

Analysis

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Biology

Chapter		2006						2007						2008						2009						2010							
		P1		P 2		P 3		P 1		P 2		P 3		P1		P 2		P 3		P 1		P 2		P 3		P 1		P 2		P 3			
		O	A	B	C	Q1	Q2	O	A	B	C	Q1	Q2	O	A	B/C	Q1	Q2	O	A	B/C	Q1	Q2	O	A	B/C	Q1	Q2	O	A	B/C	Q1	Q2
	1. Introduction to Biology																																
F	2. Cell Struc. and Cell Org.	2	1					4						2	1				2	0.5					4	1							
O	3. Movement of Sbst acr Pl. Mbr	4		1			1	2	1					3		1		1	5	0.5					3	1							
R	4. Chemical Comp. of the Cell	2				1		3						3					3				1	2	1								
M	5. Cell Division	3						3	1					2	1				2					1	0.5								
	6. Nutrition	4	1	1	1			8				1		8		1			7		1	1		6		1							
4	7. Respiration	2						3		1			1	3					6	1				5				1					
	8. Dynamic Ecosystem	4						5		1				3			1		3		1			5								1	
	9. Endangered Ecosystem	2						3		1				3		1			4					2		1							
No. of question for Form 4		23	2	2	1	1	1	31	2	3		1	1	27	2	3	1	1	32	2	2	1	1	28	3.5	2	1	1					
F	10. Transport	6			1			4						5		1			5		1			3		1							
O	11. Locomotion and Support	3							1					5					1	1				1	1								
R	12. Coordination and Response	5	1					6	1	1				4	1				5					4		1							
M	13. Reproduction & Growth	5	1					5						5	1				5	1.5				8									
	14. Inheritance	5	1					2	1					2	1				1		1			3									
5	15. Variation	3						2						2					1	0.5				3	0.5								
No. of question for Form 5		27	3	0	1	0	0	19	3	1		0	0	23	3	1	0	0	18	3	2	0	0	22	1.5	2	0	0					
TOTAL		50	5	2	2	1	1	50	5	4		1	1	50	5	4	1	1	50	5	4	1	1	50	5	4	1	1					



Biology Paper 1

[4551/1]

1. Diagram 1 shows an animal cell.

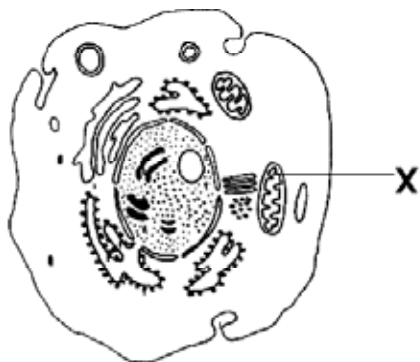


Diagram 1

What is organelle X?

- A Nucleus
- B Chloroplast
- C Mitochondrion
- D Golgi body

2. Which of the following have the highest density of mitochondria?

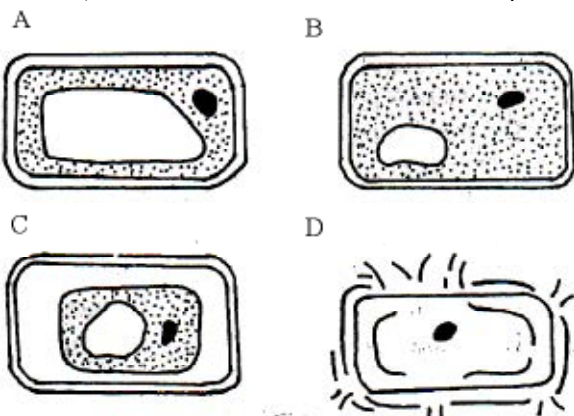
- A Heart
- B Biceps
- C Brain
- D Kidney

3. A cell is immersed in distilled water for 10 minutes. It is then taken out and immersed in 20 % sucrose solution. Table 1 shows the observed condition of the cell.

Type of solution	Distilled water	20% sucrose solution
Condition of cell		

Table 1

If the cell is put back into the distilled water for another 10 minutes, which condition of the cell would be expected?



4. Diagram 2 shows the movement of molecule X across the plasma membrane through process Y.

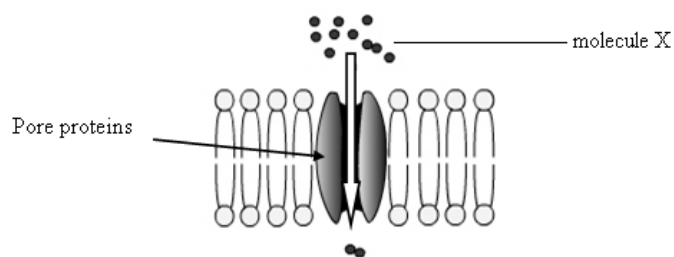


Diagram 2

What is process Y?

- A Osmosis
- B Simple diffusion
- C Active transport
- D Passive transport

5. Diagram 3 shows a visking tubing filled with 20 % sucrose solution immersed in distilled water for 30 minutes.

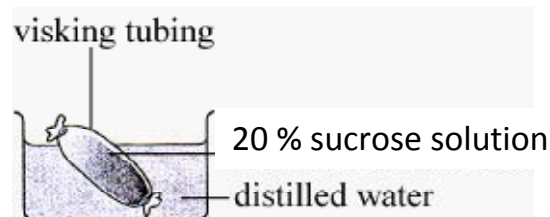


Diagram 3

What happens after 30 minutes?

- A Water goes into the visking tubing.
- B Water flows out of the visking tubing.
- C The visking tubing decreases in weight.
- D The visking tubing is flaccid.

6. Diagram 4 is a graph which shows the relationship between the rate of reaction and the substrate concentration when factor P is varied.

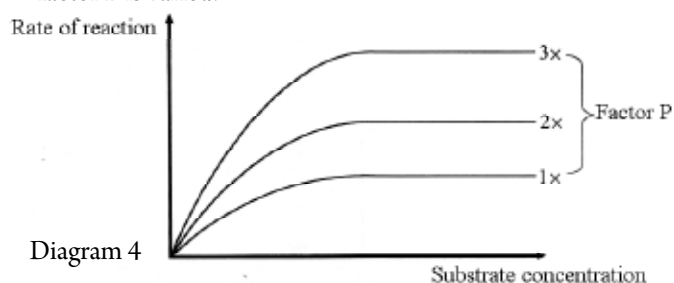


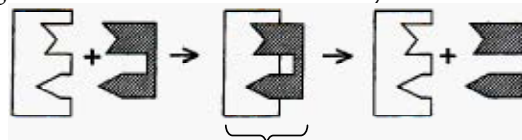
Diagram 4

What is factor P?

- A pH
- B Time
- C Inhibitor
- D Enzyme concentration



7. Diagram 5 shows the mechanism of enzyme action.



Enzyme-substrate complex

Diagram 5

The name of the above mechanism is

- A Enzyme-substrate mechanism
- B Enzyme-substrate hypothesis
- C Lock and key hypothesis
- D Lock and key mechanism

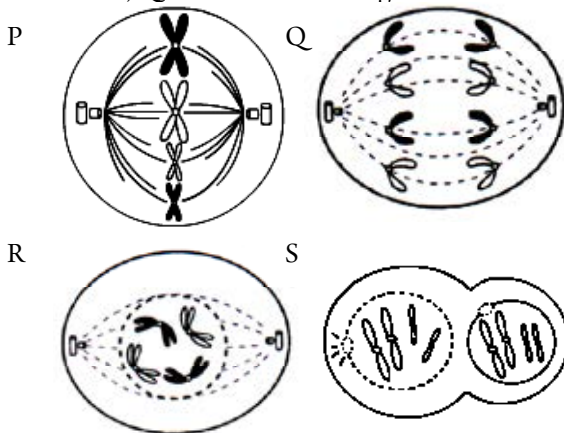
8. The following information shows protein molecules undergoing process Y.

Protein $\xrightarrow{\text{Process Y}}$ polypeptides $\xrightarrow{\text{Process Y}}$ peptides $\xrightarrow{\text{Process Y}}$ amino acids

What is process Y?

- A Photosynthesis
- B Polymerization
- C Condensation
- D Hydrolysis

9. Processes P, Q, R and S occur during mitosis in a cell.



Which of the following shows the correct sequence for mitosis?

- A P → Q → R → S
- B S → R → Q → P
- C R → P → Q → S
- D R → Q → P → S

10. The chromosomal number of a chicken is 78. If one of the homologous chromosome pairs does not separate during Meiosis I, how many chromosomes can be found in the gametes?

- A 39
- B 37
- C 77
- D 38

11. Diagram 6 shows part of the human digestive system.

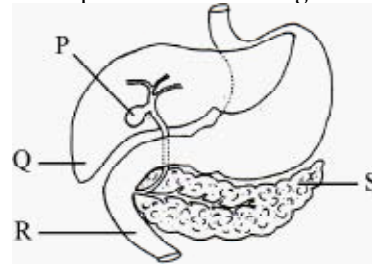


Diagram 6

Which of the following enzyme is secreted by organ S?

- A Erepsin
- B Pepsin
- C Rennin
- D Trypsin

12. The table below shows the result of an experiment to determine the content of vitamin C in pineapple juice.

Sample	Volume required to decolourise 1.0 cm of 0.1% DCPIP solution
0.1% Ascorbic acid	0.5
Pineapple juice	1.5

What is the amount of vitamin C in the pineapple juice?

- A 3.3 mg/cm³
- B 0.4 mg/cm³
- C 0.3 mg/cm³
- D 5.0 mg/cm³

13. As a doctor you have confirmed that a patient is suffering from disease of the bile duct. The patient's bile duct was removed by surgery. Which of the following type of food has to be reduced by the person?

- A Butter
- B Bread
- C Papaya
- D Biscuit

14. Diagram 7 shows the cross-section of a dicotyledonous leaf.

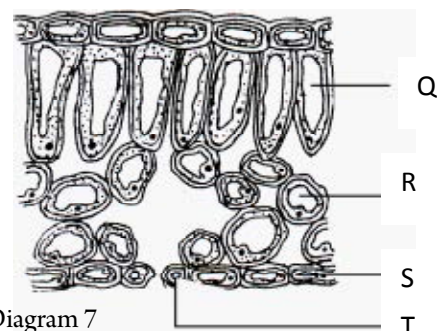


Diagram 7

Photosynthesis takes place in

- A Q and R only.
- B Q and S only.
- C Q, R and T only.
- D Q, R and S only.



15. Diagram 8 shows the rate of enzyme hydrolysis reactions, W and X, in the human body.

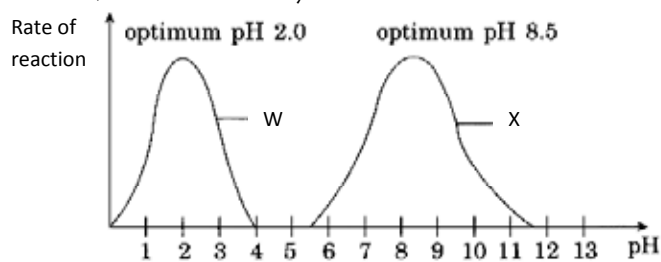


Diagram 8

Which of the following is true about enzymes W and X?

	Enzyme W	Enzyme X
A	W is trypsin	X is lipase
B	The active site changes at pH more than 4	The active site changes at pH more than 7
C	Secreted in the stomach	Secreted in the duodenum
D	Synthesized in the rough endoplasmic reticulum	Synthesized in the smooth endoplasmic reticulum

16. Diagram 9 shows one of the levels of protein structures.

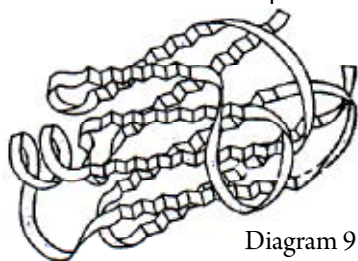


Diagram 9

An example of a protein having the above protein structure is

- A silk
- B keratin
- C hormone
- D haemoglobin

17. Diagram 10 shows the respiratory system of a cockroach.

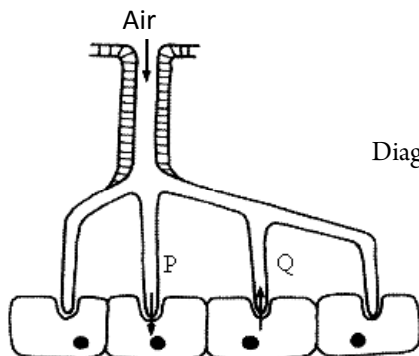


Diagram 10

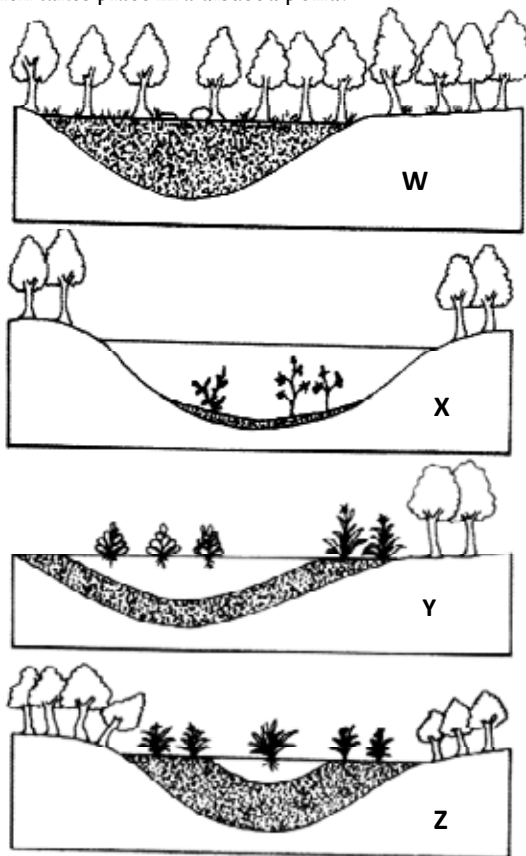
What process occurs at P and Q during gaseous exchange of the insect?

