/slope used/gradient of slope		
	c.	Briefly describe the steps the student should carry out in order to test his hypothesis.		[2]
		Measure weight of toy car Release toy car from fixed point Record time taken to reach fixed point at the bottom of slope [Calculate speed using distance/time if dependent variable is speed] Repeat using toy car of different weight		

A2	A golf ball is given a light push and it rolls in the direction shown in the diagram.			
	(a) On the diagram, draw and label two forces acting on the golf ball.			[2]
	(b) Explain why the golf ball comes to a stop eventually.			[1]
	Kinetic energy of the ball is converted to heat and sound due to friction therefore the ball stops eventually.			

A3	(a)	$\frac{1}{R} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$ $R = 2 \Omega$ $\therefore \text{effective resistance, } R_{\text{total}} = 2 + 2 + 8 = 12 \Omega$	[2]
	(b)	$I_1 = \frac{\varepsilon}{R_{\text{total}}} = \frac{9}{12} = 0.75 \text{ A}$	[2]
	(i)	$\therefore \text{potential difference across } 2 \text{ ohm resistor} = 0.75 \times 2 = 1.5 \text{ V}$	
	(ii)	$\therefore \text{potential difference across } 8 \text{ ohm resistor} = 0.75 \times 8 = 6 \text{ V}$	

(c)	$I_2 = \frac{9 - 6 - 1.5}{6} = 0.25 \text{ A}$	
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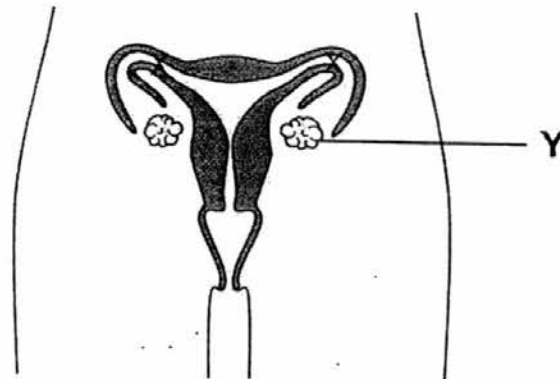
A4	a.	Particle N is a metal because N's electronic structure is 2,8,1. It has 1 valence electron thus it is in group I in the periodic table / it will form a cation of 1+ charge.	[2]
	b.	i. L : 2,4 M : 1	[1]
		ii. Covalent bonding. One atom of L shares its four valence electrons with four atoms of M forming four single L-M bonds to reach stable octet electronic configuration.	[2]

A5	a.	Sulfuric acid : H_2SO_4 Sodium hydroxide : NaOH	[2]
	b.	Add a few drops of universal indicator /methyl orange to each beaker separately. If it is sulfuric acid, universal indicator will turn from green to red (UI) /orange to red (methyl orange). Or dip both red and blue litmus paper into each of the beakers. If it is sulfuric acid, it will turn from blue litmus red. Or add some calcium carbonate into each of the beakers. There will be effervescence observed in the beaker with sulfuric acid	[2]

A6	a.	R Phloem S Xylem	[1]
	b.	Stoma. The guard cells control the opening are of T.	[1]
	c.	Transpiration. The process whereby plants lose water through evaporation from aerial parts of the plant (mainly the stomata of leaves)	[2]

A7	a.	read +/- one small square from graph (expect 174)	[1]
	b.	at higher speed muscles are used more / more active / contract more frequently; respiration rate increases so more oxygen / oxygenated blood needed; heart rate increases to supply more oxygen / oxygenated blood	[2]
	c.	i. It is carried by haemoglobin in red blood cells	[1]
		ii. Pulmonary artery. Blood coming from the head and the rest of the body is deoxygenated.	[2]

