

HONG KONG EXAMINATIONS AUTHORITY  
HONG KONG CERTIFICATE OF EDUCATION EXAMINATION 1985

生物 試卷一  
**BIOLOGY PAPER I**

8.30 am–10.00 am (1½ hours)

This paper must be answered in English

Attempt **THREE** questions only.

All questions carry equal marks.

1. (a) The drawings on the opposite page show a variety of organisms living in different habitats.

(i) Organisms *A*, *B* and *C* are normally found in the same kind of habitat. What is this habitat ?

(ii) With reference to drawings *A* to *K*, state

- (1) the structure for locomotion possessed only by *D* and *E*.
- (2) the structure for perpetuation of species possessed only by *F* and *G*.

(iii) Name the major animal or plant group to which each of the following organisms belongs :

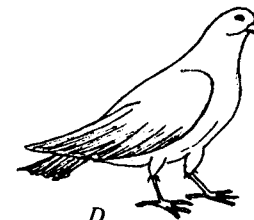
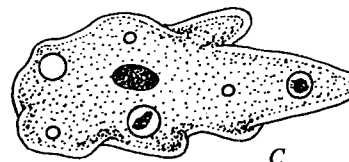
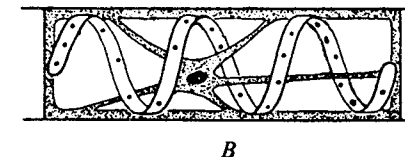
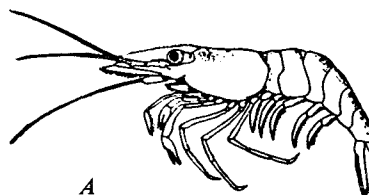
- (1) *D*
- (2) *E*
- (3) *F*
- (4) *G*

(iv) State one external feature which is useful for classifying each of the following organisms :

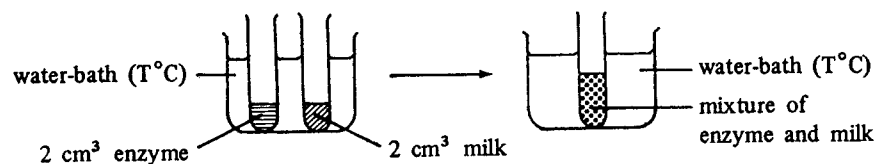
- (1) *H*
- (2) *J*
- (3) *K*

(8 marks)

( The organisms are not drawn to the same scale.)



1. (b)



The diagram above shows a set-up of an experiment to investigate the effect of temperature on the action of an enzyme for coagulating milk. The enzyme and the milk were first kept in separate test-tubes in a water-bath (at  $T^{\circ}\text{C}$ ) for 15 minutes before they were mixed. The resulting mixture was kept in the same water-bath and the time taken for the mixture to coagulate was noted. The experiment was repeated by using water-baths of different temperatures and the corresponding times taken for the mixture to coagulate are shown in the table below :

Set	Temperature of water-bath ( $T^{\circ}\text{C}$ )	Time taken for coagulation (minutes)
A	10	$\infty$ (no coagulation)
B	20	7.0
C	30	4.0
D	40	1.5
E	50	4.0
F	60	$\infty$ (no coagulation)

- (i) Why would the results be more accurate when the enzyme and milk were kept in the water-baths for 15 minutes before mixing ?
- (ii) Compare and explain the results shown in sets B and D.
- (iii) State and explain whether there would be any change in the results
  - (1) if the mixture in set A were warmed to  $30^{\circ}\text{C}$ .
  - (2) if the mixture in set F were cooled to  $30^{\circ}\text{C}$ .
- (iv) State one factor, other than temperature, that can affect the activity of enzymes.

(9 marks)

1. (c) Equal numbers of pea seedlings of the same age and size were planted in pots *A*, *B*, *C* and *D*, each containing equal amounts of pure sand. The sand in each pot was given a different treatment :

pot *A* — a certain amount of fresh garden soil added.  
 pot *B* — the same amount of baked garden soil added.  
 pot *C* — nitrate added.  
 pot *D* — nothing added.

