

HONG KONG EXAMINATIONS AUTHORITY

HONG KONG CERTIFICATE OF EDUCATION EXAMINATION 1986

生物 試卷一
BIOLOGY PAPER I

8.30 am–10.00 am (1½ hours)

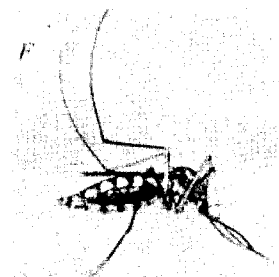
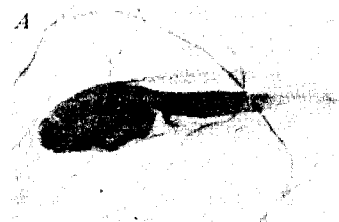
This paper must be answered in English

Attempt **THREE** questions only.

Each question consists of three parts.

All questions carry equal marks.

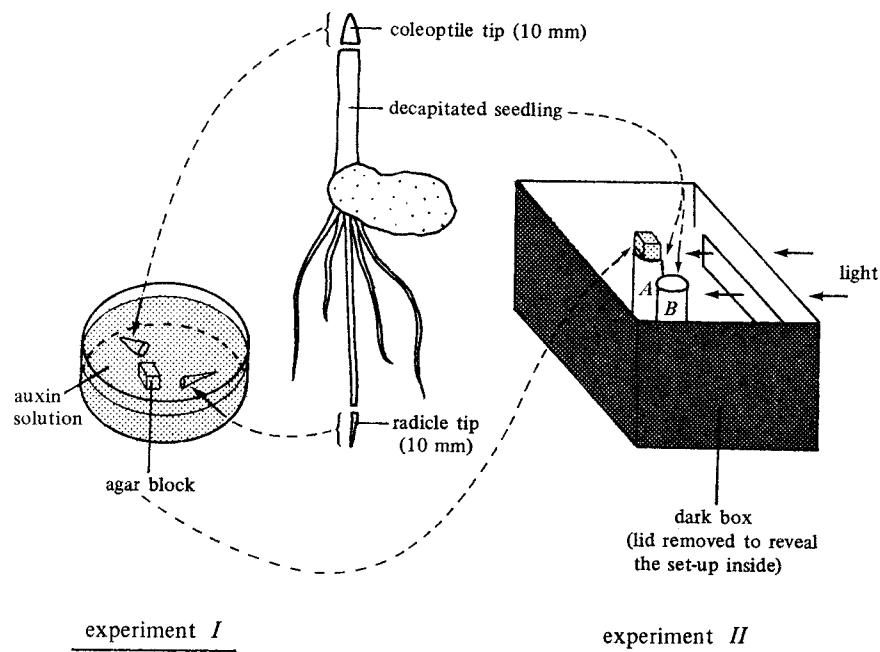
1. (a) The different stages in the life history of the mosquito and the frog are shown below :
(The organisms are not shown to the same scale.)



- (i) State the term which describes the series of changes by which the mosquito or frog larvae develop into adults.
- (ii) Using the letters marked on the photographs, arrange the stages in the correct sequence of development for the
 - (1) mosquito.
 - (2) frog.
- (iii) Both the mosquito and the frog leave the aquatic habitat after becoming adults. State one advantage gained by the change in habitat.
- (iv) In what way is the frog beneficial to man ?
- (v) (1) Give one reason why the mosquito is harmful to man.
 (2) Suggest two methods of controlling this pest.

(8 marks)

1. (b) The diagram below shows two experiments to study the effect of auxins on the growth of oat seedlings.
 In experiment *I*, the tips of radicles and coleoptiles measuring 10 mm were removed and immersed in auxin solutions of different concentrations and left there for two days.
 In experiment *II*, two of these decapitated seedlings, *A* and *B*, were then grown inside a dark box illuminated by a unilateral light source. An agar block, previously immersed in an auxin solution of 10^{-1} ppm concentration, was placed on top of seedling *A*.
 (The parts are not drawn to the same scale.)