- A Simple diffusion
- B Osmosis
- C Facilitated diffusion
- D Active transport

18. The haemoglobin content of a pregnant mother is low. Which food should be taken to increase the haemoglobin content in her blood?

- A Papaya
- B Broccoli
- C Cucumber
- D Tomatoes

19. Diagram 11 shows a process of colonization and succession which takes place in a disused pond.



Arrange the diagram in the correct sequence.

- A W → X → Y → Z
- B X → Y → Z → W
- C X → Y → W → Z
- D Y → Z → W → X

20. The table below shows the result of a study on the population of garden snails in a garden.

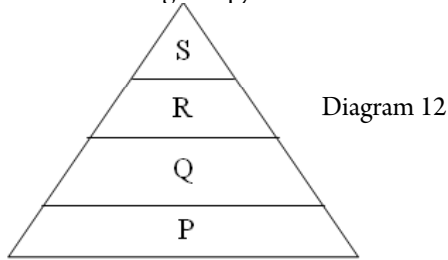
Number of garden snails		
	Marked	Unmarked
First capture	100	
Second capture (After a week)	40	60

The estimated population size of the garden snail is

- A 200
- B 250
- C 300
- D 350



21. Diagram 12 shows a food guide pyramid.



Which level of food needs to be taken the least?

- A P
- B Q
- C R
- D S

22. Diagram 13 shows the distribution of mangroves at a river mouth.

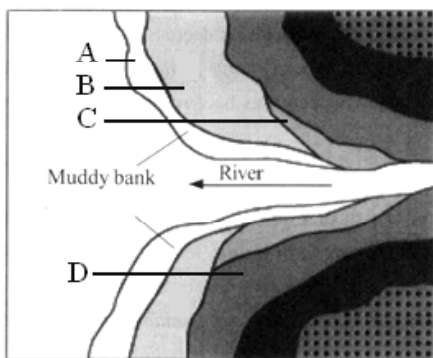


Diagram 13

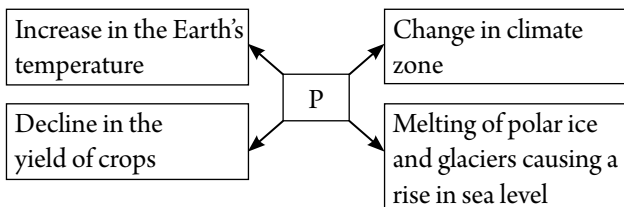
Which zone is colonized by *Avicennia* sp.?

- A Zone A
- B Zone B
- C Zone C
- D Zone D

23. The sample of water in a lake shows a low BOD level. Which of the following statement best describe the situation?

- A Pollution by untreated waste
- B An increase in the temperature of the lake.
- C The high amount of dissolve oxygen in the lake.
- D A decrease activity of microorganism in the lake

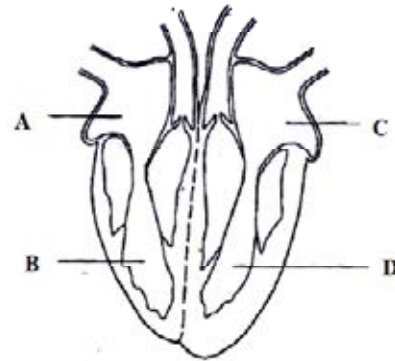
24. Diagram 14 shows the impacts of phenomenon P.



What is phenomenon P?

- A Greenhouse effect
- B Ozone depletion
- C Thermal pollution
- D Global warming

25. Diagram 15 shows a cross section of the human heart.



Which of the labelled parts A, B, C and D pumps blood to all parts of the body?

26. Diagram 16 shows a type of human activity.



Why should this activity be stopped?

- A Causes air pollution
- B Causes soil erosion
- C Causes eutrophication
- D Causes thinning of the ozone

27. Diagram 17 shows a stage in the blood clotting mechanism.

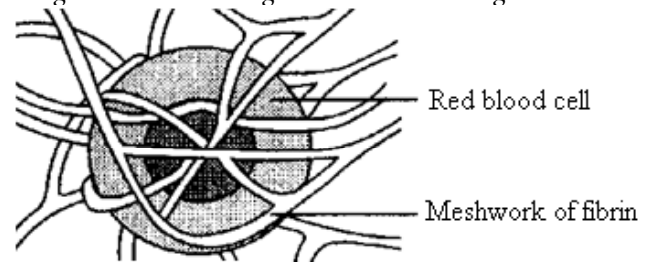


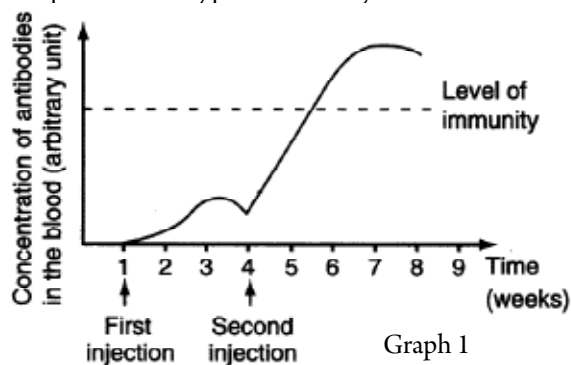
Diagram 17

Which of the following statement explains this stage?

- A Thrombokinas converts prothrombin to thrombin
- B Thrombin converts fibrinogen to meshwork of fibrin.
- C Platelets stimulate the formation of meshwork of fibrin.
- D Platelets release the thrombokinas to form meshwork of fibrin.



28. Graph 1 shows a type of immunity.



Which of the following statements is true about the graph?

- A Both injections contain serum that can raise antibody level.
- B Second injection is required to boost the level of immunity.
- C Both injections contain pathogen which control production of antibody.
- D Second injection contains higher level of antibody.

29. A young plant has all its root hairs removed.
The rate of transpiration of the plant drops

Which of the following statement correctly explain the condition?

- A Reduce surface area for absorption of water.
- B Reduce rate of water transport
- C Reduce rate of evaporation.
- D Reduce capillary action.

30. Which combination will give the highest rate of transpiration in a plant?

Environmental Factor			
	Temperature	Relative Humidity	Light Intensity
A	High	Low	High
B	High	High	Low
C	High	High	High
D	High	Low	Low

31. Which type of immunity is obtained through injection with a vaccine?

- A Passive artificial immunity
- B Passive natural immunity
- C Active artificial acquired immunity
- D Active natural acquired immunity

32. Diagram 18 shows some bones of a human.

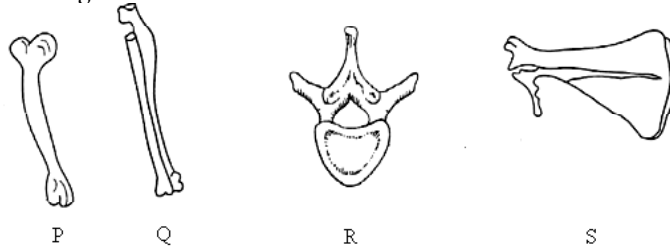


Diagram 18

Which of the following forms a ball and socket joint?

- A P and R
- B Q and R
- C P and S
- D Q and S

33. Diagram 19 shows an aquatic plant.

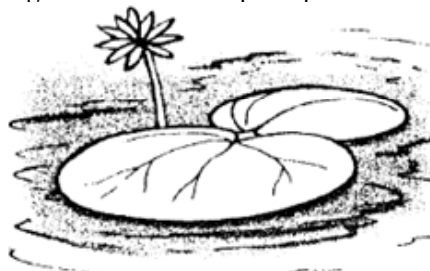


Diagram 19

How can the plant shown in Diagram 19 float?

- A It has a big flower
- B The stem has many thorns
- C The stem has a lot of xylem tissues
- D The stem and leaves have a lot of air sacs

34. Diagram 20 shows a ball and socket joint. Which of the following parts labelled A, B, C or D is tough and elastic?

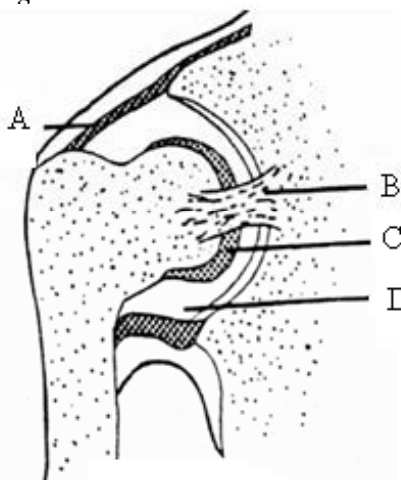


Diagram 20



35. Which of the following shows the correct arrangement of the vertebrae in the spine from the neck downwards?

- A Cervical vertebra → Lumbar vertebra → Thoracic vertebra → Sacrum → Coccyx.
- B Cervical vertebra → Thoracic vertebra → Lumbar vertebra → Sacrum → Coccyx.
- C Coccyx → Sacrum → Thoracic vertebra → Lumbar vertebra → Cervical vertebra.
- D Thoracic vertebra → Lumbar vertebra → Sacrum → Cervical vertebra → Coccyx.

36. Diagram 21 shows the pathways of nerve impulses in the hand withdrawal reflex when we touched a hot pan.

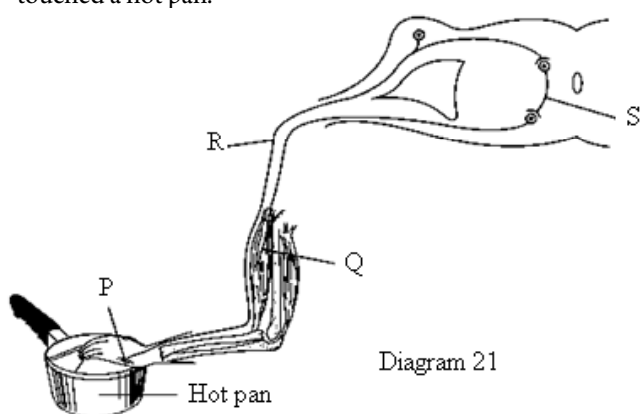


Diagram 21

Which of the following shows the correct sequence for the above reflex action?

- A P → Q → R → S
- B P → R → S → Q
- C Q → R → S → P
- D Q → S → R → P

37. Diagram 22 shows the different endocrine glands in a human. Which gland labelled A, B, C or D produces hormone that prepares the body for stressful situations?

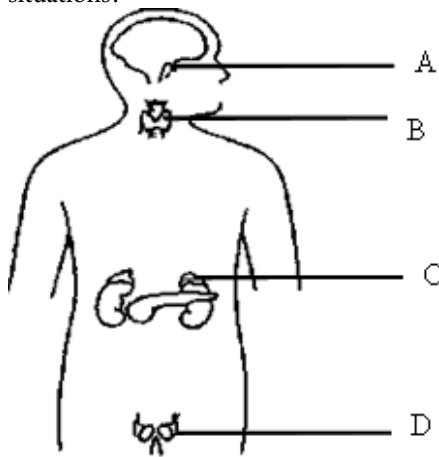


Diagram 22

38. Diagram 23 shows a straightened leg.

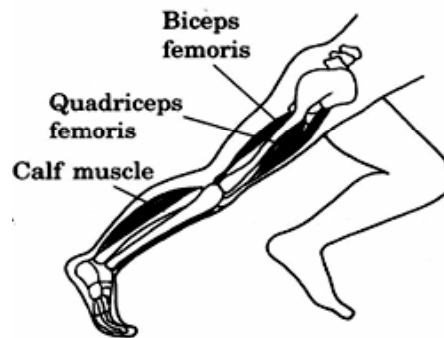
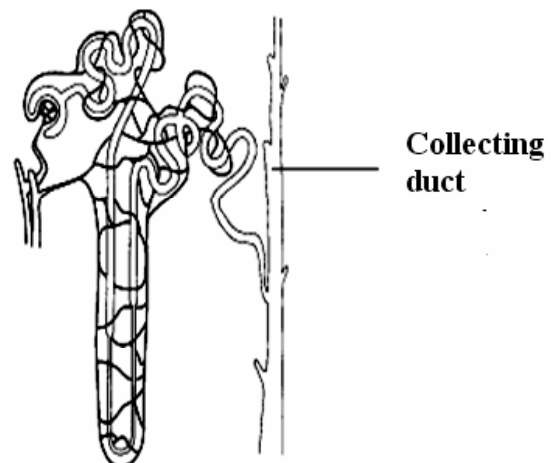


Diagram 23

Which of the following muscle actions will bend the leg?

