



A Level

Biology

Session: 1974 June
Type: Question paper
Code: 870

BIOLOGY

870/1

ADVANCED LEVEL

PAPER 1

(Two hours and a half)

Answer any five questions.

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

1 With the aid of **one** example in each case, describe how cross-pollination takes place in the following:

(a) a monoecious plant (male and female flowers on the same plant), (4)

(b) a wind-pollinated plant with hermaphrodite flowers, (4)

(c) an insect-pollinated plant with hermaphrodite flowers. (4)

Describe the problems involved in making a controlled cross between different plants of the same species of **either** class (b) or class (c). (6)

How would you attempt to check that self-pollination had not occurred? (3)

2 Explain what is meant by the term *species*. (6)

Give examples of (a) how one species differs from another species in the same genus, and (b) variation within a species. In your answer you should explain how morphological and physiological differences are important, as well as chromosomal differences such as chromosome aberrations and polyploidy. (9,6)

water in 1953. It was not possible to grow crops for a few years after the floods had receded, and yet some plants thrive in tidal salt marshes. Discuss these facts briefly. (11)

9 (a) Make a labelled diagram of a longitudinal section through a single sarcomere of a striated muscle fibre. (8)

(b) Describe briefly the events that lead to the contraction of a striated muscle fibre. (9)

(c) What adaptations would you expect to find in a muscle which operates for long periods without rest? (4)

3 Either

Make a list of the ways in which animals and plants gain and lose water. (6)

With reference to your list discuss how animals and plants are adapted for life in dry places. (15)

Or

Make a list of the ways in which animals and plants gain and lose heat. (5)

With reference to your list discuss how animals and plants are adapted for life in cold places. (15)

4 (a) What is the meaning of the term *gland*? (3)

(b) Make a labelled drawing of **one** gastric gland of a mammal to show its detailed, **microscopic** structure. (7)

(c) Give an account of the functions of mammalian gastric glands and their secretions. (12)

5 By reference to **named** plants, illustrate the differences between tropic and nastic responses, and discuss briefly the meanings of the terms *presentation time*, *latent period* and *summation*. (6,9)

Describe an experiment to show that the downward bending of a radicle does not result merely from its own weight. (6)

6 What is the importance to animals and plants of a continuous supply of oxygen? (20)

7 The most noticeable external feature of an earthworm is the 'ringed' body. Explain how this external feature is related to the animal's internal organisation. (11)

Give labelled drawings which show clearly how the blood of an earthworm is distributed to and collected from the main organs of the body. (10)

8 Describe an experiment by which you could measure the osmotic pressure of plant cells. (10)

Farming areas of eastern England were flooded by sea

(c) What do you understand by the terms *visual sensitivity* and *visual acuity*?

Visual sensitivity

Visual acuity

(d) Where is the pigment *rhodopsin* found?

.....

(e) Which vitamin is associated with the synthesis of rhodopsin?

(f) Name, and state a function of, the layer of the eye wall that lies next to the retina.

.....

2 (a) Name the repeating units which are joined to form the macromolecule of DNA (deoxyribonucleic acid).

.....

(b) Give a labelled diagram of a representative length of the DNA molecule (the chemical structure of the different constituents is not required).

(c) Suppose that a section of DNA has the following sequence of bases:

G G A T T A A C A C C T

What will be the complementary messenger RNA sequence?

.....

(d) Using the table of amino acid triplets below, determine the sequence of the amino acids of the protein to be synthesised.

AAU - asparagine	CCU - proline	GAA - glutamic acid
AUG - methionine	CUA - leucine	GGA - glycine
ACA - threonine	CUG - alanine	UGU - cysteine

.....

(e) Name two other kinds of RNA which are believed to participate in protein synthesis.

.....

ADVANCED LEVEL

PAPER 2

(One hour and a half)

Attempt all the questions.

Give short answers.