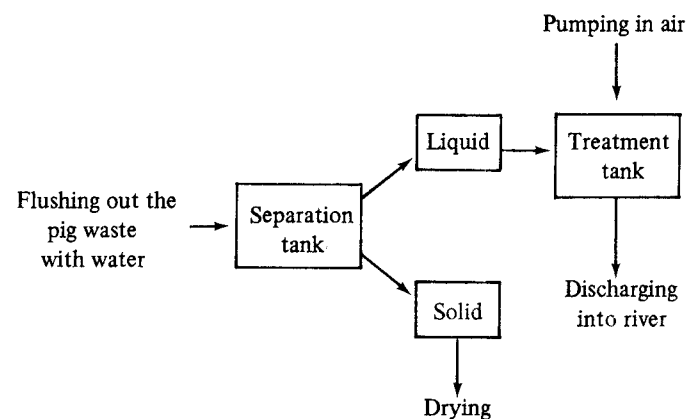
The results of experiment I are shown in the table below :

Concentration of auxin solution (ppm)	Lengths (mm) after two days	
	radicle tips	coleoptile tips
10^{-6}	12.3	12.2
10^{-5}	13.5	12.2
10^{-4}	12.5	12.5
10^{-3}	11.1	13.3
10^{-2}	10.6	13.9
10^{-1}	10.4	15.1
1	10.1	15.7
10^1	10.1	14.6
10^2	10.1	13.3
10^3	10.1	11.3

- Using graph paper, draw two curves on the same graph to show the data given in the table.
- Which concentration of auxin solution would exert
 - the greatest inhibitory effect on the radicle ?
 - the greatest stimulative effect on the coleoptile ?
- Compare the effect of auxin on the radicle and that on the coleoptile at each of the following concentrations :
 - 10^{-4} ppm
 - 10^3 ppm
- With reference to experiment II, state and explain the direction of bending, if any, for seedlings A and B after they have been growing for two days.

(15 marks)

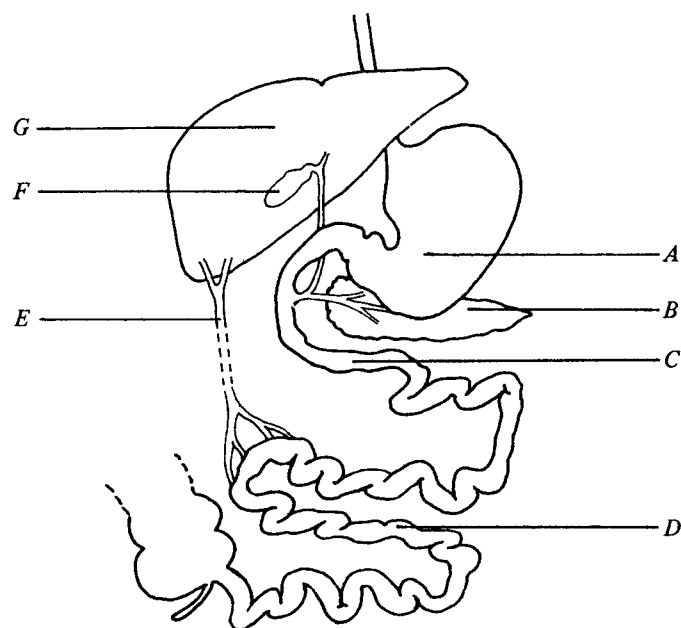
- (c) The diagram below shows the major steps for treating the waste from a pig farm before discharging it into the river.



- State one advantage of flushing the pig waste more frequently.
- State one general method by which the solid can be separated from the liquid.
- Suggest one use for the dried solid waste.
- State the purpose of pumping air into the treatment tank.
- State the main biological process taking place in the treatment tank.
- State two effects caused by the direct discharge of untreated pig waste into the river.

(7 marks)