	Quadriceps femoris	Biceps femoris
A	Contracts	Contracts
B	Contracts	Relaxes
C	Relaxes	Relaxes
D	Relaxes	Contracts

39. Diagram 24 shows the structure of a nephron.



Which of the following may occur to the collecting duct if more antidiuretic hormone (ADH) is released by the pituitary gland?

- A Collecting duct is more permeable, more urine is produced but in a dilute form
- B Collecting duct is more permeable, less urine is produced but concentrated
- C Collecting duct is less permeable, more urine is produced but in a dilute form
- D Collecting duct is less permeable, less urine is produced but concentrated



40. Diagram 25 shows part of a flower at one stage during reproduction.

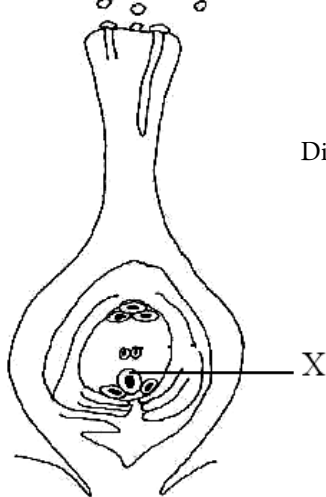
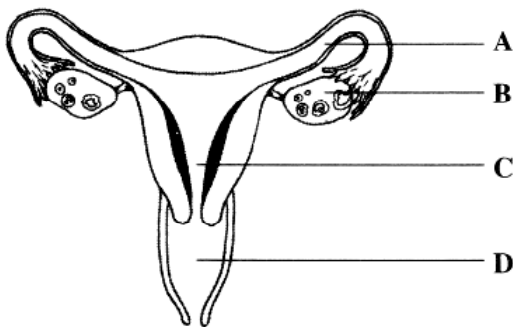


Diagram 25

Which of the following is structure X?

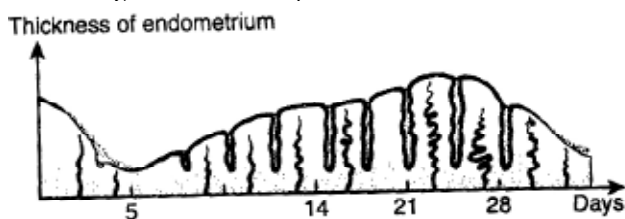
- A. Polar nuclei C. Synergid cell
 B. Egg cell D. Antipodal cell

41. Diagram 26 shows the female reproductive system.



Which of the parts, A, B, C or D is the place where fertilisation occurs?

42. Diagram 27 shows the changes in the thickness of the uterus wall during the menstrual cycle.



On which day can an ovum most likely be fertilized by a sperm?

- A 5
 B 14
 C 21
 D 28

43. The following statements are about hormone X.

- Produced by corpus luteum and placenta
- Promotes growth of endometrium and prevents menstruation.

What is hormone X?

- A Oestrogen
 B Progesterone
 C Luteinising hormone
 D Follicle stimulating hormone

44. Diagram 28 shows the stages in the development of follicle in the ovary of human.

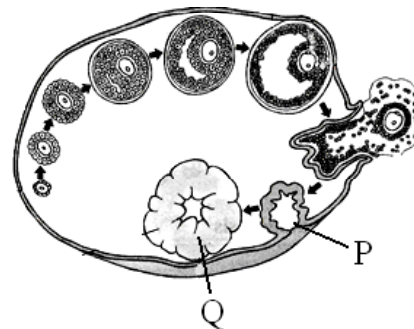


Diagram 28

What is the effect to the uterine wall when P develops into Q?

- A It is repaired C It thickens
 B It breaks down D Its thickness is maintained

45. Diagram 29 below shows two identical twins. However, their weight and body size is different

Which factor causes the differences in the characteristics?

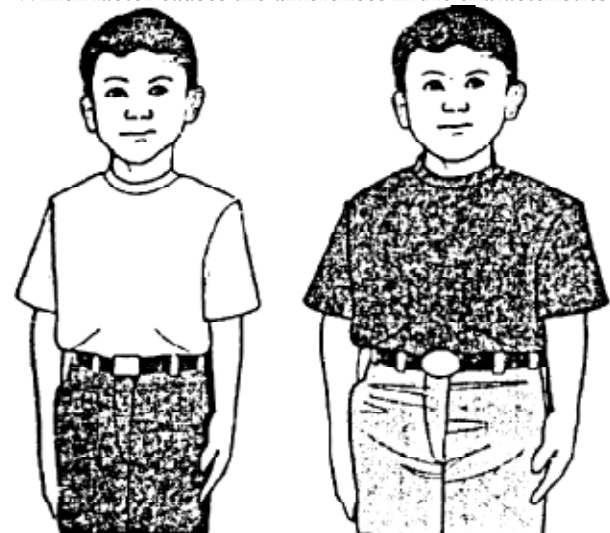
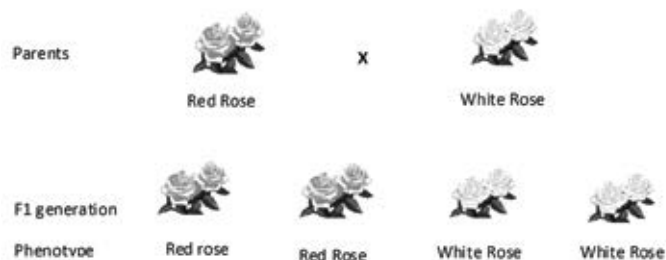


Diagram 28

- A mutation
 B genetic factors
 C environmental factors
 D genetic and environmental factors



46. Diagram 30 shows a red rose plant crossed with a white rose plant. The F1 generations produced are two red rose plants and two white rose plants. The allele for red rose plant, R is dominant to white rose plant, r.



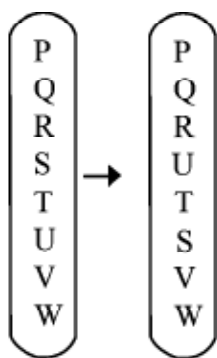
What is the genotype of the parents?

	Red Rose	White Rose
A	RR	Rr
B	Rr	Rr
C	Rr	rr
D	RR	rr

47. Zainal has blood group B and his sister, Zarina has blood group A. What are the possible blood groups of their parents?

	Father	Mother
A	AB	AB
B	AA	BB
C	AA	BO
D	BO	BO

48. What type of chromosomal mutation is shown in Diagram 31?



- A Duplication.
B Inversion.
C Translocation.
D Deletion.

49. Diagram 32 shows the karyotype of an offspring that has undergone mutation.

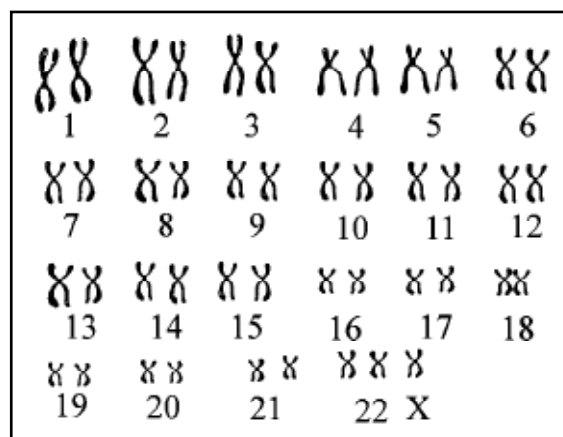
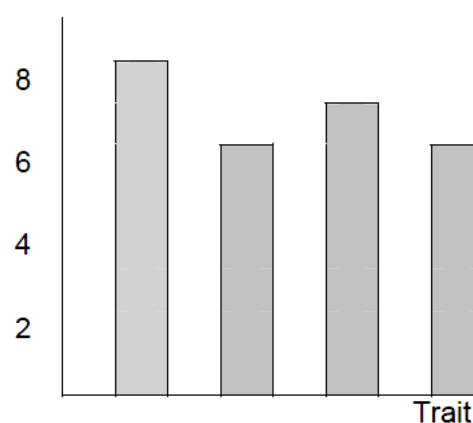


Diagram 32

Name the genetic disease suffered by the offspring.

- A Sickle cell anemia
B Down Syndrome
C Haemophilia
D Turner's Syndrome
50. The bar chart below shows the variation among students in 5 Berdikari.

Number of students



This trait most probably refers to the

- A Height
B Weight
C Skin colour
D Type of blood group

END OF QUESTION PAPER



Biology Paper 2

[4551/2]

Section A
[60 marks]

Answer all questions in this section.

1. Diagram 1.1 shows a plant cell. X, Y and Z are structures found in the cell.

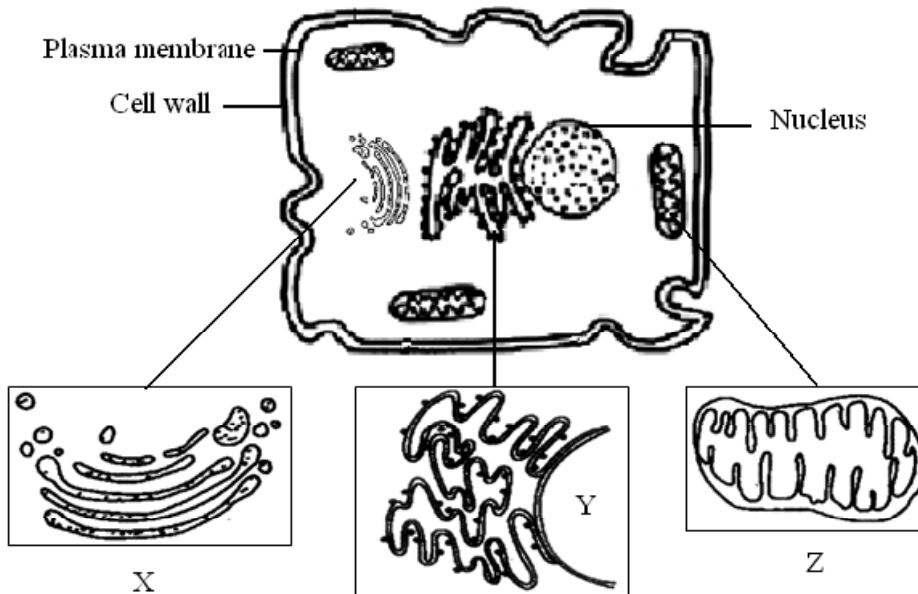


Diagram 1.1

- (a) (i) Name the structures X and Y.

X: _____

Y: _____

[2 marks]

- (ii) State the function of Z.

[1 mark]

- (b) Explain the function of X and Y in the transportation of extracellular enzyme.

[3 marks]

All enzymes are protein. Enzymes are sensitive to temperature.

- (c) (i) Explain why food is kept in the refrigerator?

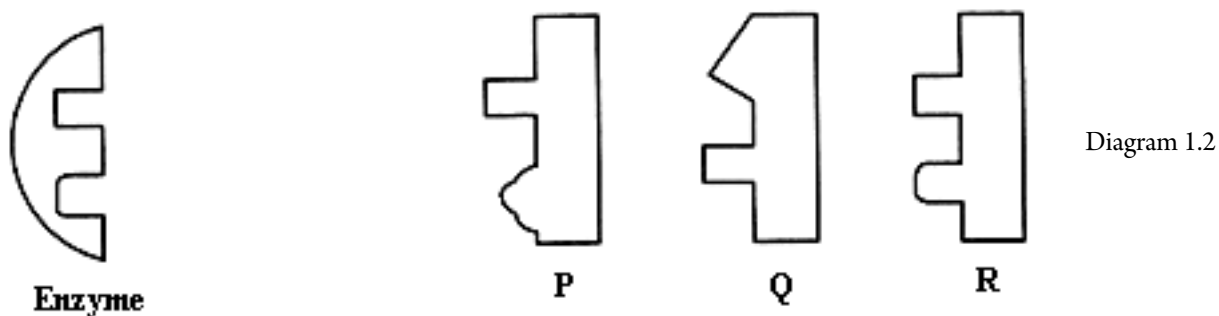
[2 marks]

- (ii) A branded washing machine is provided with temperature regulator. A housewife uses the detergent containing enzyme at 40°C to wash the clothes. By using the information given, explain why?

