

# BIOLOGY

## Format of Biology Paper SPM Level

Aspect \ Paper	Paper 1 4551/1	Paper 2 4551/2	Paper 3 4551/3
Types of Item	Objective Items : • Multiple-choice • Multiple-combination Each item consists of four opinions: A, B, C and D.	Subjective Items : • Section A : Structured based items • Section B : Limited response items • Section C : Extended response items	Subjective Items : • Structured-based items • Extended response items
Number of questions	50 questions. Answer all	Section A : • 5 items - Answer all Section B : • 2 items – Choose one Section C : • 2 items – Choose one	Structured item : • 1 @ 2 items - Answer all Extended item : • 1 item – Compulsory
Total marks	50 marks	100 marks	50 marks
Duration of test	1 hour 15 minutes	2 hours 30 minutes	1 hour 30 minutes
Requirement of construct	Section A : • Knowledge – 25 Section B : • Understanding - 15 Section C : • Application – 10	Knowledge - 10 Understanding - 20 Application skills - 30 Analysing skills - 15 Synthesising skills - 15 Evaluating skill - 10	Scientific Process skills • 16 aspects with maximum score of 3
Marking	Dichotomous 1 or 0 mark.	Analytical marking based on rubric scoring.	Analytical marking based on rubric scoring for 3 levels.
Level of difficulty : Low : L : 50% Moderate : M : 30% High : H : 20%	L : M : H 3 : 1 : 1 • 30 easy items • 10 moderate items • 10 difficult items	L : M : H 4 : 4 : 2 • 40 easy scores • 20 moderate scores • 20 difficult scores	L : M : H 3 : 3 : 1 • 10 easy aspect • 30 moderate aspects • 30 difficult aspects



### Analysis of Biology Paper SPM Level

TOPICS	2003			2004			2005			2006			
	P1	P2	P3	P1	P2	P3	P1	P2	P3	P1	P2	P3	
	OBJECTIVE	STRUCTURE	ESSAY	OBJECTIVE	STRUCTURE	ESSAY	OBJECTIVE	STRUCTURE	ESSAY	OBJECTIVE	STRUCTURE	ESSAY	
1 Introduction to Biology.													
2 Cell structure and cell organisation.	4			3			4			3	1		
3 Movement of substances across the plasma membrane.	4		1	3	1		4			1	4	1	
4 Chemical composition of the cell.	5			4	1		2	1		3	½	1	
5 Cell division	2	1		2			2	1		3			
6 Nutrition	3	1	1	1	5		1	6		1	3	½	2
7 Respiration	2			2		1	2	1		3			
8 Dynamic ecosystem	7	1		½	3	1	1	3	1		4		
9 Endangered ecosystem	1		1		3			3		1	2		
10 Transport	6			8	1		5	1		5		1	
11 Support and locomotion	2			2			3		1	3			
12 Coordination and response	5		1		5	1		5			4	1	
13 Reproduction and growth	3				4	1		5		1	5	1	
14 Inheritance	4	1			4		1½	5		1	5	1	
15 Variation	2	1		½	2		½	1			3		
<b>TOTAL</b>	<b>50</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>50</b>	<b>5</b>	<b>4</b>	<b>2</b>	<b>50</b>	<b>5</b>	<b>4</b>	<b>2</b>	



# CONTOH KERTAS SOALAN

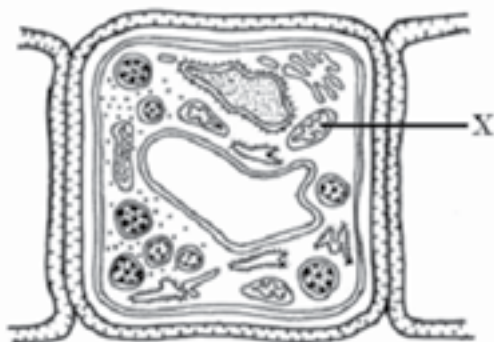
# BIOLOGY

PAPER 1

ONE HOUR FIFTEEN MINUTES

**Instructions: Each question is followed by four options.  
Choose the best options for each questions.**

1. Diagram below shows a plant cell. What is X?



- A. Vacuole  
B. Golgi apparatus  
C. Mitochondrion  
D. Chloroplast

2. The process in which the cytoplasm of a plant cell shrinks due to osmosis is called

- A. Plasmolysis  
B. Endocytosis  
C. Crenation  
D. Flaccid

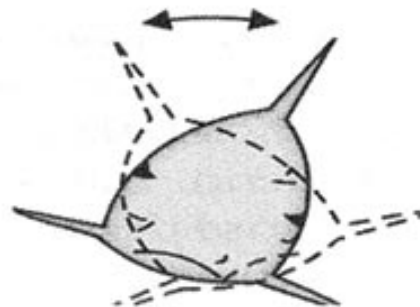
3. Enzymes can be denatured by...

- A temperature  
B substrate  
C alkali  
D acids

Which of the following plant hormones induce parthenocarpy?

4. A Gibberellin  
B Ethylene  
C Ethene  
D Auxin

- 5.

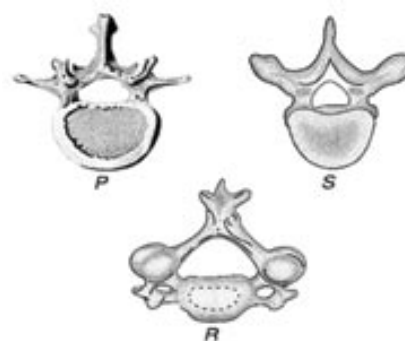


The diagram shows a fish having difficulty while swimming. A fish overcomes this difficulty with the help of its...