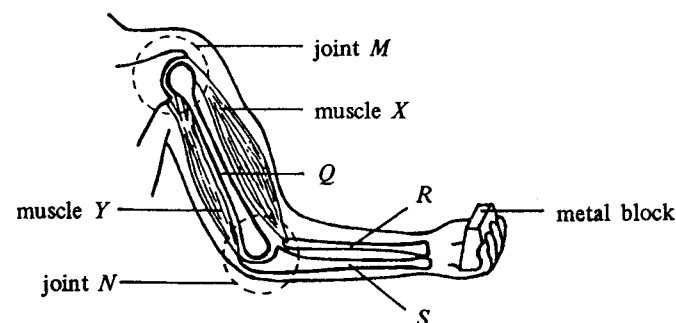
After some days, the seedlings were removed and their dry weights determined. The results are shown in the table below :

Pot	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Dry weight (g)	16.4	0.9	16.3	0.8

- (i) (1) What is meant by the 'dry weight' of the pea seedlings ?  
 (2) State one major compound that builds up the dry weight of the pea seedlings.
- (ii) State and explain the effect of the treatment given to  
 (1) pot *A*.  
 (2) pot *B*.
- (iii) State the purpose of setting up pot *D* as a control.
- (iv) If the experiment were to be repeated using maize seedlings instead of pea seedlings, the difference in dry weights obtained in pots *A* and *B* would be less. Give one reason for this.
- (v) Based on the results of these experiments, what two methods would you suggest to farmers for increasing the yield of their crops ?

(13 marks)

2. (a) The diagram below shows the arm muscles and bones of a man :



- (i) Both muscles *X* and *Y* are involved in raising the metal block.  
 (1) Which is the extensor ?  
 (2) Which is the flexor ?  
 (3) What is the term used for describing this pair of muscles for this mode of action ?
- (ii) What is the tissue connecting  
 (1) bone *Q* to bone *S* ?  
 (2) muscle *X* to bone *R* ?
- (iii) After rotating the arm vigorously for some time, the man felt tired.  
 (1) Which joint, *M* or *N*, was involved in this movement ?  
 (2) Which carbon compound, stored in the muscles, was used to provide the energy for this movement ?  
 (3) Which carbon compound, accumulating in the muscles, caused muscle fatigue ?
- (iv) If the man were blindfolded, what type of sensory receptor would enable him to detect a drawing pin dropped on his hand  
 (1) with its blunt end downwards ?  
 (2) with its pointed end downwards ?

(10 marks)

2. (b) The table below shows the different amounts of air breathed out by a young man :

	Breaths per minute	Volume (cm <sup>3</sup> ) of a single expiration / exhalation
Before exercise	19	500
After exercise	36	1100

- (i) From the above data, state two changes in breathing as a result of performing exercise.
- (ii) In order to bring about the changes in (i), state
- (1) the part of the brain involved.
  - (2) the stimulus concerned.
  - (3) the two effectors responsible.
- (iii) What is the volume of air breathed out per minute
- (1) before exercise ?
  - (2) after exercise ?
- (iv) If the percentage by volume of oxygen is 20% in atmospheric air and 16% in expired air, what is the volume of oxygen retained in the body per minute
- (1) before exercise ?
  - (2) after exercise ?

(10 marks)

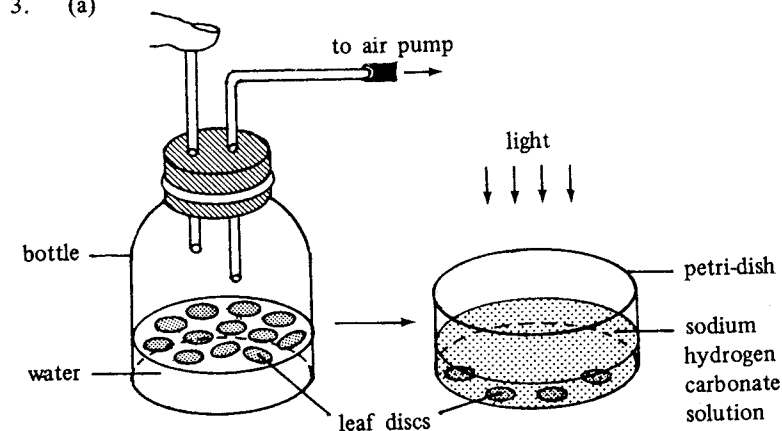
2. (c) An experiment was conducted to study the relationship between the rate of transpiration and the number of stomata on a dorsi-ventral leaf from two plants, *A* and *B*. A student placed identical strips of dry cobalt chloride papers on both surfaces and recorded the time taken for the paper to change colour. The number of stomata on the epidermis of the leaves was then counted. The results obtained are shown in the table below :

Plant	<i>A</i>		<i>B</i>	
Leaf surface	upper	lower	upper	lower
Time (minutes) taken for cobalt chloride paper to change colour	7	1	more than 60	6
Number of stomata/mm <sup>2</sup>	0	170	0	10