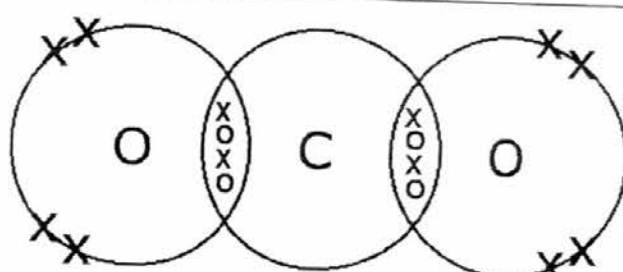
A8		In this model, what represents,	
	a.	tubing	[1]
	b.	water	[1]
	c.	Starch (do not accept starch and amylase)	[1]

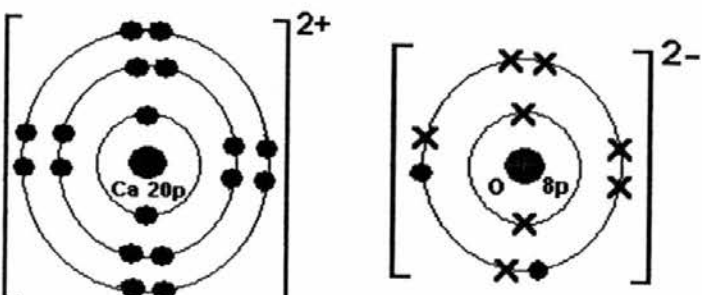
A9	The female reproductive system is shown in Figure A9.		
			
Figure A9			
a.	On Figure A9, mark the oviducts with the letter X.		[1]
b.	State and explain briefly the process that occurs at Y?		[1]
	Ovulation.		

A10	a.	State two trends shown by the graph.	[2]
		Any two of the following: i. number of affected people increasing ii. fastest increase in 1990s any 3 iii. rate of increase slows (after 1998) iv. more women affected than men	
	b.	Suggest two ways by which the spread of HIV/AIDS may be reduced.	[2]
		Any two of following: i. education / make people aware ii. Don't share needles iii. use of condoms iv. fewer sexual partners / abstinence	