- I ventral fins  
II pelvic fins  
III dorsal fins  
IV pectoral fins

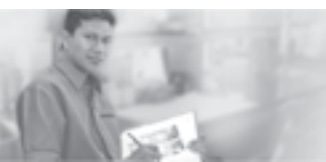
- A I and II only  
B I and III only  
C II and III only  
D III and IV only

6. The diagram below shows three types of vertebrae.



What is the correct position of the vertebrae in the vertebral column below the skull?

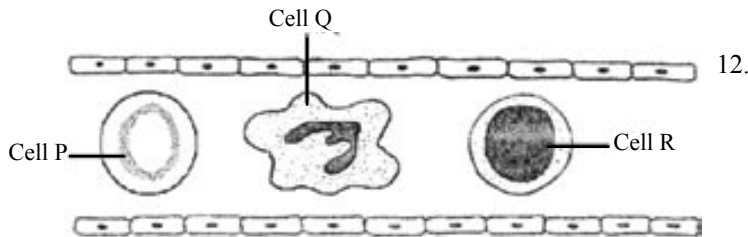
- A P, R, S  
B R, P, S  
C R, S, P  
D S, P, R



7. Antibiotics would be effective against ...

- A the flu virus
- B viral meningitis
- C the malaria protist
- D bacterial pneumonia

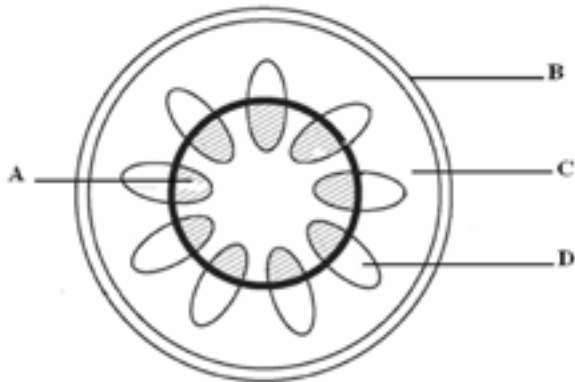
8. The diagram shows the human blood cells in the blood capillaries.



Which of the following cell function as the body's defence mechanism?

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

9.



A plant was exposed to radioactive carbon dioxide in daylight. After two hours, a thin slice of the cross-section of the stem was cut and placed on photographic film which turns black if there is radioactive carbon.

Which tissue on the cross-section of the stem in the diagram above is the fastest to turn black?

10. What process involves the movement of substances across membranes with the help of carrier proteins but without the need for energy ?

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

11. A cell is placed in a hypertonic solution. What will happen ?

- A Solutes will move into the cell from the surrounding solution.
- B Water will move into the cell from the surrounding solution.
- C Solutes will move out of the cell into the surrounding solution.
- D Water will move out of the cell into the surrounding solution.



The diagram shows a somatic cell of an animal in the process of meiosis I. How many chromosomes are there in the daughter cell after cell division?

- A 2
- B 4
- C 8
- D 16

13. In the human digestive system, damage to the pancreas will affect the digestion of

- A proteins
- B starch and lipids
- C protein and starch
- D lipid, starch and proteins

14. The diagram below shows the food chain

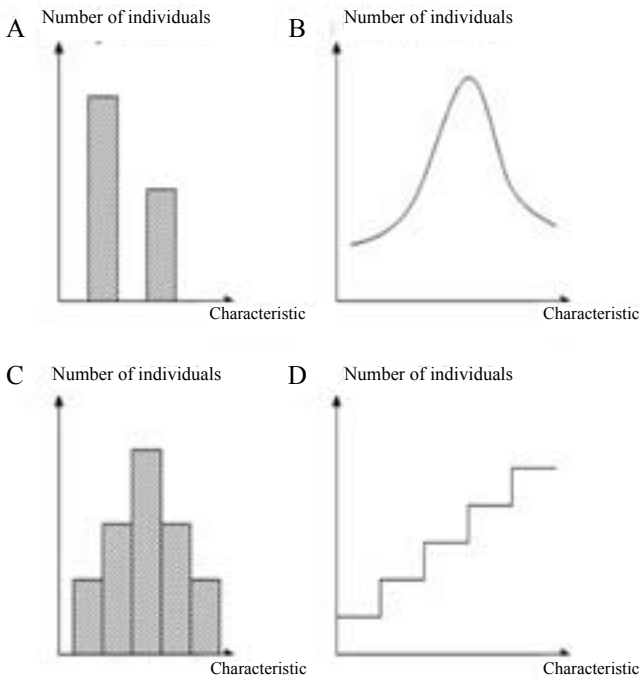


An insecticide was sprayed to kill organism R. Which of the following statement is true?