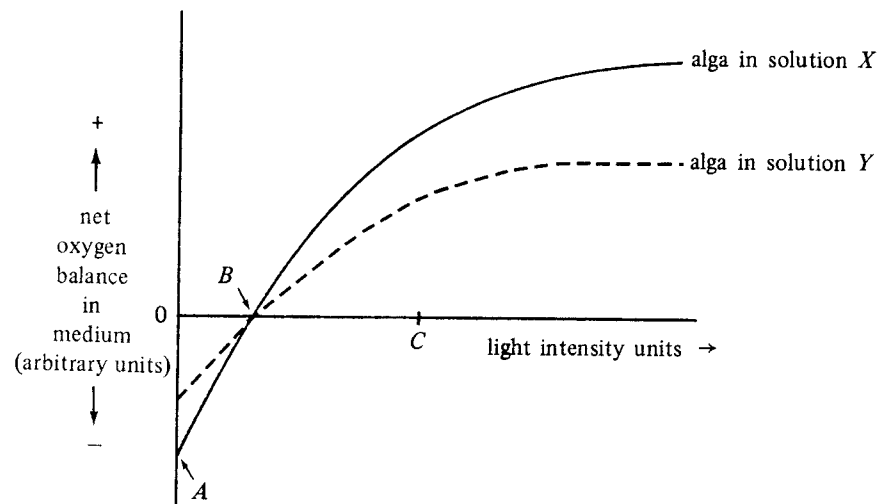
2. (a) The diagram below shows a certain region of the human digestive system. (The parts are not drawn to the same scale.)



- Compare the pH values of the juices contained in *A* and *F*.
- What juice is contained in *F*? State its effect on peanut oil.
- Using the letters in the diagram, name all the parts which produce the juices required for the complete digestion of egg white.
- The digestive product of egg white is transported to *G* through *E*.
 - What is this product?
 - What process is carried out by *G* when an excess of this product is present?

(6 marks)

2. (b) The graph below shows the results of an experiment to investigate the effect of light intensity on the production of oxygen from plants. Equal numbers of green algal cells were grown separately in two different culture solutions : solution *X* was a complete culture medium but solution *Y* was a magnesium-deficient medium.



- What two biological processes contributed to the net oxygen balance in the medium in this experiment?
- For the alga grown in solution *X*, state and explain the net oxygen balance at
 - point *A*.
 - point *B*.
- For the alga grown in solution *Y*,
 - state the effect of the absence of magnesium on the colour of the alga, and
 - state the material in the algal cell which would clearly show this effect.
- State and explain how the amount of oxygen produced from the alga in solution *Y* differed from that in solution *X* at light intensity *C*.

(13 marks)

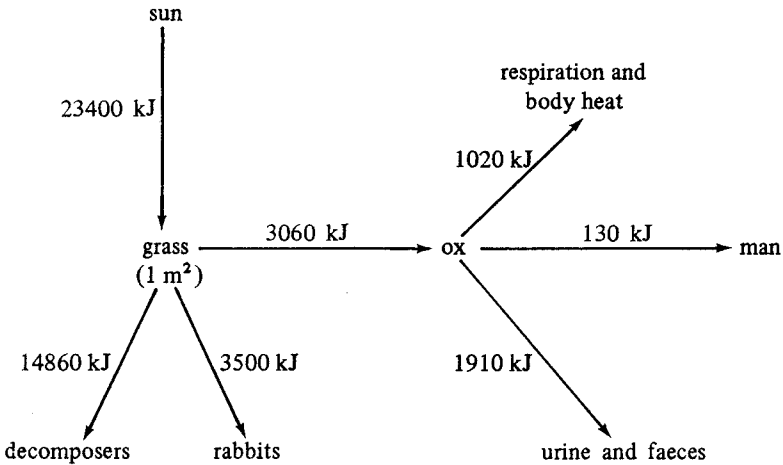
2. (c) A certain bacterium was inoculated (introduced) on sterilized agar plates. It was then covered with a lid and treated in different ways or incubated at different temperatures. The results observed after 24 hours are shown in the table below :

Agar plate	Treatment	Temperature	Observation
A	inoculated	40°C	entire surface cloudy
B	inoculated, a paper disc (soaked with antibiotic X) placed on the surface	40°C	clear zone around the paper disc, remaining surface cloudy
C	inoculated, a paper disc (soaked with antibiotic Y) placed on the surface	40°C	entire surface cloudy
D	inoculated, entire surface covered with vinegar	40°C	entire surface clear
E	inoculated	0°C	entire surface clear
F	not inoculated	40°C	entire surface clear

- What does the observation on plate A show ?
- Compare and explain the effects of antibiotics X and Y on this bacterium.
- Give one possible explanation for the observation on plate D.
- When plate E was reincubated at 40°C for 24 hours, it then became cloudy. Give a reason for the observations before and after this treatment.
- From this experiment, suggest two different methods for preserving food, and indicate the plate from which the principle of each method is derived.
- If plate F was incubated without a lid, a cloudy surface was observed. Give a possible reason for such a result.