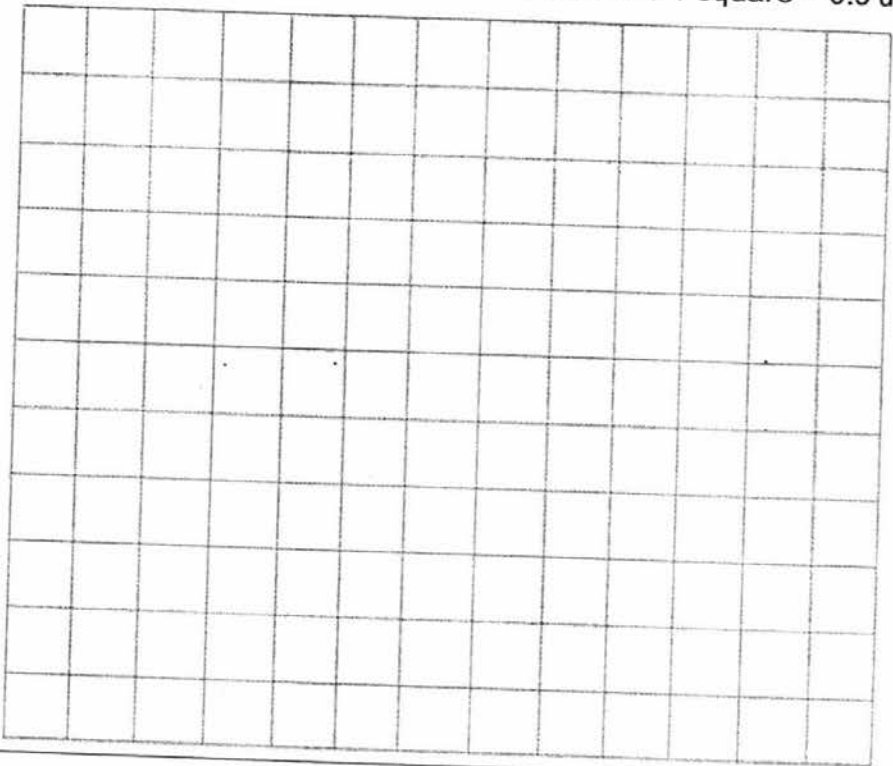
Section B

B1	(a)	<table border="1"> <thead> <tr> <th>Terminals of fused plug</th> <th>Wires of power cable</th> <th>Colour codes of wires in power cable</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Earth</td> <td>green/yellow</td> </tr> <tr> <td>Y</td> <td>Neutral</td> <td>blue</td> </tr> <tr> <td>Z</td> <td>Live</td> <td>brown</td> </tr> </tbody> </table>	Terminals of fused plug	Wires of power cable	Colour codes of wires in power cable	X	Earth	green/yellow	Y	Neutral	blue	Z	Live	brown	[3]
	Terminals of fused plug	Wires of power cable	Colour codes of wires in power cable												
	X	Earth	green/yellow												
	Y	Neutral	blue												
	Z	Live	brown												
		[1/2 mark for each correct answer]													
	(b)	The purpose of the earth wire is to <u>divert excess current flowing on the external metal parts</u> of appliance to the ground/electrical socket, if the <u>live wire touches the metal case</u> . This is so that the <u>user will not get an electric shock</u> .	[1]												
	(c)	10 A. Fuse value chosen should be slightly higher than rated current. This ensures that the current is cut off as soon as a fault develops in the appliance. [idea that current may increase to a value that causes appliance to be damaged if not cut once fault develops]	[1]												
	(d)	(i) $E = 0.09 \text{ kW} \times \frac{1}{2} \text{ h} \times 7 \text{ days} = 0.315 \text{ kWh}$ [1m for correct conversion of W to kW and minutes to hours] (ii) $\text{cost} = 0.315 \text{ kWh} \times 27 \text{ cents per kWh} \times 4 = 34.0 \text{ cents}$ allow ecf	[3]												
	(e)	Any one of the following: - Worn insulation – may cause electric shock if user comes into contact with bare live wire - Overloading – may cause overheating and electrical fires if current is too high - Damp conditions – result in short circuit and electric shocks if user with damp hands handle electrical appliances	[2]												

B2	a.	i.		[2]
		ii.	When carbon dioxide dissolves in the ocean, it forms carbonic acid which ionizes (partially) to produce hydrogen ions. This increases the total concentration of hydrogen ions in the ocean decreases the pH value.	[2]

		iii.	The calcium carbonate in the shell reacts with the acid / hydrogen ions present in the ocean to form salt, carbon dioxide and water.	[1]
	b.	i.	Ca (2,8,8,2) O (2,6)	[1]
		ii.		[2]
		iii.	Calcium oxide + carbonic acid → calcium carbonate + water	[1]
		iv.	By reducing the emission of carbon dioxide / using energy efficiently and conserving energy so that less energy is produced by burning fossil fuel which will produce carbon dioxide.	[1]

B3	a.	i	A Stomach B Pancreas C Small intestine D Rectum	[2]
		ii	Mouth. Pancreas	[1]
		iii	Starch – Salivary amylase → maltose , <u>or</u> Starch – Pancreatic amylase → maltose	[1]

	b.	i	Using the data from the table, draw a line graph of the "Amount of Product vs. pH" (plot the pH on the x-axis). Axis + Plotting + Line	[3]
			Scale X-axis: use 1 square = 1 unit Y-axis: use 1 square = 0.5 unit 	
		ii	Less products are found in test tubes 1 and 2 than in the others as these tubes are placed in an acidic environment. Trypsin which is found in the small intestine works best in an alkaline condition and thus more products are found in the other tubes.	[2]
		iii	The amount of product formed increases from an acidic condition (low pH) till an alkaline condition (higher pH).	[1]