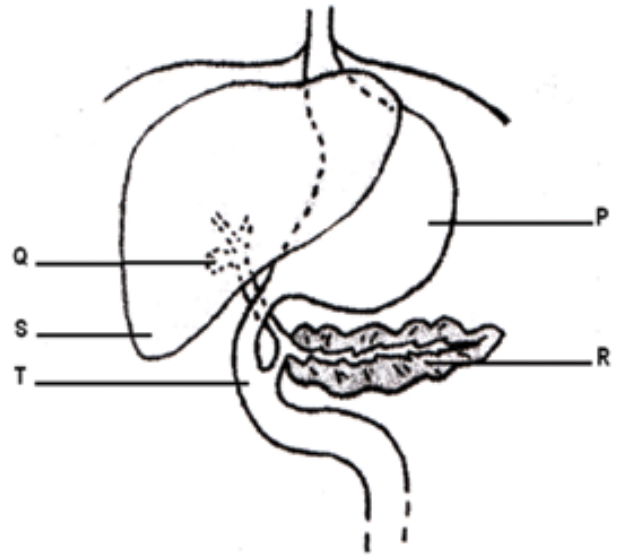
- A The number of producer decreases
- B The number of organism S increases
- C The number of organism S decreases
- D No change in the number of producer



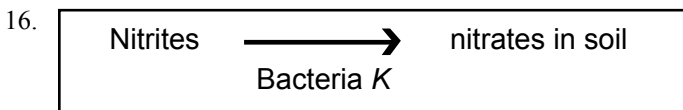
15. Which of the following shows the variation caused by the genetic factor?



18. The diagram below shows a part of alimentary canal of a man. Which part between P,Q,R,S and T is responsible in production storage and receives the bile?



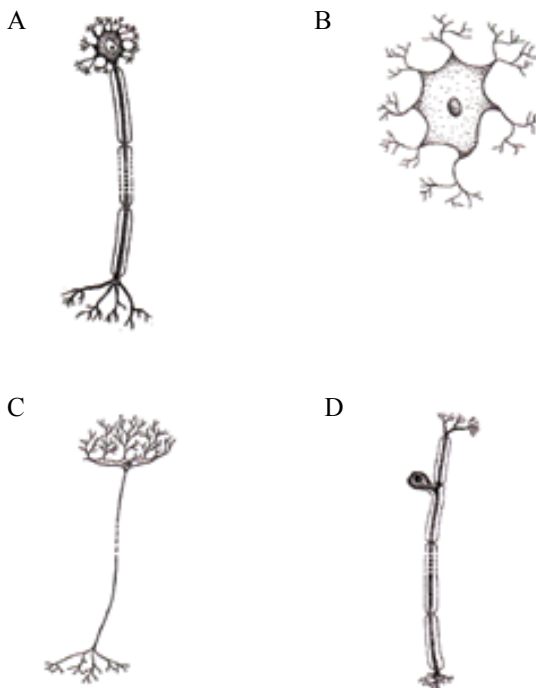
	Production	Storage	Receiving
A	T	S	R
B	S	Q	T
C	Q	S	P
D	S	T	R



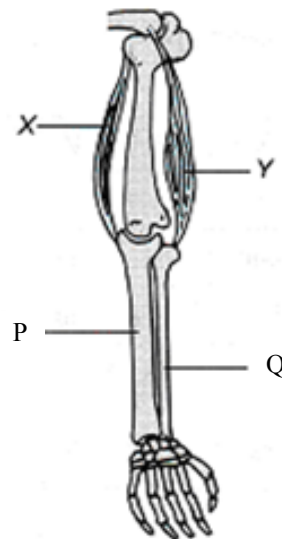
What is bacteria K involved in the process shown above?

- A *Rhizobium sp.*
- B *Nitrobacter sp.*
- C *Clostridium sp.*
- D *Nitrosomonas sp.*

17. Which of the following neuron send impulses from the receptor to the central nervous system?



19.



The diagram shows an upper limb. What causes the arm to bend?

- A When muscle P contracts, bone X is pulled up.
- B When muscle Q contracts, bone Y is pulled up.
- C When muscle P relaxes, bone X is pulled up.
- D When muscle Q relaxes, bone Y is pulled up.

20. The current theory on the structure of the plasma membrane is best described by the

- A fluid-mosaic model
- B membrane unit model
- C electrochemical model
- D bilayer model

21. Muscle fibre is made up of bundles of smaller units called

- A filaments
- B myofibrils
- C the sarcomere
- D the sarcoplasm

22. Which of the following matches between the vertebrae and its quantity is incorrect?

Vertebrae	Quantity
A Sacrum	5
B Thorax	10
C Cervix	7
D Lumbar	5

23. Which of the following statement is not the appropriate precaution to be taken during vigorous activities?

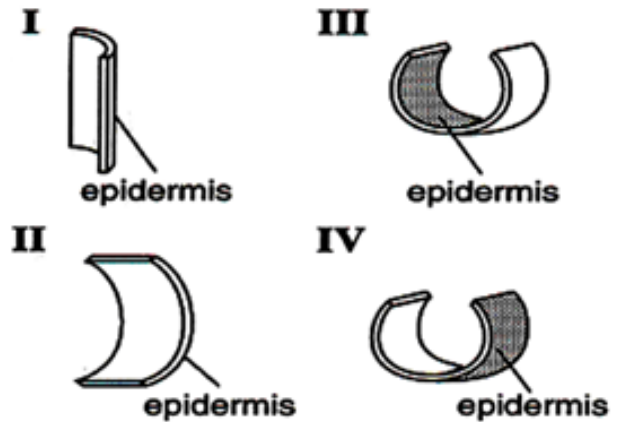
- A Stretching exercises must be done before and after the workout.
- B Keep the body adequately hydrated during such activities.
- C Wear loose and comfortable clothing at all times.
- D Drink a fruit juice if you have been sweating for more than an hour.

24. Which of the statements below correctly refers to osteoarthritis?

- A A sudden contraction of one or more muscles and an inability to use the affected muscles.
- B The progressive degeneration and weakening of the skeletal muscles that control movement.
- C A common bone disorder which causes the bones to become thinner, more brittle and more porous.
- D The ageing process caused by the wear and tear of the cartilage between the bones inside certain joints.