- (i) Draw a labelled diagram to show the appearance of a stoma and its neighbouring cells on a leaf surface as seen under the high power magnification of a microscope.
- (ii) Why should identical strips of cobalt chloride paper be used ?
- (iii) State the colour of the cobalt chloride paper
- (1) when dry.
  - (2) when wet.
- (iv) Give one possible reason why the rate of transpiration from the upper leaf surface of plant *A* is much greater than that of plant *B*.
- (v) State the conclusion that could be drawn from the results shown by the lower leaf surfaces of plants *A* and *B*.
- (vi) In what type of terrestrial habitat would you expect to find plant *B* ?

(10 marks)

3. (a)



The diagram above shows the apparatus used in an experiment on photosynthesis. The leaf discs were punched from the same dicotyledonous leaf and were put in a bottle. Air trapped in the discs was removed by means of an air pump until all the discs sank to the bottom.

Equal numbers of leaf discs were then transferred to separate petri-dishes containing sodium hydrogen carbonate solutions of different concentrations.

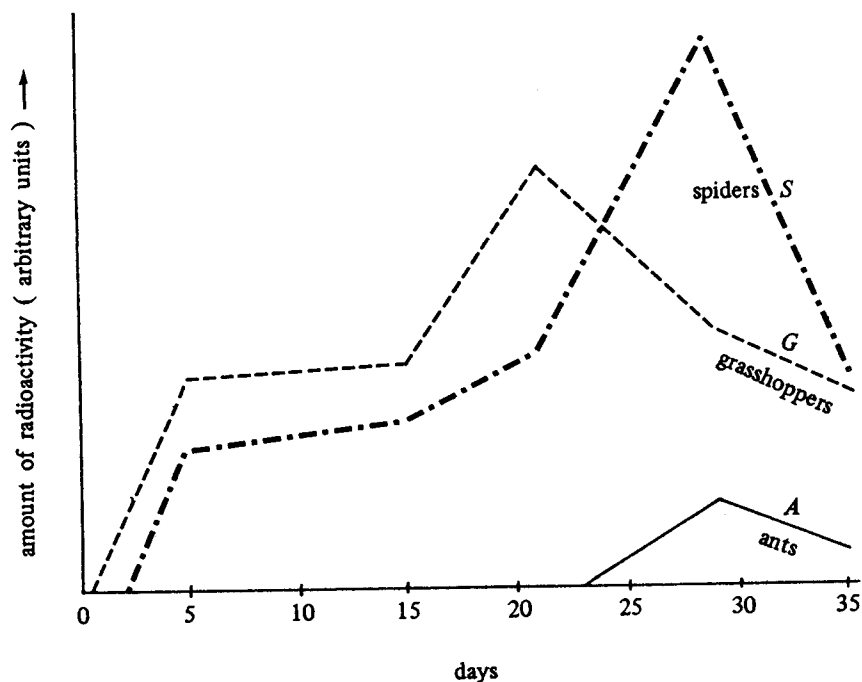
All dishes were exposed to light of the same intensity. The time required for all discs in each petri-dish to rise to the surface was measured for calculating the rate of photosynthesis as shown in the table below :

Concentration of sodium hydrogen carbonate solution (%)	Time (T) for the leaf discs to rise to the surface (seconds)	Rate of photosynthesis in terms of $1/T$ (second <sup>-1</sup> )
0	$\infty$	0
0.10	135	$7.4 \times 10^{-3}$
0.20	105	$9.5 \times 10^{-3}$
0.30	90	$11.1 \times 10^{-3}$
0.40	83	$12.0 \times 10^{-3}$
0.50	83	$12.0 \times 10^{-3}$

- Using graph paper, draw a curve to show the relationship between the rate of photosynthesis and the concentration of sodium hydrogen carbonate solution.
- Describe the relationship shown by the curve drawn in (i).
- Before transferring the leaf discs to the sodium hydrogen carbonate solution, why was it necessary to remove the air so that they all sank ?
- Explain why the leaf discs
  - failed to rise in 0% sodium hydrogen carbonate solution.
  - rose in the solutions of other concentrations.
- Why would the results be less accurate if the discs were punched from the mid-rib region of the leaf ?
- If the experiment were to be repeated with the same number of leaf discs, suggest one way to shorten the time to obtain the results.