[2 marks]

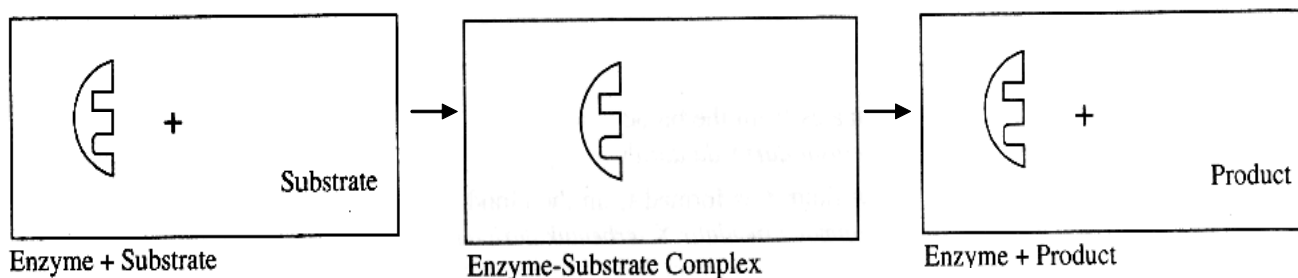


(d) Diagram 1.2 shows the structure of an enzyme and three substrates P, Q and R.



Based on Diagram 1.2, complete the schematic diagram below to show the mechanism of enzyme action on a suitable substrate.

[2 mark]



2. Diagram 2.1 shows the relationship between a cell, chromosome, DNA, genes and bases.

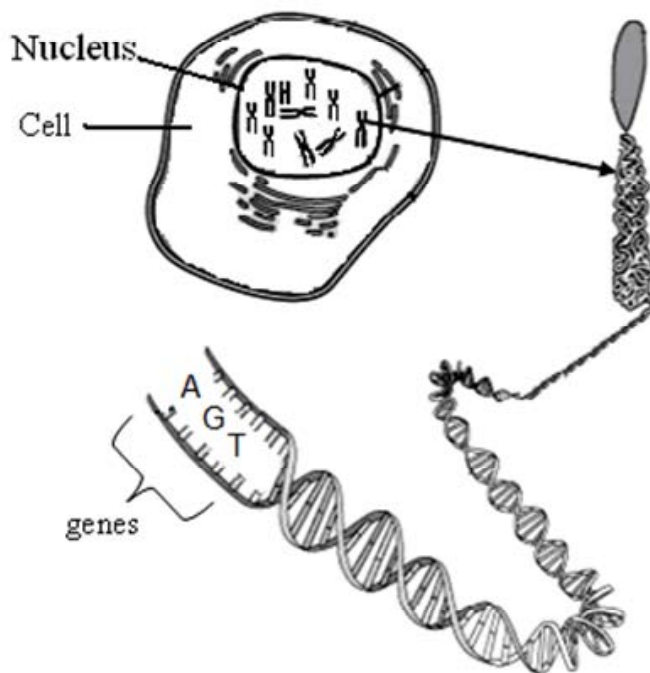


Diagram 2.1

a) State the chromosome number of the cell shown in Diagram 2.1

[1 mark]

b) What can you deduce about genes based on Diagram 2.1?

[1 mark]



c) Diagram 2.2 represents parts of a molecule of DNA.

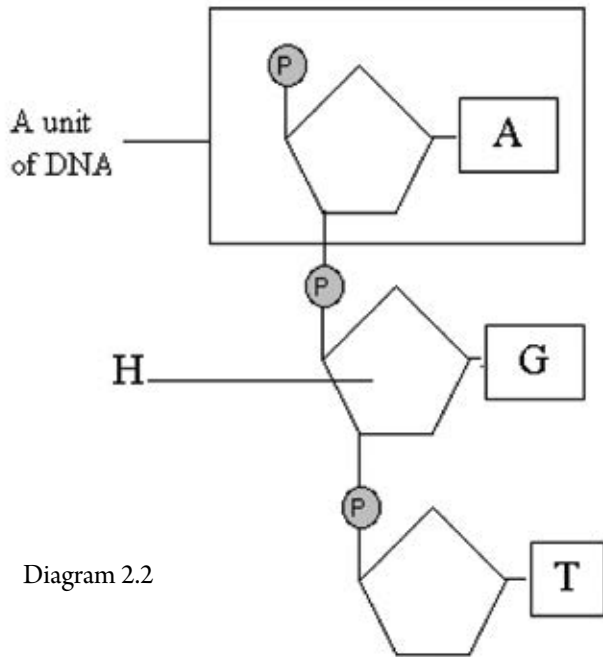


Diagram 2.2

i) What is the name of a unit of DNA?

_____ [1 mark]

ii) Name the structures P and H.

P : _____

H : _____

_____ [2 marks]

iii) Complete the Diagram 2.2 to show that DNA molecule consist of two strands that are joined together by hydrogen bonds. Part of one strand of DNA has been drawn.

[3 marks]

d) Diagram 2.3 below shows the karyotype of an individual with a genetic disease.

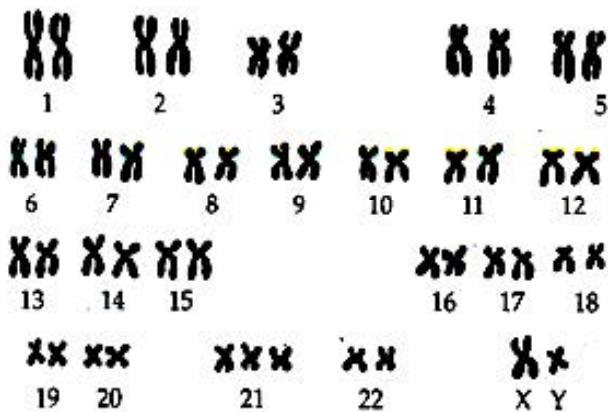


Diagram 2.3

i) Determine the sex of the individual in Diagram 2.3.

[1 mark]

ii) Name the genetic disease suffered by the individual. State a reason why the genetic disease occurs?

Disease : _____

Reason : _____

[2 marks]

iii) State a characteristic of the individual with this genetic disorder.

[1 mark]

3. Figure 3.1 represents a model of the human lungs in the respiratory mechanism.

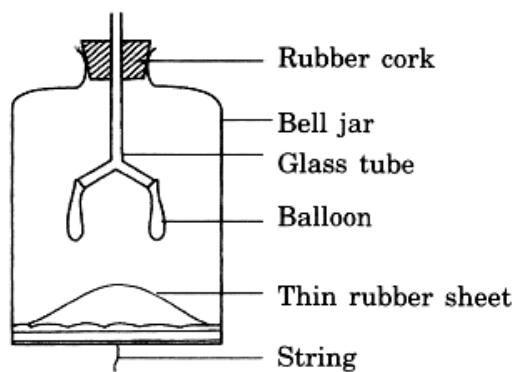


Figure 3.1

- (a) Based on the model of the lungs in Figure 3.1, what are the equivalent structures to the glass tube and the bell jar in the human respiratory system?

Glass tube : _____
 Bell jar : _____ [2 marks]

- (b) (i) The thin, rubber sheet represents the diaphragm in the human respiratory system. What is the function of the thin rubber sheet in the model of the lungs?

 _____ [1 mark]

- (ii) The balloons represent the human lungs. Explain one characteristic of the balloons which is similar to the human lungs.

 _____ [2 marks]

- (c) (i) The string in the model of the lungs is pulled down. Draw the changes to the thin rubber sheet and the balloons in Figure 3.2 below. [1 mark]

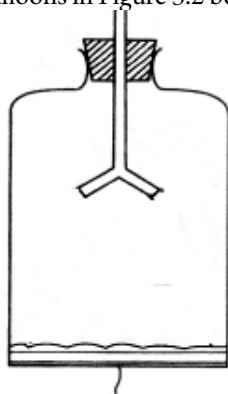


Diagram 3.2

- (ii) Based in your drawing in (c)(i), explain the process of inhalation.

 _____ [2 marks]

- (d) (i) The percentage of oxygen and carbon dioxide gases in inhaled and exhaled air is determined by using the J-tube. Why is the air in the J-tube treated with potassium hydroxide solution first and then followed by potassium pyrogallol solution?

 _____ [1 mark]

(ii) Table below shows the result of a study on the content of inhaled and exhaled air.

Type of gas	Inhaled air (%)	Exhaled air (%)
Oxygen	21.0	16.0
Carbon dioxide	0.04	4.0
Nitrogen gas	78.0	78.0
Water vapour	Vary	Saturated

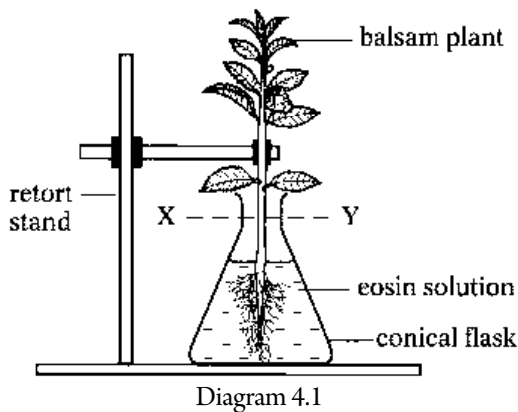
Explain why there is an increase in percentage of carbon dioxide in the exhaled air.

 _____ [2 marks]

(iii) Smoking is hazardous to human health. State one reason.

 _____ [1 mark]

4. Diagram 4.1 shows the apparatus set up in an experiment to study the role of the vascular tissue in the transport of water in plants.

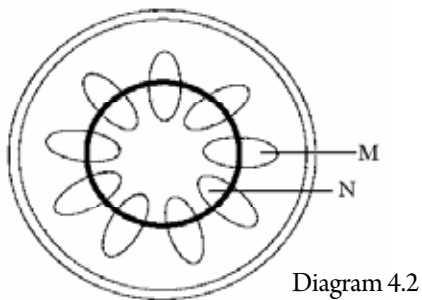


(a) State the function of the eosin solution.

 _____ [1 mark]

(b) The stem of the plant is cut across at XY and viewed under a microscope. A cross section of the stem is shown in Diagram 4.2.

Name the parts labelled M and N.



M : _____
 N : _____ [2 marks]

(c) Name the tissue which is responsible for transporting water and minerals ions from the roots to the upper parts of the plant.

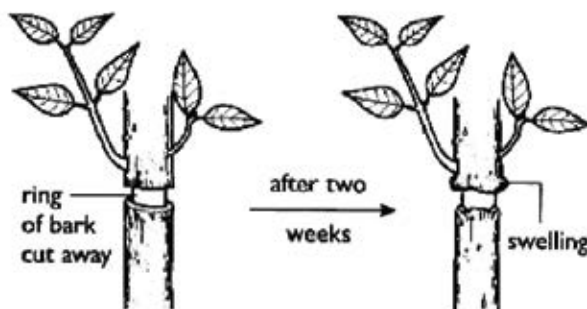
 _____ [1 mark]

(d) If the root of the plant is cut across, draw and label the observation made.

[3 marks]



(e) Diagram 4.3 shows the effect of removing tissue M from the stem.



(i) State the type of transport involved in Diagram 4.3.

_____ [1 mark]

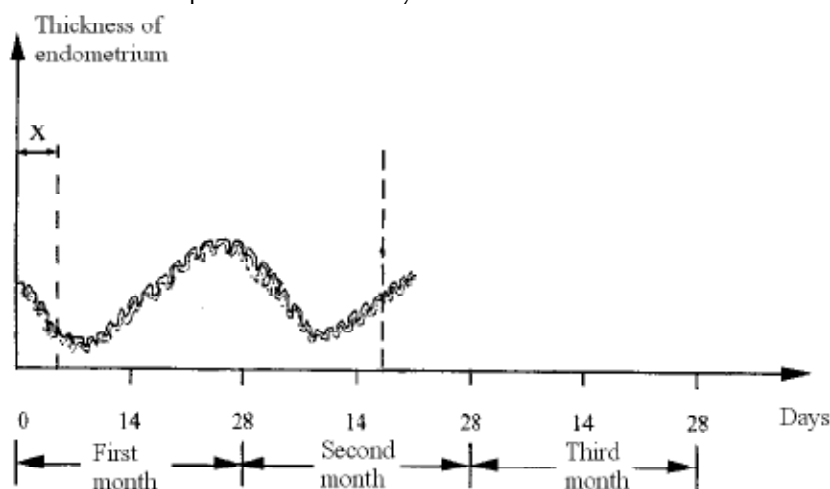
(ii) Explain why the part above the ring becomes swollen after two weeks.

 _____ [2 marks]

(iii) Explain why the leaves have not wilted after two weeks.

 _____ [2 marks]

5. Diagram 5.1 shows a graph on how the endometrium in the human uterus varies in thickness with time. Fertilisation took place on the 16th day of the second month.



(a) (i) State the process which took place at X.

_____ [1 mark]

(ii) Based on the Diagram 5.1, state one reason to support your answer in (a) (i).