25. Four strips of carrots were immersed for 30 minutes in sucrose solutions of different concentrations. The shapes of the strips observed are as seen below.

Which strips were immersed in hypertonic solutions?



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

26. Some students want to compare the rate of evaporation of two liquids. What must they do to ensure a fair test?

- A use equal volumes of the two liquids
- B use two liquids of same colour
- C place the liquids in evaporating dishes
- D carry out the experiment in a laboratory

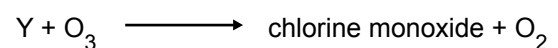
27. Which of the following causes the greenhouse effect?

- A The absorption of sunlight by Earth and reflection of heat energy into the atmosphere
- B Burning of fossil fuels releases gases which dissolve in water vapour to become acid rain
- C The flow of excess fertilisers into ponds results in eutrophication
- D The release of excess carbon dioxide into the atmosphere causes infrared rays to be trapped

28. What are the products produced in the light reaction which are then used in the dark reaction?

- A Oxygen atoms
- B Hydrogen atoms
- C Glucose
- D Water

29. The following reaction represents the breakdown of ozone in the stratosphere.



What is represent by Y?

- A Chlorine
- B Fluorine
- C Carbon dioxide
- D Sulphur dioxide

30. The stomach of a cow consists of four cavities. Which of the following is the true stomach of the cow ?
- Rumen
  - Abomasum
  - Reticulum
  - Omasum
31. The enzymes is an organic catalyst which is specific in its actions. Which of the following explains the above statement ?
- Enzyme is easily denatured
  - Enzyme is not soluble in the body fluid
  - The active site of an enzyme is specific to a certain substrate
  - Enzyme is an organic substance
32. The thigh muscle attached to the bone is called...
- tibia
  - femur
  - humerus
  - tarsus
33. What is the function of the synovial fluid found in joints which hold bones together ?
- Lubricates the joints to reduce the friction between the ends of bones
  - Prevents the bones from wearing away
  - Binds two bones to form a joint
  - Connects the ligaments to a bone
34. Which of the following is part of the axial skeleton of humans ?
- Femur
  - Scapula
  - Pelvic girdle
  - Cervical vertebrae
35. Which of the following blood components is involved in the body's defence against diseases ?
- Platelet
  - Fibrinogen
  - Antibody
  - Erythrocyte
36. Which of the following cells are present in both the xylem and phloem?
- Vessels
  - Sieve tube
  - Parenchyma
  - Companion cell
37. Which of the following events occur during meiosis I ?
- Crossing over
  - The homologous chromosomes assemble at the metaphase plate
  - Paired chromatids separate
  - Pairing of the homologous chromosomes
- I, II and III only
  - I, II and IV only
  - II, III and IV only
  - I, II, III and IV
38. The information below shows the stages of the blood clotting mechanism in humans.
- P - Fibrinogen changes into fibrin

Q- Clumped platelets

R- Meshwork of threads are formed over the wound

S- Release of thrombokinase

T- Prothrombin changes into thrombin
- Which is the correct sequence of the blood clotting mechanism?
- S, T, Q, P, R
  - P, Q, R, S, T
  - Q, S, T, P, R
  - Q, P, S, T, R



39. 
  - Defends the body against infection
  - Returns excess tissue fluid to the blood

The above statement refers to the.....

- A endocrine system  
 B lymphatic system  
 C muscular system  
 D excretory system
40. A solution with a higher concentration of water as compared to the contents of a cell is known as...
- A a hypotonic solution  
 B a hypertonic solution  
 C an isotonic solution  
 D a saline solution
41. Which of the following is correct concerning making a hypothesis ?
- A Making a guess about an event based on collected data  
 B Stating a tentative generalisation which is subjected to testing by one or more experiments  
 C Performing a series of data-gathering processes  
 D Grouping of objects or events
42. Enzymes are \_\_\_\_\_ produced by living things.
- A lipids  
 B glycerol  
 C proteins  
 D carbohydrates
43. During transpiration, water molecules which escape from the surface of the leaves draw other water molecules from the mesophyll cells.
- Which phenomenon best describes this process?
- A Capillary action  
 B Transpirational pull  
 C Cohesive force  
 D Root pressure

44. All the following animals have a double closed blood circulatory system that is incomplete except

- I cow  
 II fish  
 III grasshopper  
 IV frog

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

45. Which statements explain the opening and closing mechanism of the stoma?

- I During the day, the guard cells become hypertonic and water enters the cells by osmosis, causing the stoma to open.  
 II At night, the rate of transpiration is higher than the rate of photosynthesis  
 III At night, the guard cells become flaccid and the stoma closes  
 IV During the day, the glucose concentration is high and this causes the stoma to close

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

46. Which adaptations help the villi to absorb nutrients effectively?

- I Abundant in number  
 II Thin walls  
 III Blood capillaries  
 IV Lacteals to absorb fatty acids and glycerol

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

47. Which of the characteristics enable the xylem tissue to carry out its function efficiently?

- I The end walls of the vessels are perforated with pores
  - II The tissue consists of hollow vessel joined end to end
  - III Its strong and impermeable walls are thickened with lignin
  - IV It has a continuous tube system from the roots to the leaves
- A III and IV only
  - B I, II and III only
  - C II, III and IV only
  - D I, II, III and IV

A frog's locomotion characteristics include :

- I having strong and long back legs
  - II having back legs folded in a 'Z' shape
  - III having big and strong back leg muscles
  - IV having a curved back bone that straightens very fast
- A II and IV only
  - B I, II and III only
  - C I, II and IV only
  - D I, II, III and IV

Which statements are true about muscle contractions?