(15 marks)

3. (b) Radioactivity was first detected from decaying organic matter hidden in a pile of rubbish, and it was later detected in green plants growing nearby. Some time later, animals living in the same area were also found to have radioactivity. The amounts in each kind of animals are shown in the sketch below :



- (i) Which two types of organisms are responsible for the decay of organic matter ?
- (ii) If radioactivity is emitted from radioactive carbon atoms, which radioactive compound would be produced by the process of decay ?
- (iii) Briefly describe how the compound in (ii) is incorporated into the green plants.
- (iv) With reference to the sketch, which animal first took up the radioactivity ?  
By what means did it acquire the radioactivity ?
- (v) State the reason why (1) curve *S* lags behind curve *G*, and  
(2) curve *S* reaches a higher peak than curve *G*.
- (vi) Deduce the diet of (1) grasshoppers, and  
(2) spiders.
- (vii) Suggest one possible reason why the ants took up the radioactivity at a later stage.
- (viii) Which two living processes may have led to the decrease of radioactivity as shown in curves *A*, *G* and *S* ?

(15 marks)

4. (a) Diagram *I* below shows the connection between a freshly-dissected mammalian heart and lungs. Two of the blood vessels of the heart are connected to two separate bottles containing the same coloured liquid.

(The parts are not drawn to the same scale.)

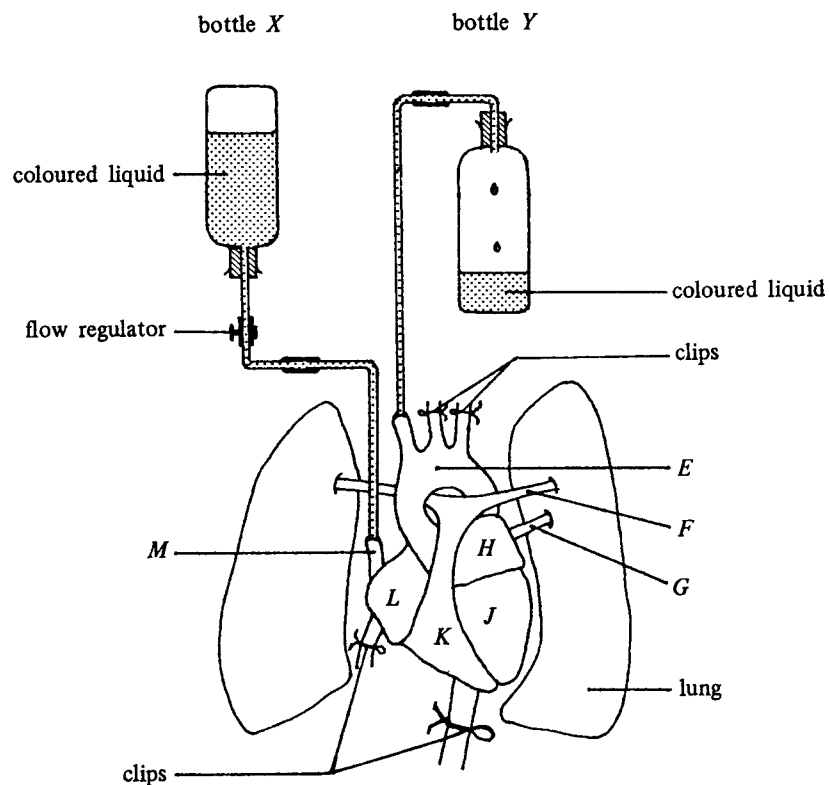


diagram *I*

Diagram *II* below shows the valves present inside the heart.

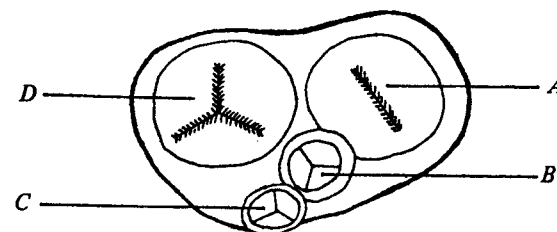


diagram *II*

- (i) Using the letters in diagram *I*, indicate the route for the coloured liquid from bottle *X* to reach bottle *Y*, if the liquid is introduced into *M*.
- (ii) In diagram *II*, name the valve and state the direction of the valve movement when blood is flowing through
  - (1) *C*.
  - (2) *D*.
- (iii) If the liquid is introduced to *E* by inverting bottle *Y*, state and explain whether or not the liquid can reach bottle *X*.
- (iv) Compare and explain the oxygen content of the blood in vessels *F* and *G* in a living mammal.