_____ [1 mark]

(b) (i) Complete the graph in Diagram 5.1 to show the changes in the thickness of the endometrium after day 16 in the second month until day 28 of the third month.

[1 mark]

(ii) Explain why the thickness of the endometrium changes in the way shown in (b) (i).

 _____ [2 marks]



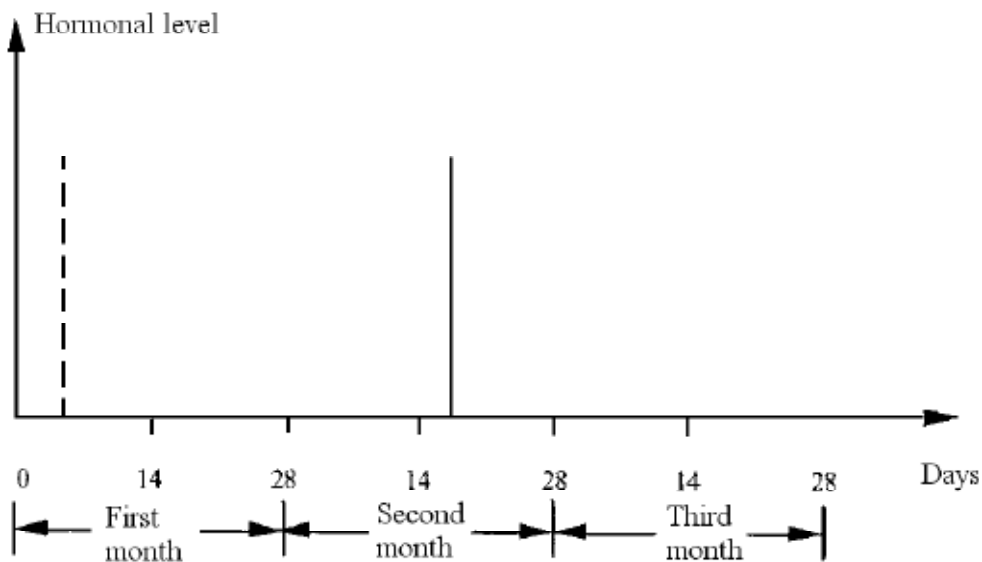
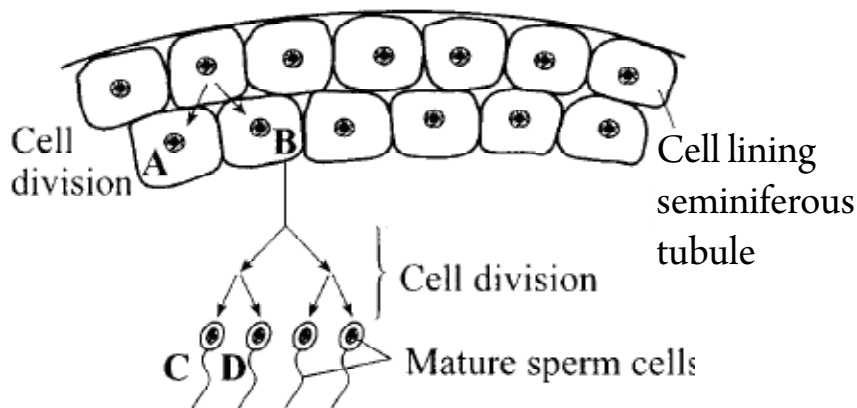


Diagram 5.2

- (c) (i) Based on the changes in Diagram 5.1, complete Diagram 5.2 to indicate the level of the hormone progesterone from the first to the third month. [1 mark]
- (ii) Explain the changes in the level of progesterone in the three months as shown in Diagram 5.2. [2 marks]
- (d) A woman who is a heavy smoker becomes pregnant. Explain why she should stop smoking. [2 marks]
- (e) Diagram 5.3 shows the process of sperm formation in the human testis.



Are cell A, cell B and cell C genetically identical? Explain.

[2 marks]

Section B
 [20 marks]
 Answer any two questions.

6. Diagram 6.1 shows the movement of water from the roots to the leaves and out to the atmosphere.

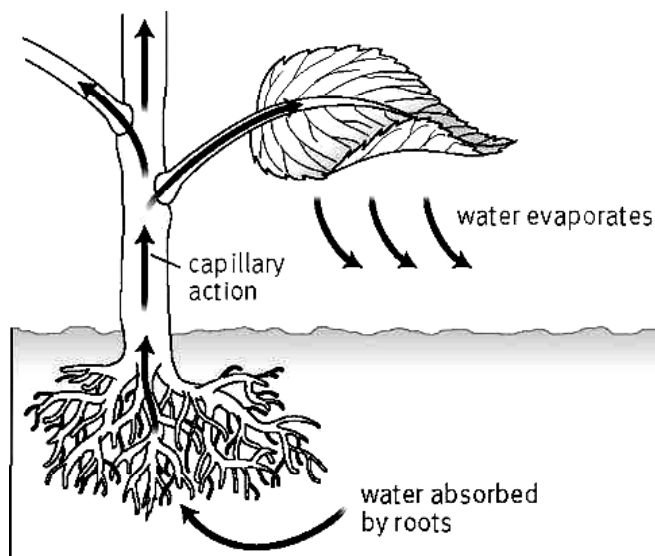


Diagram 6.1

- (a) Based on Diagram 6.1, describe the movement of water from roots to the leaves. [10 marks]
- (b) Diagram 6.2 shows part of the blood circulatory system and the lymphatic system in the human body.

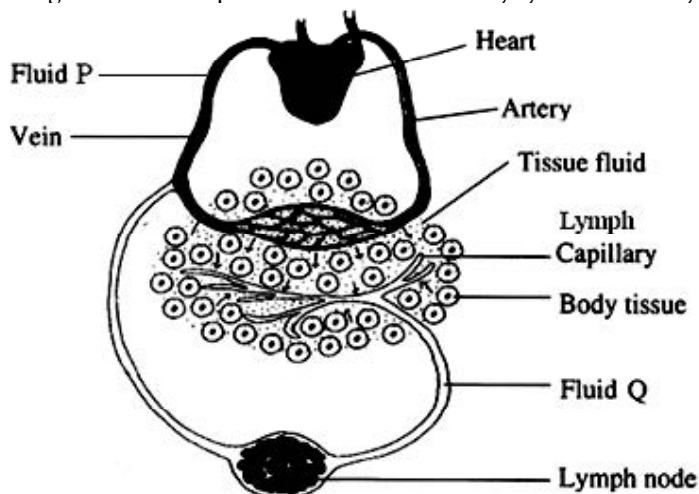


Diagram 6.2

- (i) Explain the differences between the composition of fluid P and fluid Q. [4 marks]
- (ii) Describe how fluid Q is formed from blood until it is brought back into the blood circulatory system. [6 marks]



7. (a) Diagram 7.1 shows reflex arc when a hand touches a hot object while Diagram 7.2 shows synapse.

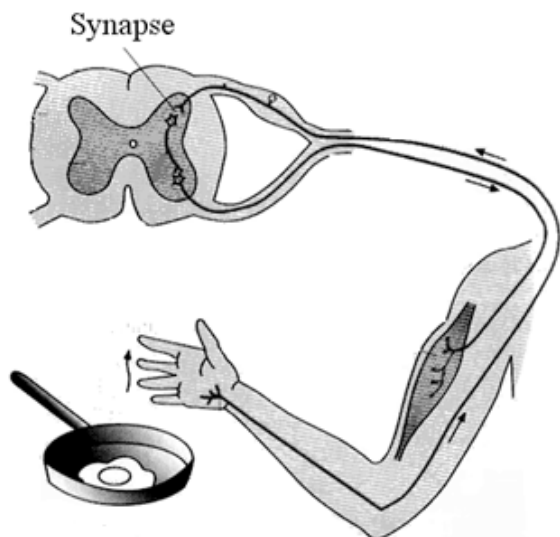


Diagram 7.1

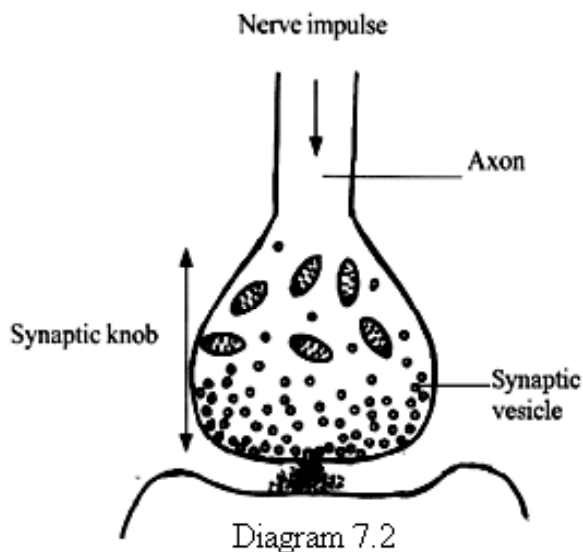


Diagram 7.2

Based on Diagram 7.1 and 7.2, explain the pathway of an impulse in a reflex arc shown in Diagram 7.1. [8 marks]

- (b) (i) Explain with the help of diagrams, how geotropism is brought about in a plant root and shoot. [8 marks]
(ii) Explain the advantages of geotropism to a plant. [4 marks]

8. (a) Anna took a plate of steam rice with fried fish for her lunch. Explain how the food she ate for lunch would be digested. [8 marks]

- (b) Table below shows a daily food intake by a teenager.

Breakfast	Lunch	Dinner
Fried egg	Chicken burger	Fried noodles
Fried sausage	Mashed potatoes	Fried chicken

- (i) Explain the long term effect of consuming the above foods on the teenager's health. [6 marks]

- (ii) Malnutrition is a condition due to taking an unbalanced diet in which certain nutrients are lacking, in excess or in the wrong proportions. Explain the effect on a child who is given insufficient amount of any 2 nutrients of food for a long period of time. [6 marks]

9. Diagram 9 shows a newspaper cutting on one of the effects of environmental pollution.



- (a) Explain the causes of the phenomenon shown in Diagram 9 and the effects on the environment and organisms. Suggest ways to minimize the effects of this phenomenon. [10 marks]

- (b) As an environmental activist, explain the greenhouse effect and discuss some human activities that can lead to the greenhouse effect. Give suggestions to the public on measures to be taken to reduce the greenhouse effect. [10 marks]

END OF QUESTION PAPER

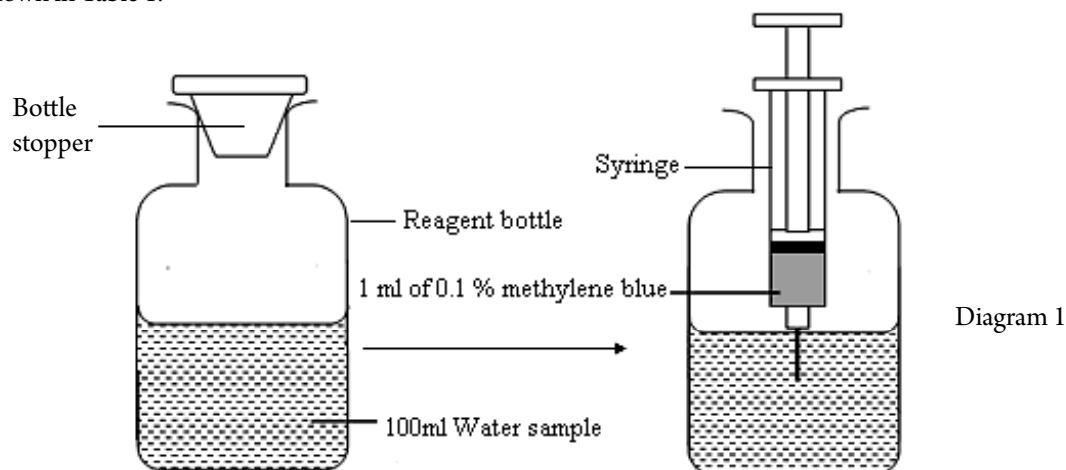


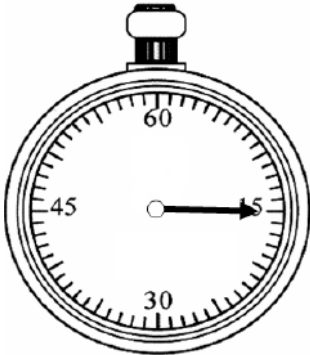

Biology Paper 3

[4551/3]

Answer all questions.

1. Four water samples (P, Q, R and S) are obtained from four different rivers around Malaysia to study the water pollution level. The volume of each water sample is 100 ml. The water samples are collected in 4 different reagent bottles and covered immediately. A syringe is used to place 1 ml of 0.1 % methylene blue solution at the bottom of each water sample (Diagram 1). The bottles are immediately closed and placed in a dark cupboard. The time taken for the methylene blue solution in each sample to decolourise is shown in Table 1.