- I The interaction between actin and myosin brings about muscle contractions
  - II Muscle contractions require energy in the form of adenosine triphosphate
  - III Muscle contractions occur in response to nerve impulses from the nervous system
  - IV Muscle contractions are independent of the action of antagonistic muscles
- A I, II and III only
  - B I, II and IV only
  - C II, III and IV only
  - D I, II, III and IV

50. Pitcher plants have structures to catch insects for food.

These insectivorous plants

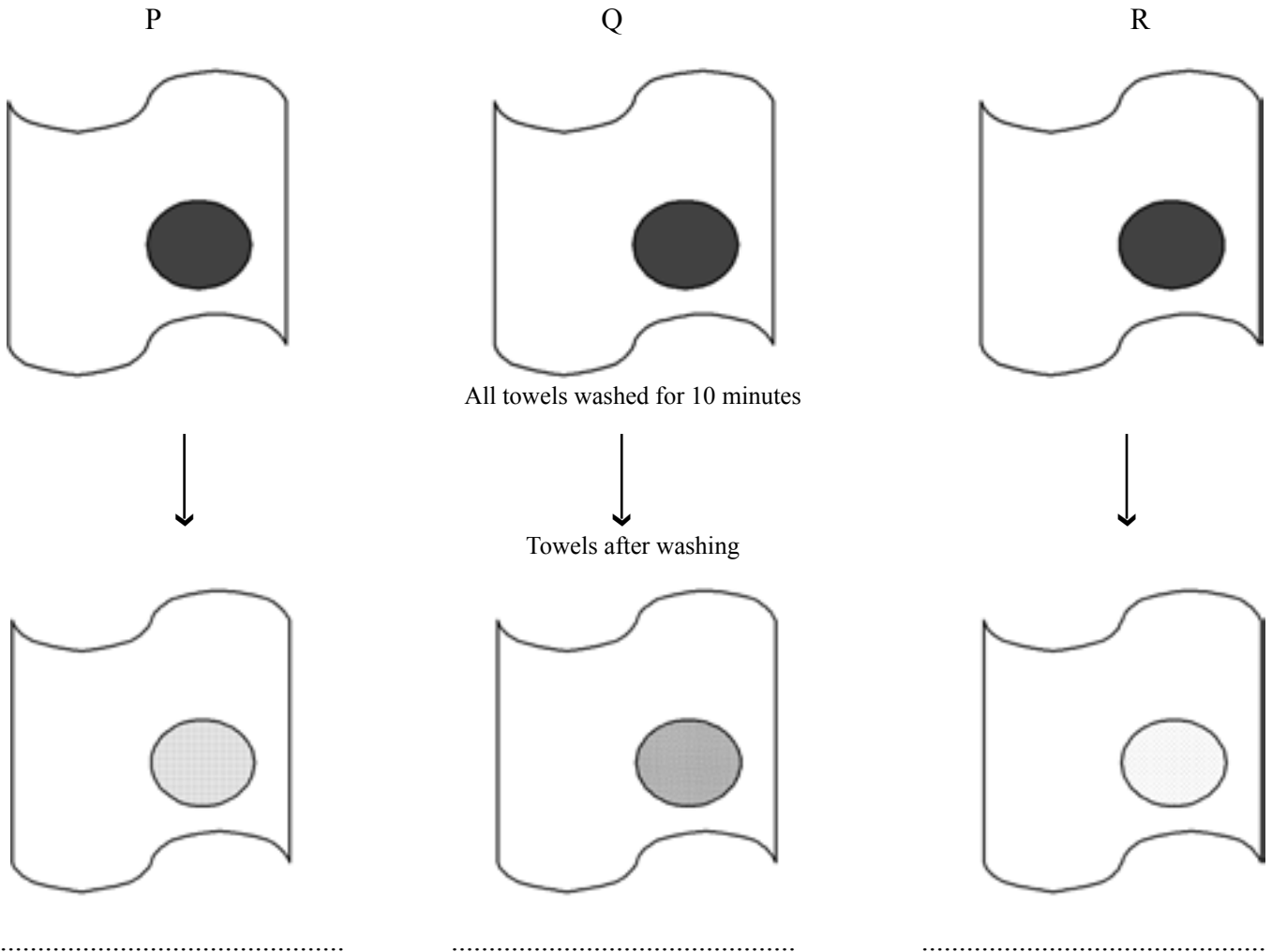
- I are heterotrophs
  - II are parasites
  - III carry out autotrophic nutrition
  - IV carry out holozoic nutrition
- A I and II only
  - B I and IV only
  - C II and III only
  - D II and IV only



**BIOLOGY PAPER 2**  
**4551/2**

**[ SECTION A ]**

1. The diagram below shows details of an experiment in which three similar towels P, Q and R with identical fat stains, were washed in an enzyme-containing washing powder at three different temperatures, 10°C, 38 °C and 63 °C.



**Diagram 1**

- (a) (i) Complete the diagram to show the temperature at which each towel was washed.  
[3 marks ]

- (ii) Explain your answer for each towel.

.....  
 .....  
 .....

[3 marks ]

- (ii) What is an enzyme?

.....  
 .....