(11 marks)

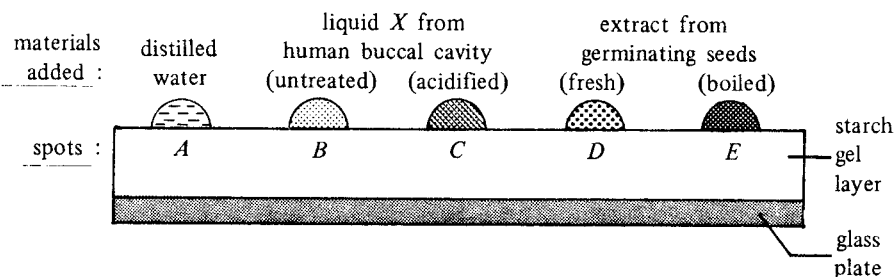
3. (a) The diagram below shows the annual energy flow through different organisms living in a grassland .



- Name the biological process which the grass carries out by using the solar energy it absorbs.
- With reference to grass, calculate the difference between the energy input and output. Give one reason for such a difference.
- Which organism in the diagram is a secondary consumer ?
- To enable the rabbits to make use of grass as food, state and explain
 - two adaptive features associated with their dentition, and
 - one adaptive feature in their alimentary canal.
- State two results if all the decomposers were removed from this habitat.

(13 marks)

3. (b) The diagram below shows an experiment in which a glass plate was coated with a uniform starch gel layer and five different materials were added separately on spots *A*, *B*, *C*, *D* and *E*.
(The parts are not drawn to the same scale.)



After leaving the set-up at room temperature for three hours, the starch plate was rinsed in distilled water and then dipped into an iodine solution.

- State and explain the colour observed in spot *A* and spot *B* after dipping the plate in iodine solution.
- Give one explanation each if the the colour observed in
 - spot *C* is similar to that in spot *A*.
 - spot *D* is similar to that in spot *B*.
 - spot *E* is similar to that in spot *A*.
- With reference to spots *B* and *C*,
 - what is liquid *X*?
 - what is the name of the active substance contained in liquid *X* responsible for the observations in this experiment?

(10 marks)

3. (c) The diagrams below show a series of steps carried out to demonstrate the presence of a certain blood vessel in a human arm.
(The parts are not drawn to the same scale.)

diagram 1

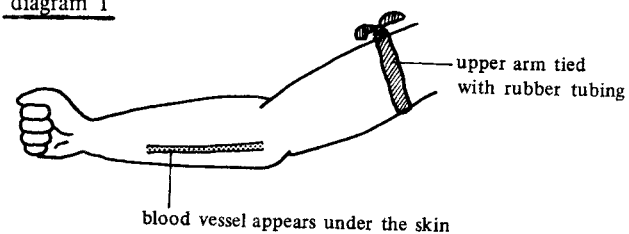


diagram 2

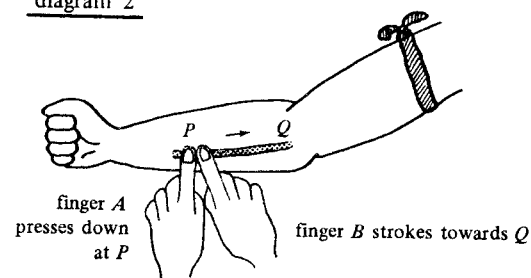
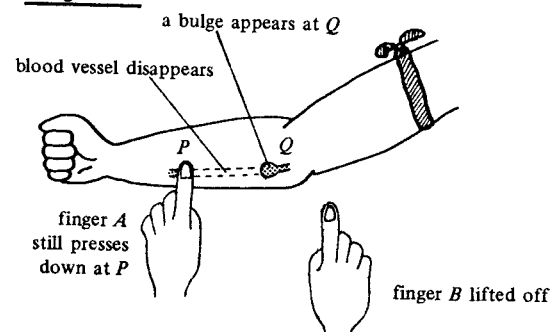