Water sample	Time taken for methylene blue solution to decolourise (minutes)
P	 <div data-bbox="1050 1373 1254 1489" style="border: 1px solid black; width: 128px; height: 52px; margin-left: auto;"></div>
Q	 <div data-bbox="1050 1758 1254 1870" style="border: 1px solid black; width: 128px; height: 50px; margin-left: auto;"></div>





R	 <div data-bbox="1050 398 1257 510" style="border: 1px solid black; width: 130px; height: 50px; margin-left: auto;"></div>
S	 <div data-bbox="1050 795 1257 907" style="border: 1px solid black; width: 130px; height: 50px; margin-left: auto;"></div>

Table 1

(a) Record the time taken for the methylene blue solution to decolourise in the boxes provided in Table 1. [3 marks]

(b) (i) State two different observations made from Table 1.

Observation 1:

Observation 2:

[3 marks]

(ii) State the inferences from the observation in 1(b)(i).

Inference from observation 1:

Inference from observation 2:

[3 marks]



(c) Complete Table 2 based on this experiment.

Variable	Method to handle the variable
Manipulated variable	
Responding variable	
Constant variable	

Table 2

[3 marks]

(d) State the hypothesis for this experiment.

[3 marks]

(e) (i) Construct a table and record all the data collected in the experiment.

Your table should have the following titles:

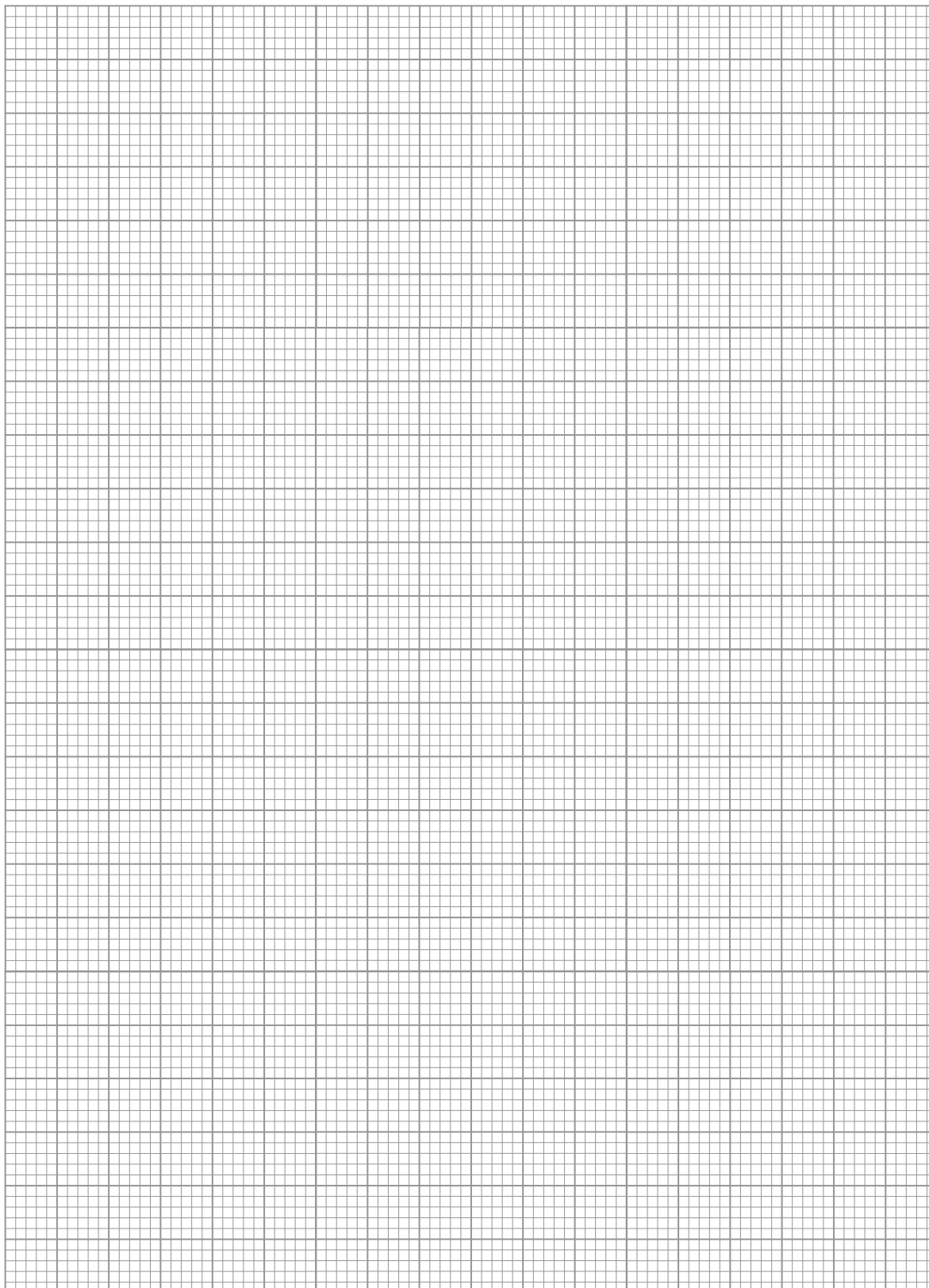
- Water sample
- Time taken for methylene blue solution to decolourise
- BOD level according to high, medium, low and very low.

[3 marks]



- (ii) Use the graph paper provided to answer this question. Using the data in 1(e)(i), draw a bar chart to show the relationship between the water sample and time taken for methylene blue solution to decolourise. [3 marks]

Bar chart of water sample against time taken for methylene blue solution to decolourise.



<http://edu.joshuatly.com/>

- (f) Based on the bar chart in 1(e)(ii), explain the relationship between the level of pollution in the water samples and the time taken for methylene blue to decolourise.

[3 marks]

- (g) The experiment is repeated on the water sample of a river near a waterfall. Predict the time taken for the decolourisation of methylene blue solution. Explain your prediction.

[3 marks]

- (h) State the operational definition for Biochemical Oxygen Demand (BOD).

[3 marks]

- (i) Diagram 1 shows part of the materials and apparatus used in this experiment. Complete Table 3 based on all the materials and apparatus labeled in Diagram 1.

Materials	Apparatus

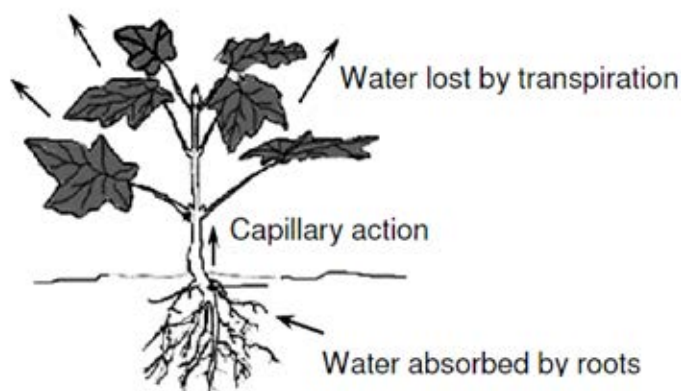
Table 3

[3 marks]



2. Transpiration is the loss of water vapour from plants, especially in leaves. Transpiration occurs mostly through the stomata. The amount of water lost by a plant depends on its size, surrounding light intensity, temperature, humidity and wind speed.

Diagram below shows the movement of water in a terrestrial plant.



Based on the above information, design an experiment to investigate the effect of temperature on the rate of transpiration in a hibiscus plant.

The planning of the experiment should cover the following aspects:

- Problem statement
- Hypothesis
- Variables
- List of apparatus and material
- Experimental procedure
- Presentation of data

[17 marks]

END OF QUESTION PAPER

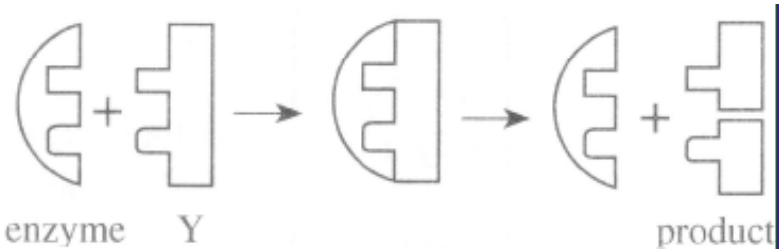
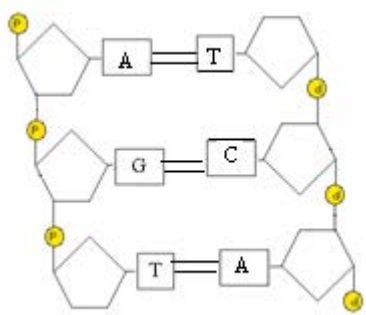


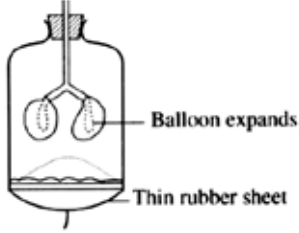
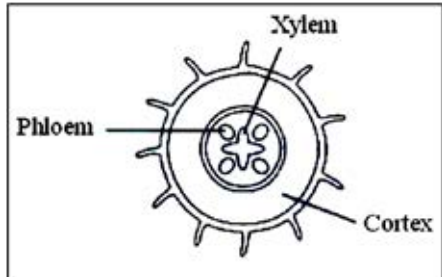
Jawapan Biology

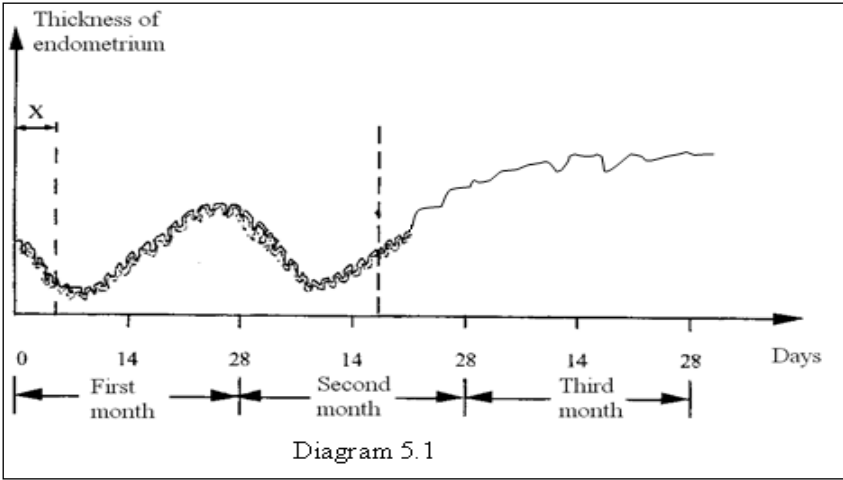
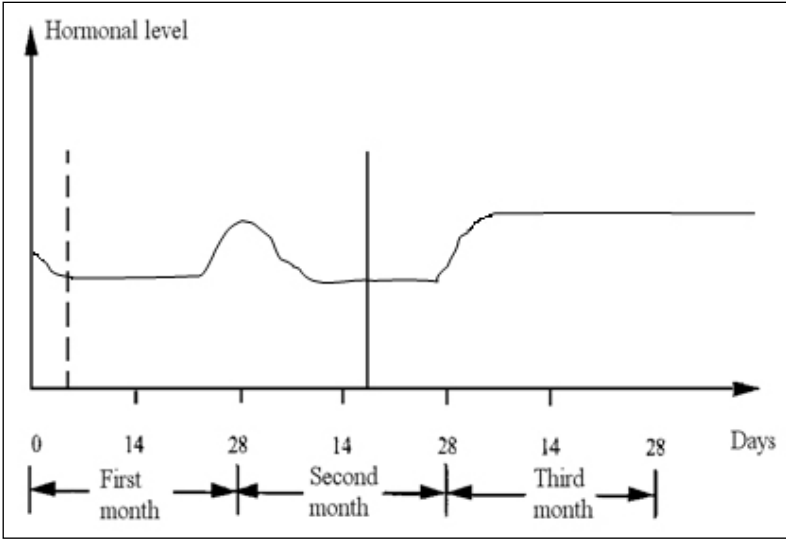
Biology Paper 1

No	Ans	No	Ans	No	Ans	No	Ans	No	Ans
1	C	11	D	21	D	31	C	41	A
2	A	12	C	22	B	32	C	42	B
3	A	13	A	23	C	33	D	43	B
4	D	14	C	24	D	34	B	44	D
5	A	15	C	25	D	35	B	45	C
6	D	16	C	26	B	36	B	46	C
7	C	17	A	27	B	37	C	47	A
8	D	18	B	28	B	38	D	48	B
9	C	19	B	29	A	39	B	49	D
10	D	20	B	30	A	40	B	50	D