[2 marks]



(b) Suggest two changes to the procedure which might have resulted in the complete removal of the stain from towel R.

(i) .....

(ii) .....

[2 marks]

(c) Name the enzymes likely to be in the powder.

[1 mark]

(d) Suggest an enzymes that is efficient in removing blood stains.

[1 mark]

2. The diagram compares the relationship between hormonal levels with the development of follicles and changes in the thickness of the uterine lining

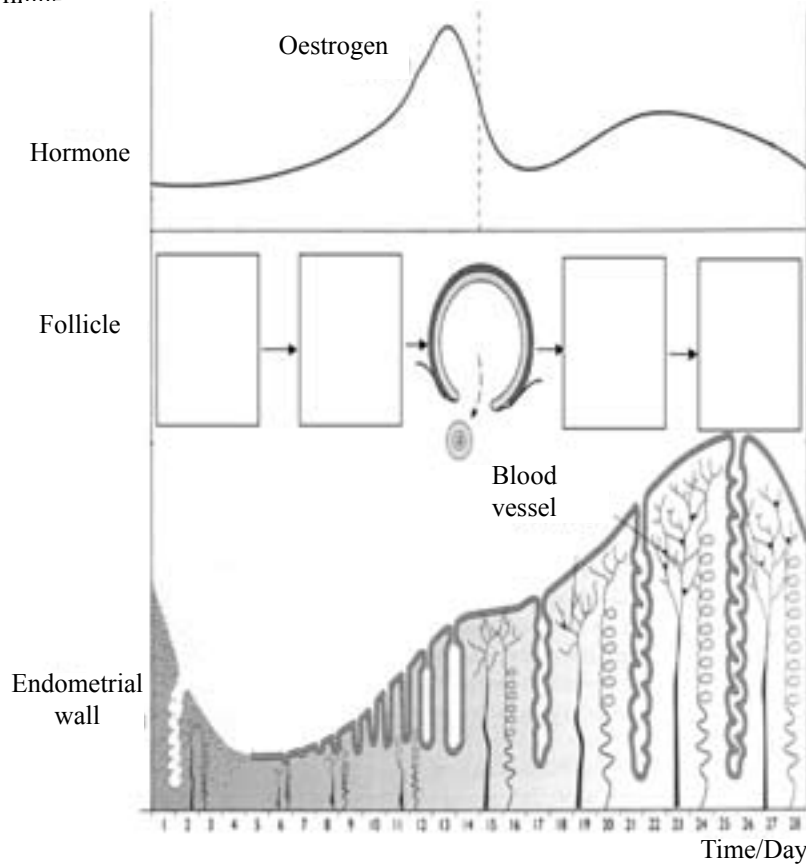


Diagram 2

(a) In the diagram, draw the graph to show changes of hormonal level of :

(i) Luteinising hormone (LH)

(ii) Progesterone

[2 marks]

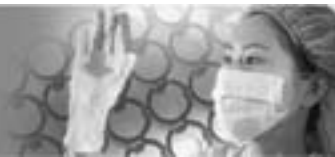
(b) In the diagram complete the follicle development in the spaces provided.

[2 marks]

(c) Based on the diagram, explain briefly the relationship between the follicle development and the levels of progesterone in stimulating the thickening of the endometrium.

.....  
.....  
.....

[4 marks]



(d) When the endometrium becomes thicker the number of blood vessels also increases. Explain briefly the relationship between those two factors.

.....  
 .....  
 [2 marks]

(e) What is the problem that is usually faced by a woman who cannot conceive because her ova cannot be fertilised by her husband's sperm?

.....  
 .....  
 [2 marks]

3. Diagram 3 shows the longitudinal section of the human heart.



Diagram 3

(a) Name the parts labelled

P : .....  
 Q : .....  
 R : .....  
 [3 marks]

(b) What are the functions of the valves in the heart?

.....  
 .....  
 [2 marks]

(c) (i) State the difference between the walls of the left ventricle and the right ventricle of the heart.

..... [1 mark]

(ii) Explain a reason.

.....  
 .....  
 [2 marks]

(d) Do the contractions of the cardiac muscle need to be stimulated by the nerve impulses? Explain your answer.

.....  
 .....  
 [2 marks]

(e) What is the circulating blood-like fluid found in some invertebrates with open circulatory systems such as the grasshopper?

..... [1 mark]

(f) State two characteristics of the circulatory system of a fish.

.....  
 .....  
 [2 marks]



4. Diagram 4 shows the structure of the functional unit of the kidneys.

(a) Name the functional unit of the kidneys.

.....  
 .....  
 ..... [1 mark]

(b) Label parts indicated

K : ..... M : .....

L : ..... N : .....  
 [4 marks]

(c) Explain what causes ultrafiltration to occur between structure K and L.

.....  
 .....  
 ..... [1 mark]

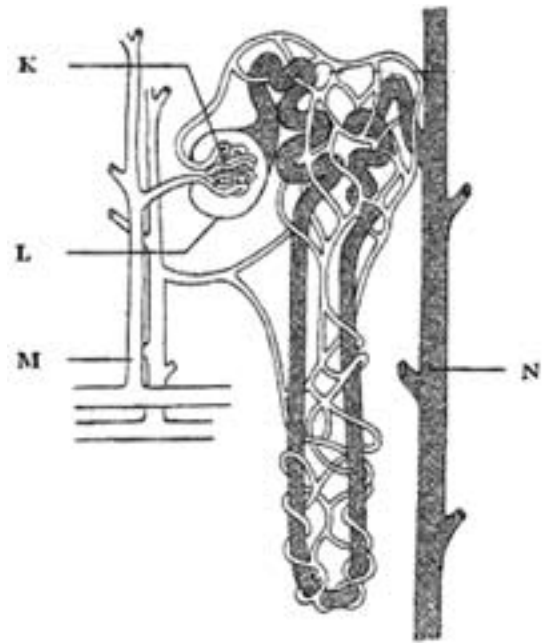


Diagram 4

(d) (i) Name the final product of secretion found in N.