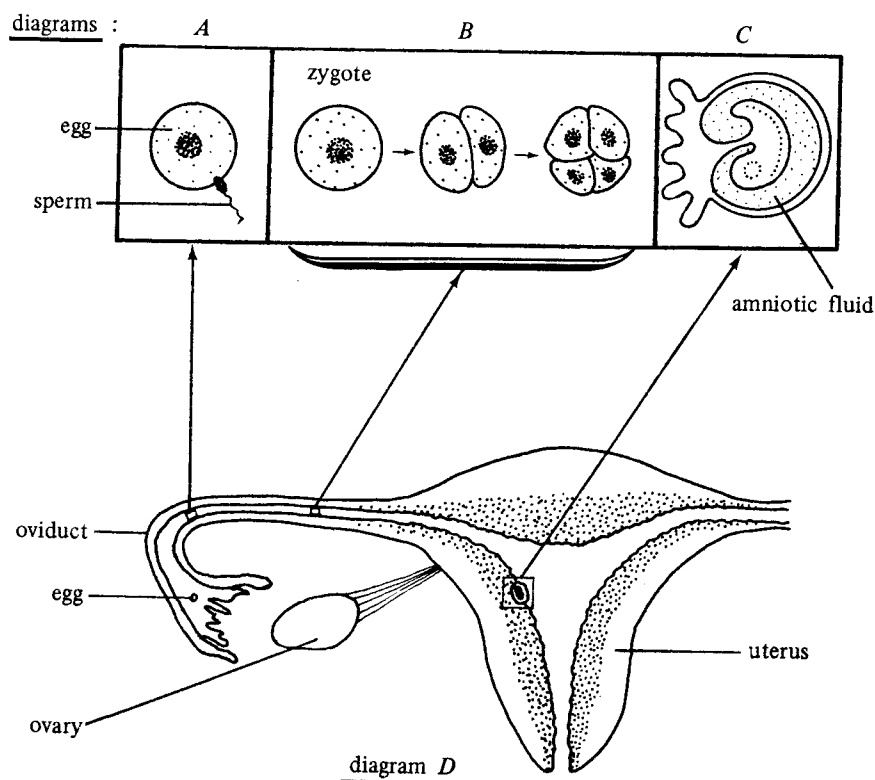
diagram 3



- (i) What structure in the blood vessel is indicated by the appearance of the bulge at *Q* in diagram 3 ?
- (ii) Referring to your answer in (i), state the kind of blood vessel being demonstrated.
- (iii) With reference to the steps shown in diagrams 1 to 3, explain why the part of the blood vessel between *P* and *Q* disappeared from view temporarily.
- (iv) (1) State the purpose of tying the arm with a rubber tubing.
- (2) Why is it necessary to remove the rubber tubing as soon as the demonstration has been completed ?

(7 marks)

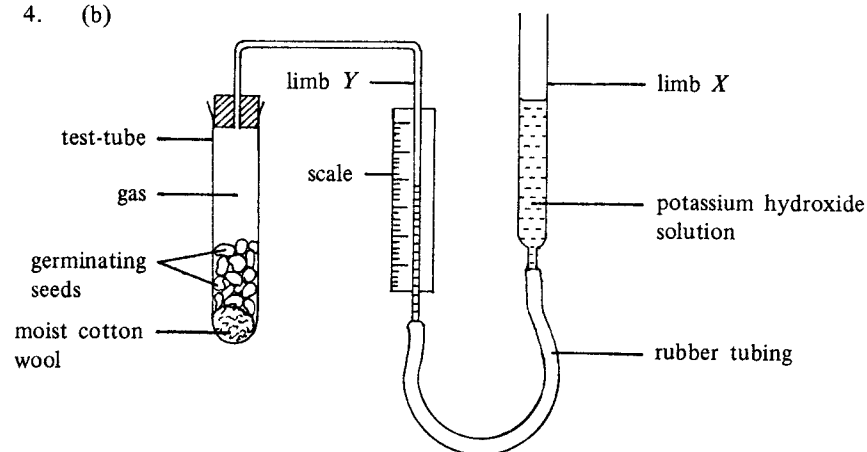
4. (a) The diagrams below show some of the stages of foetal development and their corresponding locations in the female reproductive system of a mammal.
(The parts are not drawn to the same scale.)