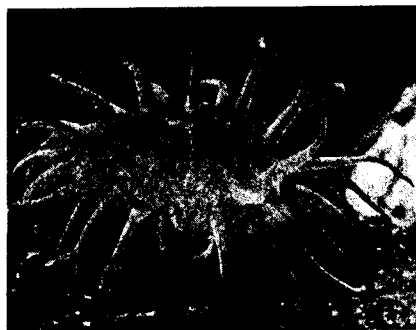
(9 marks)



4. (b) The following photographs show six different organisms *A* to *F*.  
(The organisms are not shown to the same scale.)



*A*



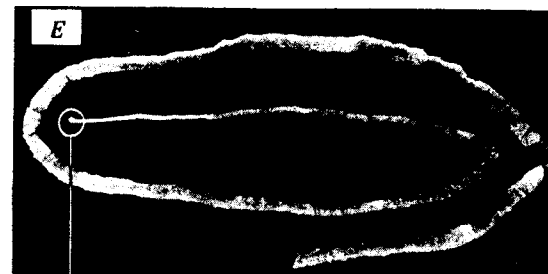
*B*



*C*



*D*



*W*



region *W*  
(magnified)



- (i) (1) What type of association may be formed if organisms *A* and *B* live together?
- (2) State one advantage gained by each partner from this type of association.
- (3) Can *A* and *B* both survive if they are separated from each other?
- (ii) (1) What type of association may be formed if *C* and *D* live together?
- (2) Point out two features of *C* that enable it to associate with *D*.
- (iii) State one structure in region *W*, which is used by *E* for attachment to the inside of *F*.
- (iv) State one structural feature of *E*, which is adapted for absorbing food from *F*.

(9 marks)

4. (c) The table below shows an analysis of the food taken by a 15-year-old boy during the course of one day :

Meal	Food taken	Food components					Energy obtained (kJ)
		carbohydrate (g)	fat (g)	protein (g)	vitamin C (mg)	roughage (g)	
Breakfast	hot dog milk	105	26	18	0	0.5	3105
Lunch	fried chicken leg potato chips soft drink	65	33	45	0	1	3238
Supper	barbecued pork rice	108	15	36	0	1	3000
Daily total		278	74	99	0	2.5	9343

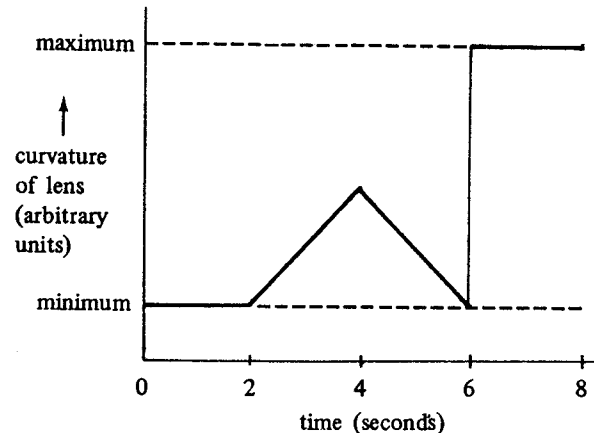
- Apart from water, which essential inorganic component of a balanced diet is not listed in the table ?
- Of the food taken for lunch and supper, which one would provide the largest proportion of carbohydrate ?
- The normal daily requirement of protein and energy recommended for such a boy is 70 g and 11700 kJ respectively.
  - Describe what happens to the excess protein in his body.
  - How can extra energy be derived from his body to meet his daily requirement ?
- It is suggested that oranges should also be taken in order to make up for the deficiency of two of the food components listed.
  - Give two reasons supporting this suggestion.
  - State two kinds of disorder he would suffer as a result of a long term deficiency of such food components.

(12 marks)

5. (a) A young lady, with one of her eyes covered, is using her uncovered normal eye to observe, at random and one at a time, the following objects within a period of eight seconds :

- (W) a stationary object nearby  
 (X) a stationary object far away  
 (Y) an object approaching her  
 (Z) an object moving away from her