..... [1 mark]

(ii) There are substances found in higher concentration in the liquid N than in M. Name two of them.

..... [2 marks]

(e) A hormone is released from a gland situated inferior to the hypothalamus; it is involved in the mechanism of osmoregulation in the blood. Name

(i) the gland : .....

(ii) the hormone : ..... [2 marks]

(f) Predict what will happen if the hormone cannot be secreted by the gland.

.....  
 ..... [1 mark]

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5. Diagram 5.1 is a schematic representation of the main components in the nervous pathway; while Figure 5.2 shows a synapse.

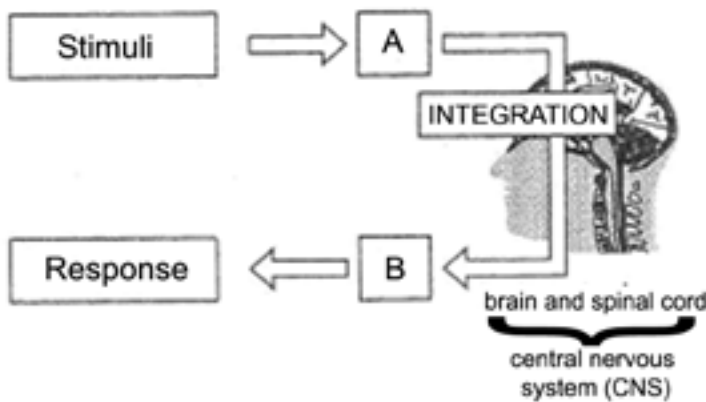


Diagram 5.1

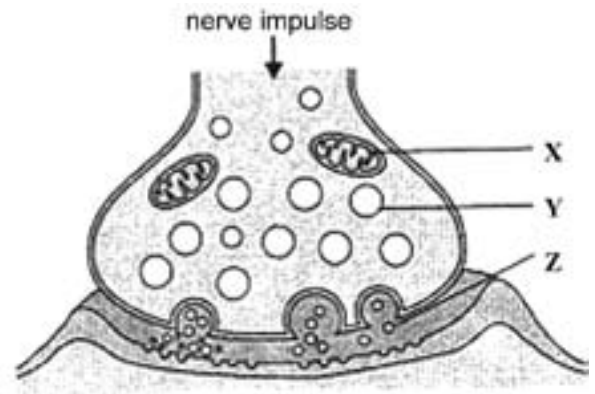


Diagram 5.2

(a) What is A and give an example of where it is located.

..... [2 marks]

(b) After being stimulated, how is information from A sent to the central nervous system?

..... [2 marks]

(c) What is structure B? Suggest one example of structure B.

..... [2 marks]

(d) (i) What is structure Y?

..... [1 mark]

(ii) Structure Y releases substance Z into the synaptic cleft. Name substance Z.

..... [1 mark]

(e) Discuss briefly the transmission of nerve impulses across the synapse.

..... [3 marks]

(f) What is the function of X?

..... [1 mark]

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[ SECTION B ]

6.



Diagram 6

The diagram above shows various types of polypeptides.

- a) (i) Name the structure P, Q and R. [3 marks]
- (ii) Describe the various structure of protein as shown above. [6 marks]
- b) Explain the meaning of ‘intracellular enzymes’ and ‘extracellular enzymes’ by giving the named examples. [4 marks]
- c) Enzymes play important roles in our daily life, whether be at home or in the industry. Discuss some applications of these enzymes.

7.

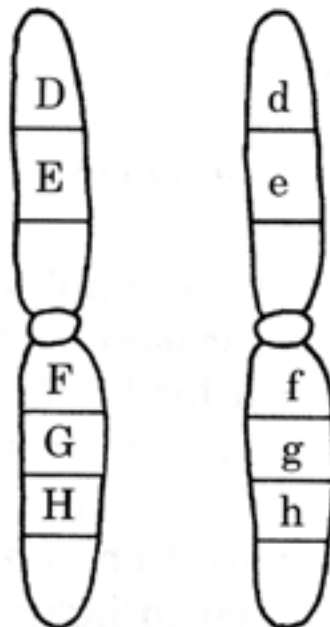


Diagram 7

The diagram above shows a pairing of homologous chromosomes and alleles.