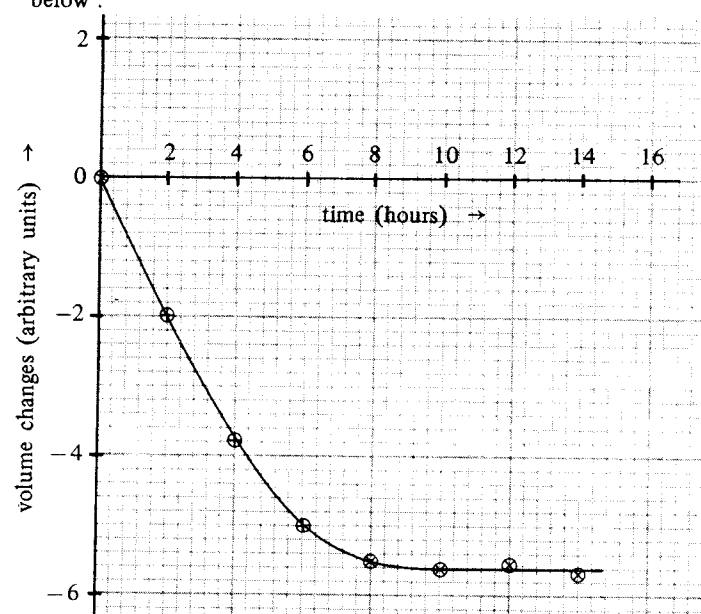
- (i) State how the sperm moves in the sperm fluid.
- (ii) State how the egg, within the oviduct, reaches the site of fertilization.
- (iii) Compare the chromosome number of the zygote with that of the sperm.
- (iv)
 - (1) Name the type of cell division taking place in the stages shown in diagram B.
 - (2) What is the significance of such cell division on the chromosome number?
- (v) State one change in the uterine wall before the attachment of the embryo.
- (vi) What structure is developed for the attachment of the embryo to the uterine wall?
- (vii) At the birth of the foetus, what is the role played by
 - (1) the amniotic fluid?
 - (2) the uterine wall?

(9 marks)

4. (b)



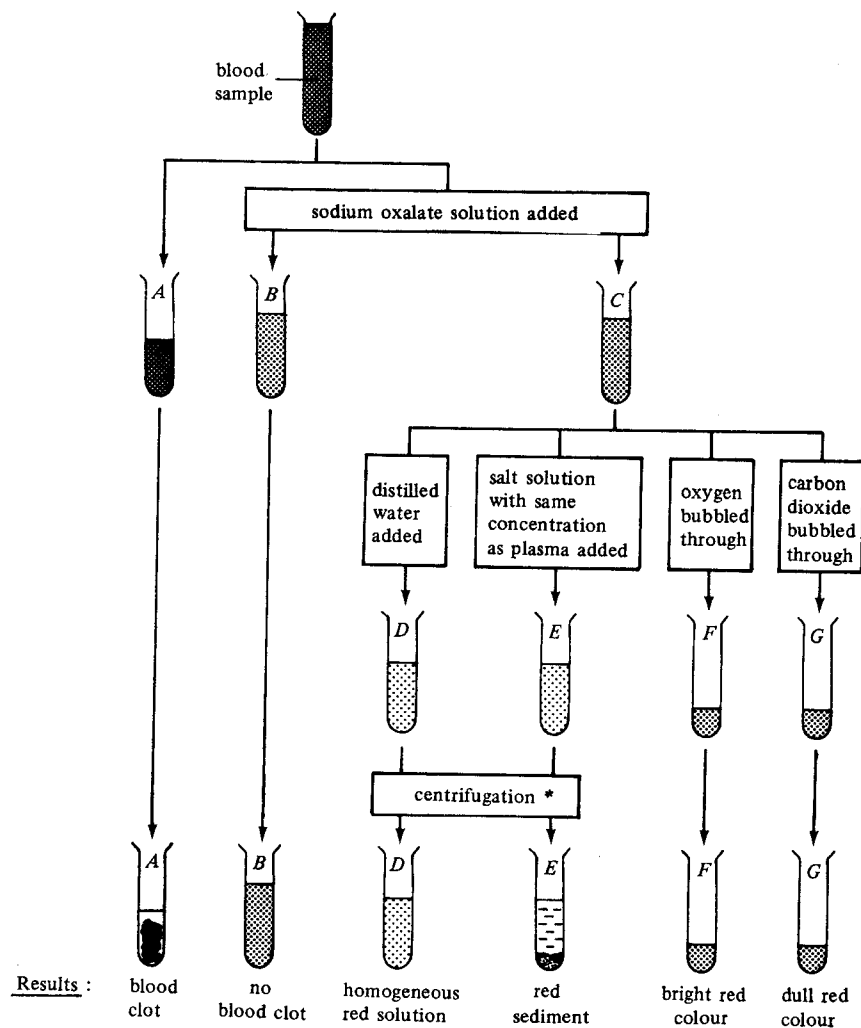
The diagram above shows an experimental set-up used to measure the changes in the volume of gas enclosed in the apparatus during the germination of seeds. At fixed time intervals the volume of the gas was measured on the scale after adjusting the liquid in limbs X and Y to the same level. The volume changes with time are shown in the graph below:



- (i) State the purpose of adjusting the liquid levels before each measurement.
- (ii) Name one external factor that would affect the accuracy of the measurements.
- (iii) Name the process carried out by the seeds that brought about the changes in gas volume.
- (iv) State and explain the changes in gas volume during the first 4 hours.
- (v) Explain why the curve levelled off after the 10th hour, even though the seeds remained alive.
- (vi) Suggest a control for this experiment.
- (vii) Why is it necessary to cover the test-tube with a dark cloth if leafy seedlings are used instead of germinating seeds ?

(12 marks)

4. (c) The diagram below shows the steps employed in treating a fresh sample of blood, and the results obtained .




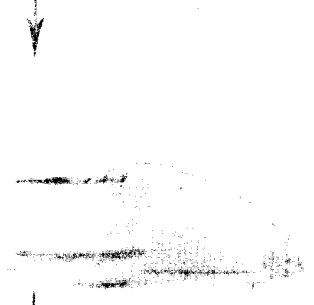




* centrifugation is a method adopted for separating the heavier particles in a mixture.

- (i) State the effect of adding sodium oxalate solution.
- (ii) Referring to tube *D*, state and explain the effect of adding distilled water to the oxalated blood sample.
- (iii) What was the substance which gave the colour of the solution in tube *D*?
- (iv) Which component of blood formed the red sediment in tube *E*?
- (v) With reference to the blood vessels associated with the lungs, which one will contain blood of the same colour as that in
 - (1) tube *F*?
 - (2) tube *G*?

(9 marks)

5. (a) In an experiment, two different potted plants X and Y, kept under the same laboratory conditions, were given varying supplies of water. The changes in their appearance are shown in the series of photographs below:

potted plant water supply	X	Y
adequate		
stopped for 7 days		
resumed		

- (i) With reference to the appearance of plants X and Y after receiving no water supply for 7 days,

- (1) explain the change in X.
- (2) draw a labelled diagram of a mesophyll cell of X as seen under high-power magnification.
- (3) point out the difference in appearance of the stems in X and Y.
- (4) state one feature, related to their structures, that caused the difference in (3).

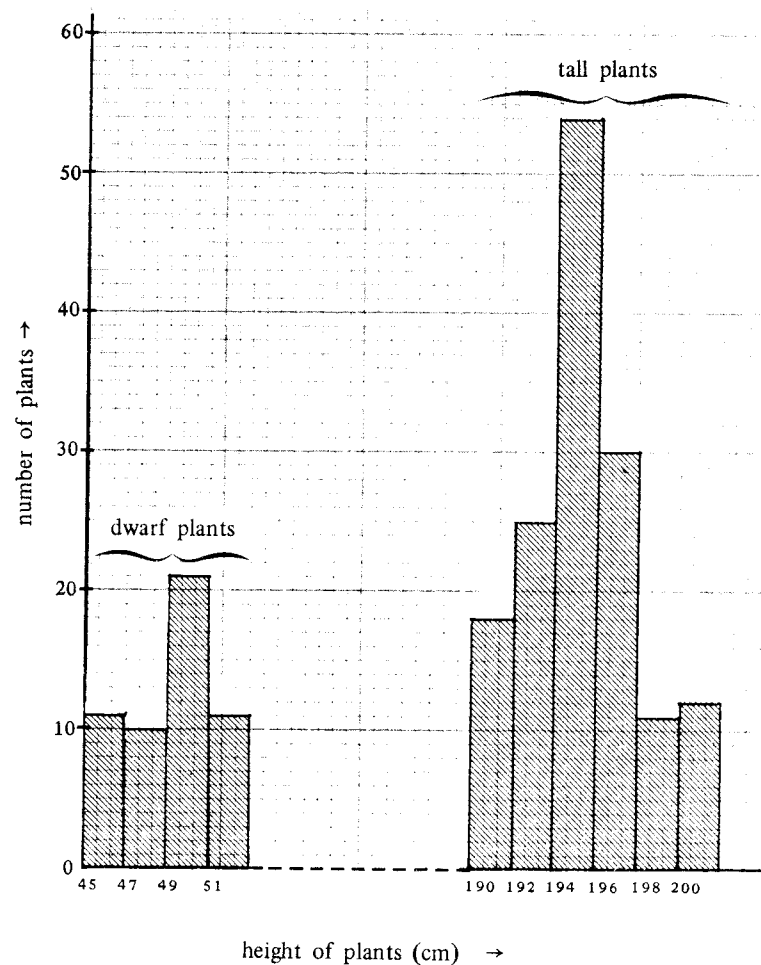
- (ii) With reference to the effects on plants X and Y after the water supply was resumed, state the cell(s) concerned and the process involved for

