

# A Level

## Biology

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**Session:** 1967 June  
**Type:** Question paper  
**Code:** 557

## BIOLOGY

557/1

## ADVANCED LEVEL

## PAPER I

*(Two hours and a half)*

*Answer the whole of Part I and four questions from Part II. Answers should be illustrated by large, clearly labelled diagrams wherever suitable. Squared paper may be obtained from the Supervisor.*

## PART I

1 *Candidates are advised not to spend more than 30 minutes on this question which carries the same mark value as other questions.*

In an experiment to investigate the effect of light intensity on the rate of photosynthesis, a small shoot of

*Elodea canadensis* was used. The shoot was immersed in a 2% sodium bicarbonate solution, maintained at 15° C. in an apparatus which allowed for the collection of the gas evolved. The light intensity was varied by moving a lamp to different distances from the *Elodea* shoot, so that the values (arbitrary units) shown in the table were obtained. The gas given off at the cut end of the shoot was allowed to collect for 3 minutes and then its volume was measured. The results obtained for each light intensity are shown in the table.

Light intensity (arbitrary units)	1	2	3	5	10	20	30	40	50
Evolution of gas (cu. mm./3 min.)	0.35	0.60	0.85	1.20	1.55	1.70	1.80	1.80	1.80

- (i) Represent these results graphically.
- (ii) What is the reason for using sodium bicarbonate in the experiment?
- (iii) If the rate of increase of photosynthetic rate observed over the range of light intensities 1 to 3 arbitrary units had not changed with increasing light intensity, how much gas would have been collected in 3 minutes at 10 arbitrary units?
- (iv) Explain the difference between the amount you calculated, and the actual amount measured in the experiment.

## PART II

*Answer four questions.*

- 2 What are the characteristics of enzyme action? State the biochemical changes brought about by **two** animal and **two** plant enzymes, and comment upon the physiological importance of each.
- 3 In what ways do cells in phloem and nervous tissue differ from a 'typical' plant cell or a 'typical' animal cell? How are the modifications related to the functions of the tissues?
- 4 State the functions of the liver of a mammal, indicating the physiological importance of each.

5 What are the characteristics of a virus? Illustrate your answer by reference to **one named** plant virus, and **one named** animal virus.

How would you classify a virus?

6 Using a **named** plant in each case, describe an experiment you would perform to show:

(a) the effect of temperature on the growth of a root, and

(b) the effect of the deficiency of an essential element on the growth of a plant.

Give details of the apparatus you would use. What results would you expect to get and how you would record them? In each case what conclusion would you draw?

7 How would you try to explain to a non-scientist the meaning of the terms: gene, chromosome, nucleus?

What are the differences between the inheritance of qualitative and quantitative characters? Give an example of each.

8 Describe in detail those features of a **named** bird, which show its adaptation to its way of life.

9 How would you prepare to study the ecology of a small habitat? If you were asked to give quantitative results, what work would you try to carry out?

## BIOLOGY

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ADVANCED LEVEL

PAPER 2

(Two hours and a half)

Answer the whole of Part I and **four** questions from Part II. Answers should be illustrated by large, clearly labelled diagrams wherever suitable.

## PART I

1 Candidates are advised not to spend more than 30 minutes on this question which carries the same mark value as the other questions.

Answer both parts of the question.

(a) In comparing the metabolic rates of animals of different size, it is convenient to relate the amounts of oxygen absorbed per unit of body weight in a given time. The metabolic rates of some familiar animals are given by the following results:

Animal	c.c. oxygen absorbed/gm./hr.
Mouse	1580
Rat	872
Rabbit	318
Man	202
Elephant	67

How do you interpret and explain these results?

(b) In an experiment to measure the oxygen intake and the nitrogen output of a human subject, it was observed that during a 24-hr. period the subject consumed 400 litres of oxygen and eliminated 12 gm. of nitrogen in waste substances.

It is known that in metabolism 1 gm. of waste nitrogen corresponds to 6.25 gm. of protein, the absorption of 6 litres of oxygen and the production of 26.5 Calories of heat. It is also known that 1 litre of oxygen is equivalent to the metabolism of 0.6 gm. of carbohydrate plus 0.3 gm. of fat.

Calculate the amounts (in grams) of protein, carbohydrate and fat metabolised by the subject in 24 hr.

If the Calorific value of carbohydrate is 4 Calories/gm. and of fat, 9 Calories/gm., calculate the total heat output of the foods metabolised by the subject in 24 hr.

## PART II

*Answer four questions from this part.*

- 2 What are the gametes of a flowering plant? Describe and explain the essential steps in their formation.  
What are the differences between a seed and an ovule?
- 3 Give a labelled drawing of a complete kidney tubule, together with its blood supply.  
In cases of severe bleeding no urine is formed. Why is this?  
Sea water contains about 3% salt, the salt content of blood is about 1% and, as a maximum, the kidneys can excrete only a 2% salt solution. Give a brief explanation for the serious consequences that occur after drinking a great deal of sea water.
- 4 What does the theory of organic evolution mean to the biologist? What, in your opinion, are the **two** most convincing kinds of evidence for evolution? Describe each as fully and as critically as you can.
- 5 Compare the vegetative structure of yeast and *Mucor* (or *Rhizopus*).  
Write an account of the life-history of yeast.
- 6 Give a simple, labelled drawing to show the appearance of a motor end-plate. What part does it play in the contraction of a muscle? Without giving biochemical formulae or naming all the intermediate compounds, outline the principal changes that occur in the breakdown of glycogen during muscle activity.  
After severe exercise increased amounts of oxygen are required by the body. Why is this?
- 7 There are no nerve cells in flowering plants and yet they often show responses beyond the stimulated area. Explain how this is possible.

Show, by means of **one** example in each case, what is meant by 'nastic responses' and by 'photoperiodism'.

8 In what ways is a locust (or cockroach) adapted for a terrestrial life?

What advantages has parthenogenesis for some insects?

9 Write an elementary account of the chemical nature of carbohydrates and fats.

What other biological functions do fats have besides providing a source of energy?

Describe **one** test by which you could identify a fat.

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## BIOLOGY

SPECIAL PAPER

(Two hours and a half)

*Answer four questions.*

*Answers should be illustrated by large, clearly labelled diagrams wherever suitable.*

*Candidates are advised to study the questions carefully and to answer them concisely.*

1 Compare and contrast nervous control with control by hormones. What advantage is it to an organism to possess both systems?

2 How far are the appearances of structures that go to make up 'typical' plant and animal cells a reflection of their function?

3 How, and why, are substances taken into and ejected from cells?

4 Describe the process of photosynthesis and point out, giving your reasons, which steps you think to be the most significant. What connection is there between the existence of the process of photosynthesis and the division of most organisms into animals and plants?

- 5 What factors affect the temperature of an organism? What are the advantages and disadvantages to an organism of maintaining its body at a more or less constant temperature?
- 6 What is the importance of sexual reproduction to the process of evolution?
- 7 What is meant by the term 'respiration'? Outline the ways in which animals provide for a supply of oxygen to their respiring tissues, and point out the features that contribute most to the efficiency of the process.
- 8 A new island is formed by a pushing up of part of the sea floor. Describe what you think would be the probable course of events in its colonization by living organisms.
- 9 Frogs have four legs yet trees have a variable number of branches. Consider this statement.