- a) Compare the following with suitable examples: [7 marks]
  - (i) Genes and alleles.
  - (ii) Dominant allele and recessive allele. [8 marks]
- b) State Mendel’s First Law and Second Law. [2 marks]
- c) With the help of a suitable chart, explain how sex chromosomes decide the sex of humans. [10 marks]

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## [ SECTION C ]

8. a) Describe the process of assimilation of digested food and the importance of liver in the process. [5 marks]
- b) Ileum, the last part of the small intestine, is the major site of nutrient absorption.
- (i) Explain how ileum is adapted for this highly specific function. [7 marks]
- (ii) Draw and label the structure of villus. [4 marks]
- (iii) Name all fat-soluble vitamins. [2 marks]
- c) Explain how bad eating habits can cause a named health problem. [2 marks]
9. a) The human skeleton is indeed a wonderful system serving many purposes. Discuss the functions of the human skeleton. [6 marks]
- b) Explain the adaptation of the skeletal system of grasshopper for the movement. [8 marks]
- c) Fishes have to face certain problems when moving in water. Describe the problems and how each problem is overcome. [6 marks]

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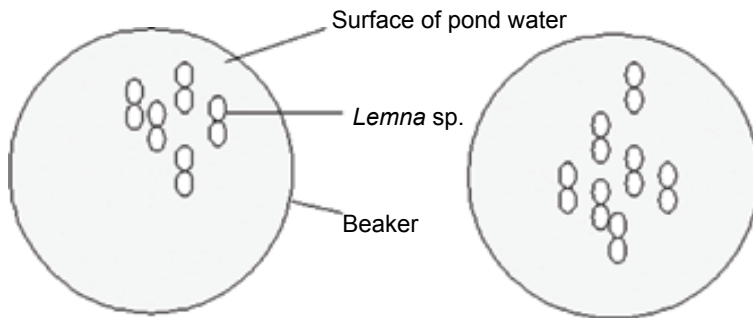


**BIOLOGY PAPER 3**

2. An experiment was carried out by 40 students of SMK Taman Sri Cahaya to study the growth of Lemna sp. The following were the procedure for the experiment:
- A small beaker was filled with some pond water.
  - Five Lemna sp. were placed in the beaker.
  - The number of Lemna sp. (each Lemna sp. consists of a frond) in the beaker was counted every two days.
  - The diagram below shows the number of Lemna sp. in the beaker from the beginning of the experiment (Day 0) until day 14.

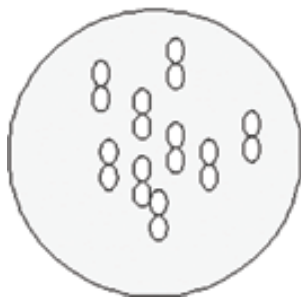
(a) In the diagram, record the number of Lemna sp. starting from day 2 until day 14 in the spaces provided.

[ 3 marks ]

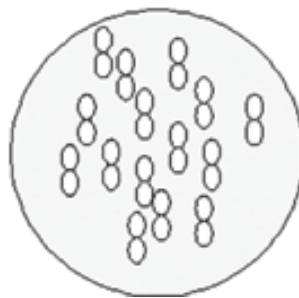


Day 0 : Number of Lemna sp.= 10

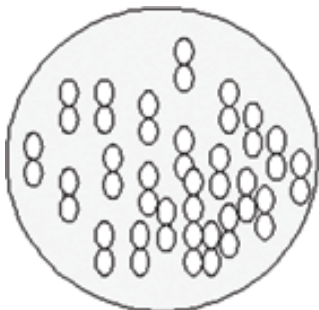
Day 2 : Number of Lemna sp.= \_\_\_\_\_



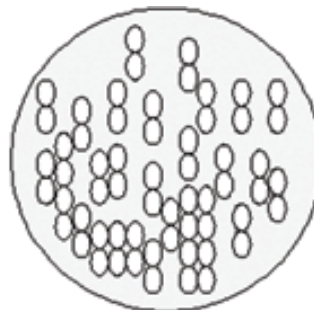
Day 4 : Number of Lemna sp.= \_\_\_\_\_



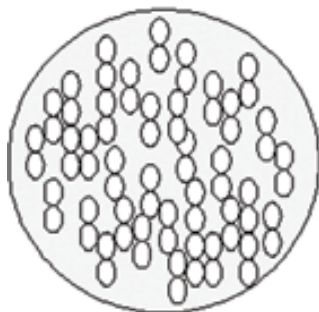
Day 6 : Number of Lemna sp.= \_\_\_\_\_



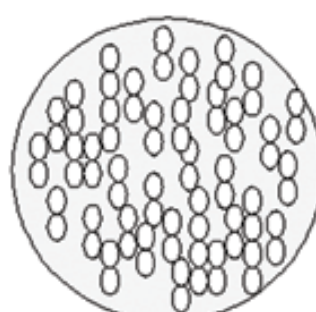
Day 8 : Number of Lemna sp.= \_\_\_\_\_



Day 10 : Number of Lemna sp.= \_\_\_\_\_



Day 12 : Number of Lemna sp.= \_\_\_\_\_



Day 14 : Number of Lemna sp.= \_\_\_\_\_

2. (b) Construct a table to record the results of this experiment. Your table must have the following headings :

- Number of Lemna sp.
- Time

[ 3 marks ]

(c) (i) State one general observation made from the table in (b).

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[ 3 marks ]

(ii) State one inference concerning the composition of pond water from the observation in (c) i.

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[ 3 marks ]

(d) Plot a graph to display your results in (b).

[ 3 marks ]

(e) State two different observations made from your table in (b).

1. ....

2. ....

[ 3 marks ]

(f) (i) State one inference for the first six days of population growth as seen in (d).

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[ 3 marks ]

(ii) State one inference from the last two days of population growth as seen in (d).

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[ 3 marks ]

(g) State the variables in this experiment :

(i) Manipulated variable: .....

(ii) Responding variable: .....

(iii) Controlled variable: .....

[ 3 marks ]

(h) State the hypothesis for this experiment.

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[ 3 marks ]

(i) In the experiment, if the small beaker with pond water is replaced by a larger beaker containing river water, predict what will happen?

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[ 3 marks ]