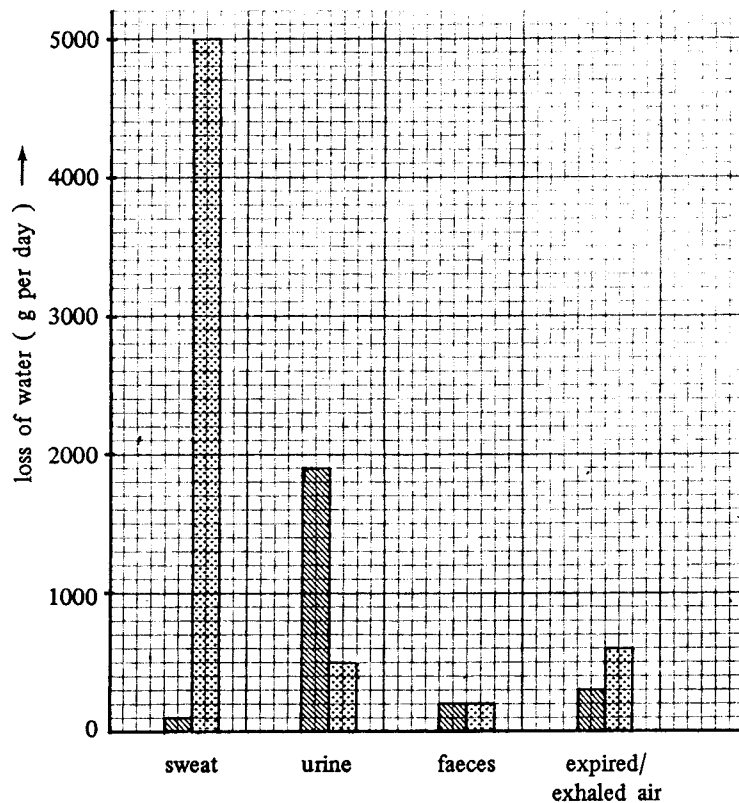
The change in the curvature of the lens of the uncovered eye during these eight seconds is shown in the sketch below :



- Using the letters (W), (X), (Y) and (Z), indicate which object is being observed during the following periods :
  - 0 – 2 seconds
  - 2 – 4 seconds
  - 4 – 6 seconds
  - 6 – 8 seconds
- What is the state of the suspensory ligaments of the uncovered eye
  - for observing object (W) ?
  - for observing object (X) ?
- Which structure, other than the suspensory ligament in the eye, is responsible for changing the curvature of the lens ?
- Draw a simple diagram to show the path of the light rays when the eye was watching object (X).

(9 marks)

5. (b) A person was confined to the same environmental conditions and was given a similar diet for two days. He rested completely on one day and performed exercises on the other. The weight of water lost from the different parts of his body in each day is shown in the chart below :

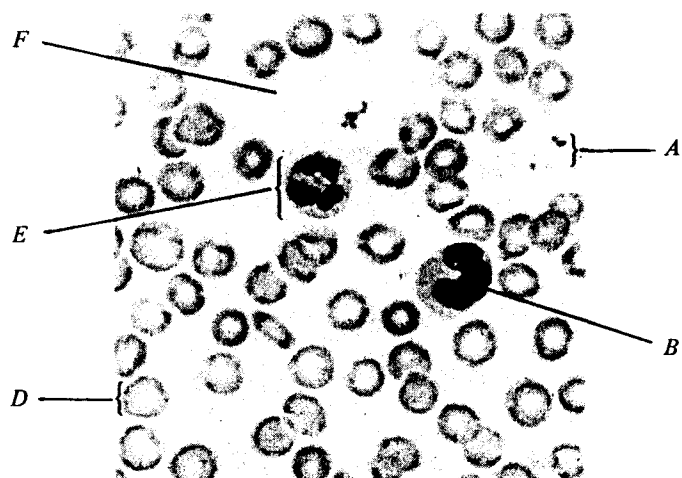


Key : day of rest day of exercise

- (i) State any two environmental conditions that should be kept constant during these two days.
- (ii) Name the part of the body which produces
  - (1) sweat.
  - (2) urine.
- (iii) What is the total weight of water lost from the body
  - (1) on the day of rest ?
  - (2) on the day of exercise ?
- (iv) On the day of exercise, what is the advantage of producing
  - (1) more sweat ?
  - (2) less urine ?
- (v) Explain why the amount of water lost in the faeces was the same for these two days.
- (vi) Suggest a simple way to show that expired air contains water vapour.

(10 marks)

5. (c) The photomicrographs below show cells in a human blood smear and a root tip squash :



- (i) Identify *A*, *B* and *C*.

- (ii) State one function each of *A*, *D* and *E*.

- (iii) (1) What is the liquid occupying space *F*?

- (2) State one inorganic and one organic component found in the liquid.

- (iv) Cells *X*, *Y* and *Z* are undergoing cell division. Arrange them in the correct sequence according to the stages of mitosis.

(11 marks)

END OF PAPER