Biology Paper 2

No.	Marking criteria	Marks	
1a)(i)	X : Golgi Apparatus/body Y: Rough Endoplasmic Reticulum	1 1 1	2 1
(ii)	Z : site for cellular respiration // to generate / produce energy	1	
b)	P1 : The nucleus / RNA instructs ribosomes to synthesized protein P2 : The synthesized protein is transported in the Rough Endoplasmic reticulum / Y P3 : to the transport vesicles P4 : then the Golgi Apparatus / X packages / modifies / sorts / transports the synthesized proteins P5 : to the secretory vesicles to be transported P6 : out of the cell through the plasma membrane Any 3	1 1 1 1 1	 3
c)(i)	P1 : Temperature in the refrigerator is very low P3 : Rate of enzyme reaction decreases as temperature decreases P3 : Enzymes are inactive at low temperature Any 2	1 1 1	2
(ii)	P1 : The optimum temperature for enzyme reaction is about 40oC. P2 : Low temperature makes the enzyme inactive P3 : High temperature denatures the enzyme Any 2	1 1 1	2
d)	 enzyme Y product	2	2
2a)	10	1	1
b)	1. a gene consists of a (short) segmen of DNA molecule 2. genes carried genetic information in form of sequence of nitrogenous base// A,G, T Any one	1 1	1
c)(i)	nucleotide	1	1
(ii)	P : phosphate group H : (pentose) sugar	1 1	2
(iii)		3	3

d)(i)	Male	1	1
(ii)	Disease :Down's Syndrome Reason : There are 2 chromosome 21	1 1	2
(iii)	Broad face//slanted eyes//protruding tongue	1	1
3a)	Glass tube: Bronchi/trachea Bell jar : Ribcage//ribs//thoracic cage	1 1	2
b)(i)	To change the volume of the bell jar	1	1
(ii)	F1 : Balloon is elastic P1 : when it expands, air goes into the bell jar during inhalation P2 : when it contracts, air goes out of the bell jar during exhalation	1 1 1	2
c)(i)		1	1
(ii)	P1 : When the rubber sheet is pulled down, the pressure inside the bell jar decreases. P2 : Air from outside enters the balloon P3 : The balloon inflates/expands	1 1 1	2
d)(i)	To prevent oxygen from being absorbed by the potassium pyragallol as it can absorb both oxygen and carbon dioxide	1	1
(ii)	P1 : Carbon dioxide is a product of cellular respiration in the body. P2 : Carbon dioxide diffuses out of the cells to be transported to the lungs.	1 1	2
(iii)	Smoking can cause cancer//corrodes the lungs//causes bronchitis	1	1
4a)	To stain the xylem (vessels) (with red dye)	1	1
b)	M : Phloem N : Xylem	1 1	2
c)	Xylem	1	1
d)	 - Neat and accurate drawing : 2m - 3 labels : 1m	2 1	3
e)(i)	Translocation	1	1
(ii)	F : The products of photosynthesis cannot be transported to the parts below the ring P : as tissue M / phloem is removed	1 1	2
(iii)	F : Water can still be transported to the leaves P : as tissue N / xylem is not removed from the stem	1 1	2

5a)(i)	Menstruation	1	1
(ii)	Thickness of the endometrium is decreasing//Endometrium breaks down	1	1
(b)i)	 <p>Diagram 5.1</p>	1	1
(ii)	F: endometrium getting ready for implantation of embryo P: endometrium vascularises and continues to thicken	1 1	2
(c)i)		1	1
(ii)	<p>First month F1 : level of progesterone increases after ovulation and then decreases P1 : as there is no implantation</p> <p>Second month F2 : level of progesterone increases after ovulation and continues to increase / is maintained P2 : as implantation has occurred</p> <p>Third month F3 : level of progesterone continues to rise / is maintained P3: as the endometrium is further developed to support the growing embryo Any F and respective P</p>	2	2
d)	F: Cigarette smoke contain chemical such as nicotine P : which can diffuse through the placenta and may cause brain damage	1 1	2
e)	F : Cell A is similar to cell B but is different from cell C. P : Cell A and cell B are products of mitosis whereas cell C is a product of meiosis.	1 1	2
Total		60	

Total	20
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8a)	- The food will be digested after five hours. - The process starts in the mouth where the steam rice which contains carbohydrate will be digested to form maltose by the enzyme amylase. - Then, with the help of the tongue and saliva the food forms bolus which will move along the oesophagus through peristalsis. - Then the fish will be digested in the stomach where the enzyme pepsin will be secreted by the gastric glands - Pepsin will digest the protein in the fish into peptone and polypeptide - Then the food will remain in the stomach for three to four hours and forms a semi-solid food called chyme - Then chyme moves from the stomach into the duodenum where the fats from the fried fish will be digested - The pancreatic juice containing enzyme lipase will hydrolyse the fats into glycerol and fatty acids. - Further digestion of the starch from the rice will be done by enzyme amylase. - Enzyme trypsin will hydrolyse peptone and polypeptide into peptides. - Finally, the food will move to the small intestine where enzyme maltase will hydrolyse the maltose into glucose. - Enzyme erepsin / peptidase will hydrolyse peptide into amino acids - and enzyme lipase hydrolyses fats into glycerol and fatty acids.	1 1 1 1 1 1 1 1 1 1 1 1	
(b)(i)	P1 : The menu contains sufficient protein but is not a balanced diet // does not contain the 7 classes of food in appropriate ratio P2 : Menu is highly rich in carbohydrates and fats // no vegetables and lack of vitamins // P3: Higher energy intake compare to energy requirement for teenager Consequences P3 : Constipation - lack of fiber , faeces moves slowly through colon P5 : Scurvy - lack of vitamin C //any other vitamins deficiency with explanation P6 : Obesity - increase in body weight drastically due to energy intake more than energy requirement P8 : Diabetes mellitus - excess of glucose contain in blood , food is highly rich in carbohydrates P10 : Arteriosclerosis - fats deposited in the lumen of blood vessel P13 : Heart attack - blockage in the coronary artery//Any other cardiovascular diseases with explanation	1 1 1 1 1 1 1 1	Max 8 2 4
b(ii)	F1- Deficient in protein, child suffer from kwashiorkor S1- protein is needed for normal growth/repair C1- lack of protein causes growth of child to be stunted /retarded F2- Deficient in Vitamin A causes night blindness S1- Vitamin A is needed to promote healthy rod cells in retina C1- Lack of Vitamin A reduces ability to see in dim light (or any other nutrients)	1 1 1 1 1 1	6
	Total	20	
9a)	Able to explain according to the following: C1 The causes of acid rain C2 The effects of acid rain to the environment C3 Suggestions on how to overcome the problems Causes of acid rain: F1 The combustion of fossil fuels from power stations, factories, domestic boilers, vehicles releases large quantities of sulphur dioxide and oxides of nitrogen. F2 Both sulphur dioxide and oxides of nitrogen combine with water vapour in the atmosphere to form sulphuric acid and nitric acid respectively. F3 They will fall back to the earth as acid rain. F4 Rain is naturally acidic with a pH of about 5.6 due to the presence of dissolved carbon dioxide which forms carbonic acid. F5 The pH of acid rain is however is less than 5.0	4 4 2 1 1 1 1 1	Max 4

	<p>Effects of acid rain:</p> <p>Agriculture :</p> <p>F1 The soil becomes very acidic and unsuitable for the cultivation of crops. 1</p> <p>F2 Acid rain causes the leaching of minerals such as potassium, calcium/magnesium which affects the growth of crops. 1</p> <p>Aquatic ecosystem:</p> <p>F3 Acid rain causes insoluble aluminium ions to accumulate in lakes and rivers. An increase in the accumulation of these ions can kill aquatic organisms (such as fish land invertebrates). 1</p> <p>Health:</p> <p>F4 Acidic soil releases the ions of certain heavy metals such as cadmium/lead/ mercury which may contaminate/ harm the supply of drinking water. 1</p> <p>F5 Increased acidity in the aquatic ecosystem also kills phytoplankton (which changes the food chain) 1</p> <p>F6 Photosynthetic tissues are destroyed. Plant leaves turn yellow and fall off. The roots are damaged and cannot absorb minerals. 1</p> <p>Buildings:</p> <p>F7 Metal railings and bridges corrode. 1</p> <p>F8 Limestone/stonework/marble monuments are eroded due to chemical weathering 1</p> <p>Suggestions to overcome the problems:</p> <p>F1 cleaning up emissions from power stations and industrial plants with scrubbers. This process involves the spraying of water to trap pollutants. 1</p> <p>F2 cleaning up emissions from vehicle exhausts through the use of catalytic converters. The pollutants react with one another in the catalytic converters to produce less harmful products. 1</p>		
9b)	<p>-Able to explain how the phenomenon happens. 4</p> <p>-Able to explain the factors which contribute to the increase of greenhouse gases in the atmosphere. 4</p> <p>-Able to give suggestions on measures to be taken to minimize the problem. 2</p> <p>Phenomenon of greenhouse effect:</p> <p>F1 The greenhouse effect is an effect in the atmosphere as a result of the presence of certain gases known as greenhouse gases. 1</p> <p>E2 Carbon dioxide, chlorofluorocarbons (CFCs), methane, nitrous oxide and low level ozone and water vapour make up the greenhouse gases. 1</p> <p>E3 As the earth is warmed, heat in the form of infrared radiation is radiated back into space. However, much of this heat does not escape, instead remains trapped by the greenhouse gases. 1</p> <p>E4 At the same time, greenhouse gases also radiate heat (in the form of infrared radiation) back to the earth. 1</p> <p>E5 This is similar to the glass planes of a greenhouse which trap heat and warm the greenhouse, hence the term greenhouse effect. 1</p> <p>Factors contributing to the greenhouse effects:</p> <p>F 1 Burning of fossil fuels from coal-fired power stations/ vehicle exhausts/ open burning/ industrial effluents like CFCs/ methane / nitrous oxide and ozone contributes to an increase in the amount of atmospheric CO₂ 1</p> <p>F2 Logging/ deforestation causes abundance amount of CO₂ in the atmosphere is not used for photosynthesis 1</p> <p>F3 As the concentration of greenhouse gases rises, the greenhouse effect becomes more pronounced. 1</p> <p>F4 Buildings with glass planes reflects more heat, thus worsen the greenhouse effects 1</p> <p>F5 As more heat is trapped, the earth's average temperature rises leading to global warming. 1</p> <p>Suggestions on measures to be taken to minimize the problem:</p> <p>E1 - Reduce the burning of fossil fuels to conserve energy. 1</p> <p>E2 - Develop alternative sources of energy such as wind/solar/ biogas /and geothermal energy. 1</p> <p>E3 - Reduce deforestation for farming purposes. 1</p> <p>E4 - Replanting after deforestation. 1</p> <p>E5 - Policies that control the emission of greenhouse gases from industrial sites must be reinforced and strictly implemented. 1</p> <p>E6 - Promotes green world. 1</p>		<p>Max 4</p> <p>Max 2</p> <p>Max 4</p> <p>Max 4</p> <p>Max 2</p>
	Total		20

Biology Paper 3

No.	Mark Scheme	Score										
1(a)	Able to record all 4 readings for the time taken for water sample to decolourise correctly. Sample answers	3										
	<table><tr><th>Water sample</th><th>Time taken for the methylene blue solution to decolourise (minutes)</th></tr><tr><td>P</td><td>15</td></tr><tr><td>Q</td><td>30</td></tr><tr><td>R</td><td>55</td></tr><tr><td>S</td><td>20</td></tr></table>		Water sample	Time taken for the methylene blue solution to decolourise (minutes)	P	15	Q	30	R	55	S	20
	Water sample		Time taken for the methylene blue solution to decolourise (minutes)									
	P		15									
	Q		30									
	R	55										
S	20											
Able to record 3 correct and 1 incorrect answer	2											
Able to record 2 correct and 2 incorrect answers	1											
Able to record 1 correct and 3 incorrect answers//No response or wrong response	0											

No.	Mark Scheme	Score
1 (b)	Able to state two different observations correctly according 2 criteria:	3
(i)	<ul style="list-style-type: none"> Water sample (MV) Time taken for the methylene blue solution to decolourise based on Table 1 correctly with units (RV). Sample answers 1. The time taken for methylene blue solution to decolourise for water sample R is 55 minutes. 2. The time taken for methylene blue solution to decolourise for water sample P is 15 minutes.	
	Able to state any one observation correctly or Able to state any two incomplete observations. Sample answers 1. The time taken for water sample R to decolourise is the longest. 2. The time taken for water sample P to decolourise is the shortest	2
	Able to state any one idea of observation (any 1 criteria). Sample answer 1. The time taken for water samples to decolourise changes.	2
	No response or incorrect response	1