- (1) entry of water from soil to root,
- (2) movement of water along the stem, and
- (3) water to reach the leaves for photosynthesis.

(13 marks)

5. (b) In garden pea plants, the height of the stem is controlled by a pair of alleles. The allele for tallness (T) is completely dominant over that for dwarfness (t).

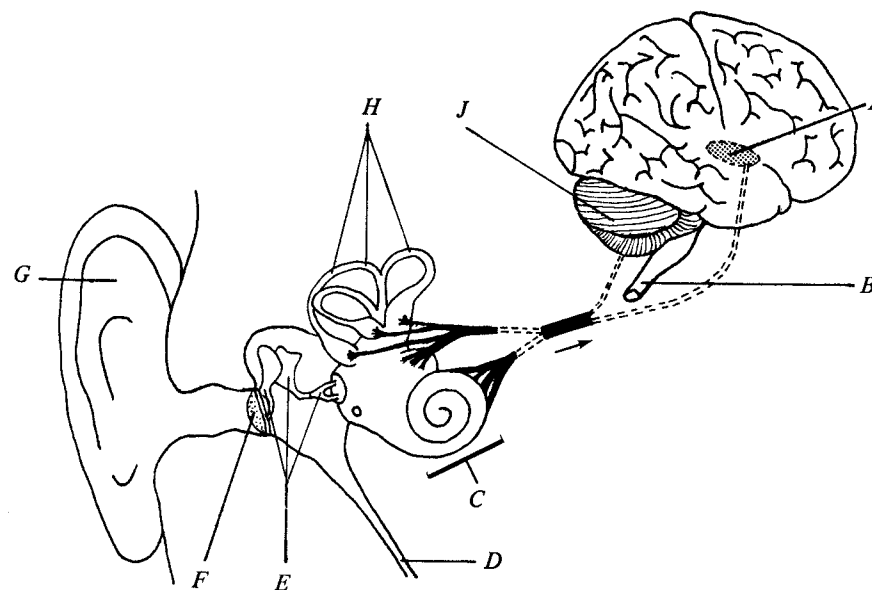
When the flowers of a single tall plant (195 cm) were self-pollinated, the plants produced were of different heights. Their height variation is shown in the chart below :



- (i) With reference to the above chart,
- (1) deduce the genotype of the parent plant, and give one reason to support your answer.
 - (2) construct a genetic diagram to illustrate this cross, and hence work out the genotypic ratio of the F_1 generation.
 - (3) state separately the total number of dwarf plants and that of tall plants.
- (ii) Give one reason why the dwarf plants are not of the same height.
- (iii) How would you show which individual among the tall plants is homozygous for tallness ?

(10 marks)

5. (c) The diagram below shows a human ear and brain.
(The parts are not drawn to the same scale.)



- (i) When a fire alarm rings, we are able to hear the bell. Using the letters in the diagram, state all the parts, in their correct sequence, involved in this hearing process.
- (ii) Using the letters mentioned for the hearing process in (i), select the part where nerve impulses are
 - (1) set up.
 - (2) interpreted.
- (iii) When we run for safety, what are the different roles played by B, H and J in this process ?

END OF PAPER

(7 marks)