No.	Mark Scheme	Score
1 (b)	Able to make two correct inferences base on two aspects:	3
(ii)	<ul style="list-style-type: none"> The time taken for water sample decolourise is longer/shorter Content of dissolved oxygen higher/lower Sample answers 1. The time taken for water sample R to decolourise is the longest because it contain the highest amount of dissolved oxygen. 2. The time taken for water sample P to decolourise is the shortest because it contain the lowest/least amount of dissolved oxygen. ***Note: Inference must match with observation***	
	Able to make one logical inference for any one observation Or Able to make one logical and incomplete inference base on one criterion for each observation. Sample answers 1. Water sample R has more dissolved oxygen. 2. Water sample P has less dissolved oxygen.	2
	Able to state one inferences correctly and one – two inferences at idea level Sample answer 1. Water samples have dissolved oxygen	1
	No response or incorrect response	0

No.	Mark Scheme	Score	
1 (c)	Able to state all 3 variables and the 3 methods to handle the variable	3	
	Sample answers		
	Variable		Method to handle the variable
	<u>Manipulated variable</u> Water sample		Collect water samples from four different rivers/different sources
	<u>Responding variable</u> Time taken for the methylene blue solution to decolourise		Measure and record the time taken for the methylene blue solution to decolourise using a stopwatch
	<u>Constant variable</u> Volume of water sample // Volume / concentration of methylene blue solution	Fix the volume of water samples at 100ml// Fix the volume of methylene blue solution at 1 ml// Fix the concentration of methylene blue solution at 0.1%	
	Able to state 4-5 ticks	2	
	Able to state 2-3 ticks	1	
	No response or incorrect response	0	

No.	Mark Scheme	Score
1 (d)	<p>Able to state a hypothesis relating the manipulated variable and the responding variable correctly with the following aspects:</p> <p>P1 = Manipulated variable (Level of water pollution of the water sample)</p> <p>P2 = Responding variable (Time taken for the methylene blue solution to decolourise)</p> <p>H = relationship</p> <p>Sample answer</p> <p>The higher the level of water pollution of the water sample, shorter the time taken for the methylene blue solution to decolourise//</p> <p>The more polluted the water sample, shorter the time taken for the methylene blue solution to decolourise.</p>	3
	<p>Able to make a hypothesis relating the manipulated variable and the responding variable incorrectly.</p> <p>Sample answer</p> <p>The source of water sample influence the time taken for the decolourisation of the methylene blue solution</p>	2
	<p>Able to make a hypothesis relating the manipulated variable and the responding variable at idea level.</p> <p>Sample answer</p> <p>The time taken for the decolourisation of the water samples changes</p>	1
	No response or incorrect response	0

No.	Mark Scheme	Score															
1 (e)	<p>Able to construct a table correctly according with following aspect.</p>	3															
(i)	<ol style="list-style-type: none"> 1. Able to state the 2 titles with units – 1 mark 2. Able to record all the data correctly – 1 mark 3. Able to state the BOD level correctly - 1 mark <p>Sample answer</p> <table border="1"> <thead> <tr> <th>Water sample</th><th>Time taken for the methylene blue solution to decolourise (minutes)</th><th>BOD level</th></tr> </thead> <tbody> <tr> <td>P</td><td>15</td><td>High</td></tr> <tr> <td>Q</td><td>30</td><td>Medium</td></tr> <tr> <td>R</td><td>55</td><td>Very low</td></tr> <tr> <td>S</td><td>20</td><td>Low</td></tr> </tbody> </table>	Water sample	Time taken for the methylene blue solution to decolourise (minutes)	BOD level	P	15	High	Q	30	Medium	R	55	Very low	S	20	Low	
Water sample	Time taken for the methylene blue solution to decolourise (minutes)	BOD level															
P	15	High															
Q	30	Medium															
R	55	Very low															
S	20	Low															
	Any two correct.	2															
	Any one correct.	1															
	No response or incorrect response	0															

No.	Mark Scheme			Score	
1 (e) (ii)	Able to draw a bar chart of water sample and time taken for the methylene blue solution to decolourise, include the following aspects:			3	
	P	:	Correct title of x-axis and y-axis with unit and uniform scale on the axis x-axis : Water sample (P, Q, R & S) y-axis : Time taken for the methylene blue solution to decolourise (minutes)		1 mark
	T	:	Correct data transferred / all points plotted		1 mark
	B	:	Bar chart		1 mark
	Any two correct.			2	
	Any one correct.			1	
	No response or incorrect response			0	

No.	Mark Scheme	Score
1 (f)	<p>Able to interpret data and explain with the following aspect :</p> <ol style="list-style-type: none"> 1. Able to state the relationship between the level of water pollution in the water sample and the time taken for the methylene blue solution to decolourise. 2. Able to state the relationship between the level of water pollution with the content of dissolved oxygen 3. Able to state the relationship between the level of water pollution with level of BOD <p>Sample answer The higher the level of water pollution in the water sample, the shorter the time taken for the methylene blue solution to decolourise. This is because the water sample contains less dissolved oxygen which means the BOD is high.</p> <p>Able to interpret data and with 2 aspects.</p> <p>Able to interpret data and with 1 aspect.</p> <p>No response or incorrect response</p>	<p>3</p> <p>2</p> <p>1</p> <p>0</p>

No.	Mark Scheme	Score
1 (g)	<p>Able to predict the outcome of the experiment correctly.</p> <ol style="list-style-type: none"> 1. Correct prediction 2. Reason 3. Effect <p>Sample answer The time taken is more than 55 minutes because there is more oxygen in the water sample near the waterfall as the water is not contaminated with microorganisms. The water is not polluted.</p> <p>Able to interpret data and with 2 aspects.</p> <p>Able to interpret data and with 1 aspect.</p> <p>No response or incorrect response</p>	<p>3</p> <p>2</p> <p>1</p> <p>0</p>

No.	Mark Scheme	Score
1 (h)	<p>Able to define operationally biochemical oxygen demand of the water sample based on the result of the experiment.</p> <ol style="list-style-type: none"> 1. The time taken 2. To decolourise 1 ml of 0.1% methylene blue solution 3. And is affected by MV <p>Sample answer Biochemical oxygen demand is the time taken to decolourise 1 ml of 0.1% methylene blue solution in each water sample and is affected by the level of pollution/ contamination in the water sample.</p> <p>Able to interpret data and with 2 aspects.</p> <p>Able to interpret data and with 1 aspect.</p> <p>No response or incorrect response</p>	<p>3</p> <p>2</p> <p>1</p> <p>0</p>

No.	Mark Scheme		Score
1 (i)	Able to list all materials and apparatus in Table 3 correctly. Sample answer		3
	Materials	Apparatus	
	Water sample Methylene blue solution	Reagent bottle Bottle stopper Syringe	
	Able to arrange with 4 correctly		2
	Able to arrange with 2-3 correctly		1
	No response or incorrect response		0

QUESTION 2

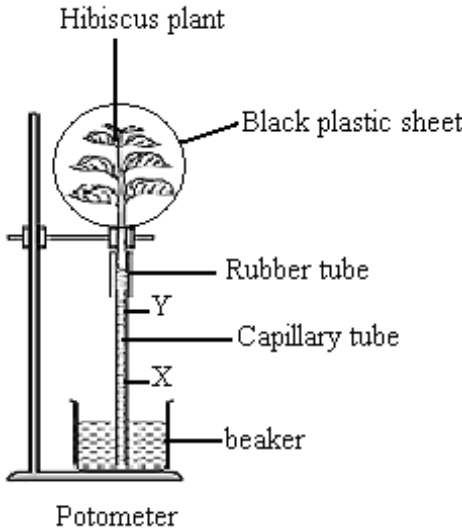
Aspect	Criteria	Score
Problem Statement	Able to write a problem statement correctly base on 3 criteria: • Manipulated variables- (Temperature) • Responding variables- (Rate of transpiration) • Relation in question form and question symbol [?]. Sample Answer 1. What is the effect of temperature on the rate of transpiration (in a hibiscus plant)? 2. Does temperature affect the rate of transpiration (in a hibiscus plants)?	3
	Able to write a problem statement but less correctly base on 2 criteria. Sample answers: 1. The rate of transpiration is affected by temperature. 2. What is the effect of temperature on the rate of transpiration.	2
	Able to give an idea about the problem statement base on 1 criterion. Sample answers: 1. Temperature affects transpiration of a plant. 2. Transpiration is influenced by temperature?	1
	Wrong or no response	0

Aspect	Criteria	Score
Variables	Able to identify all the three variables correctly	3
	Sample Answer • Manipulated variable : Temperature • Responding variable : Rate of transpiration// Time taken for air bubble to move a distance of 5 cm • Fixed variable : Type of plant/hibiscus//Light intensity//Relative humidity//Air movement (Write only one)	(1 mark each)

Aspect	Criteria	Score
Hypothesis	Able to write a suitable hypothesis correctly base on the 3 criteria: • Manipulated variable : Temperature • Responding variable : Rate of transpiration// Time taken for air bubble to move a distance of 5 cm • Relationship of the variables : increase/higher// decrease/shorter Sample Answer 1. The higher the temperature, the higher the rate of transpiration of the hibiscus plant. 2. As the temperature increases, the rate of transpiration increases. 3. The higher the temperature, the shorter the time taken for air bubble to move a distance of 5 cm.	3
	Able to write a hypothesis but less correctly base on the 2 criteria.	2
	Able to give an idea about the problem statement base on 1 criterion.	1
	No response	0

Aspect	Criteria	Score
Materials and Apparatus	Able to list all materials and apparatus needed to carry out the experiment successfully. Sample Answer Materials (M): *Hibiscus plant, *water, and plasticine/ vaseline. Apparatus (A): *Ruler / weighing balance, *potometer//capillary tube + rubber tubing // stoppered conical flask, beaker / basin, knife, stopwatch, string and tissue paper, black plastic sheet. (Must have M & A labeled *)	7A + 3M 3
	Able to list some materials and apparatus needed to carry out the experiment successfully (Must have M & A labeled *)	5A + 2M 2
	Able to list some materials and apparatus needed to carry out the experiment successfully. (Must have M & A labeled *)	3A + 2M 1
	Incomplete list or wrong or no response	0

Aspect	Criteria	Score
Procedure	Able to write all the steps in carrying out the experiment successfully. K1 : Steps to set up the apparatus (5) K2 : Steps to handle the fixed variable (1) K3 : Steps to handle the manipulated variable (1) K4 : Steps to handle the responding variable (1) K5 : Precautionary steps / steps taken to get accurate results / readings (1) All K1-K5 present	3
	Any 3 – 4K present	2
	Any 2K present	1
	1K or wrong response	0

K1		
	1	(Diagram of experimental setup with at least 5 functional labels).
	2	Obtain a hibiscus shoot and immediately immerse in water.
	3	By using a sharp knife, cut off 2 cm of the hibiscus stem obliquely under water.
	4	Fill in the capillary tube with attached rubber tubing / potometer with water.
	5	Fix in the stem of the hibiscus shoot into the rubber tubing / potometer.
	6	The potometer is sealed using vaseline to make the apparatus airtight and ensure no water leakage.
	7	Immerse the capillary tube / potometer in a beaker of water.
	8	Wipe dry the leaves with tissue papers.
	9	The black plastic sheet (to control air movement and light intensity) is used to cover the leaf shoot and the potometer is placed in the laboratory. The temperature inside the plastic frame is recorded (30oC).
	10	Leave the setup for 5 minutes (for the plant to adapt with the new environment).
	11	Lift the capillary tube from the water to trap a column of air bubble.

K1	12	Tie strings on the capillary tube to position X and Y (5cm).
K4 K2	13	Measure and record the time taken for the air bubble to travel from X to Y (5 cm) using a stopwatch.
K3	14	Repeat the experiment using similar setup as above but placed outside the laboratory. The temperature inside the frame is again recorded (35°C).
K4 K2	15	Again measure and record the time taken for the air bubble to travel from X to Y (5 cm) using a stopwatch.
K4	16	Calculate the rate of transpiration using formula: distance traveled by air bubble/time.
K5	18	Experiment is repeated to get average results
K1	17	Record results in a table // Tabulate the data.
		5K = 3m, 3-4K = 2m, 2K = 1m

Aspect	Criteria	Score																						
Presentation of data	Able to draw a complete table to record the relevant data base on the 3 criteria: <ul style="list-style-type: none">• Temperature ($^{\circ}\text{C}$) - Correct title with unit – 1m• Time taken for air bubble to move 5 cm (min)• Rate of transpiration (cmmin^{-1})	2																						
	Sample Answer																							
	<table><tr><th rowspan="2">Temperature ($^{\circ}\text{C}$)</th><th colspan="4">Time taken for air bubble to move from X to Y (5 cm) (minutes)</th><th rowspan="2">Rate of transpiration (cm/min)</th></tr><tr><th>First reading</th><th>Second reading</th><th>Third reading</th><th>Average</th></tr><tr><td>30</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>35</td><td></td><td></td><td></td><td></td><td></td></tr></table>		Temperature ($^{\circ}\text{C}$)	Time taken for air bubble to move from X to Y (5 cm) (minutes)				Rate of transpiration (cm/min)	First reading	Second reading	Third reading	Average	30						35					
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			First reading	Second reading	Third reading	Average																		
30																								
35																								