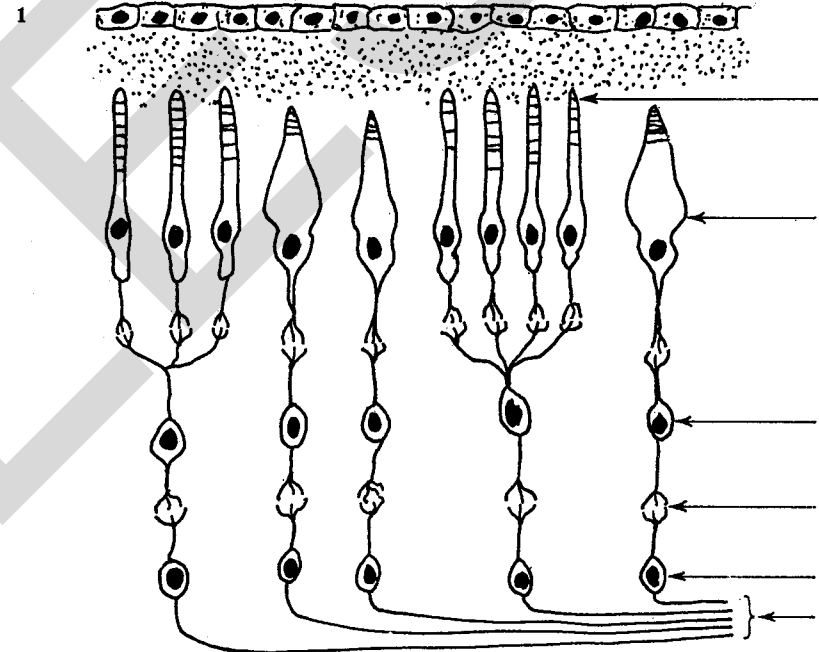


Fig. 1

(a) Label Fig. 1, which shows part of the retina of the human eye.

(b) Which of the visual (photosensitive) cells usually predominate in the retina of animals

(i) active mostly at night?

.....

(ii) active mostly during daylight?

.....

(d) Explain how the results of the crosses confirm the answer you gave to part (b) of this question.

4 (a) What are the distinguishing features of asexual reproduction?

(b) (i) Give labelled drawings to show the structures formed in the process of asexual reproduction in a **named** saprophytic fungus (other than yeast), and **named** parasitic fungus.

(ii) Describe **one** method by which the parasitic fungus spreads and infects new hosts.

(c) Organisms that reproduce asexually are important in genetic research. Why is this?

5

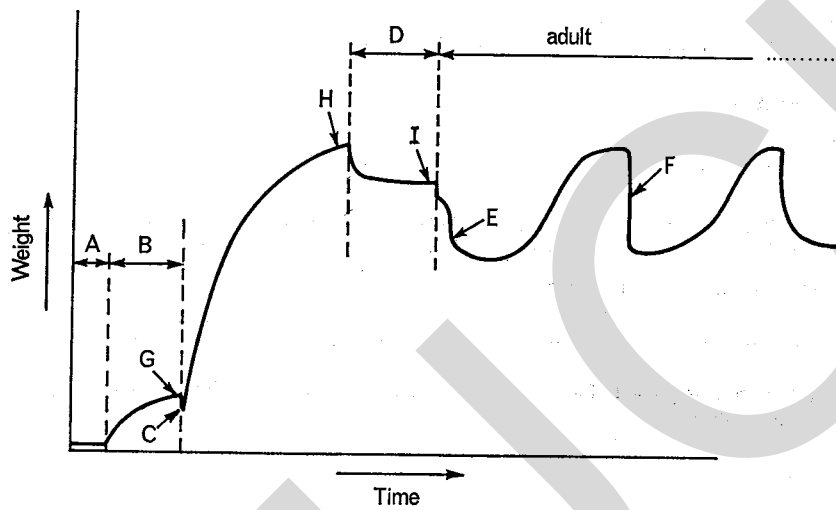


Fig. 3

The graph (Fig. 3) shows the changing weight of a female insect during its normal development from a freshly laid egg.

(a) What are stages A, B and D?

A

(f) Describe **one** piece of evidence in support of the concept of protein synthesis suggested opposite.

3

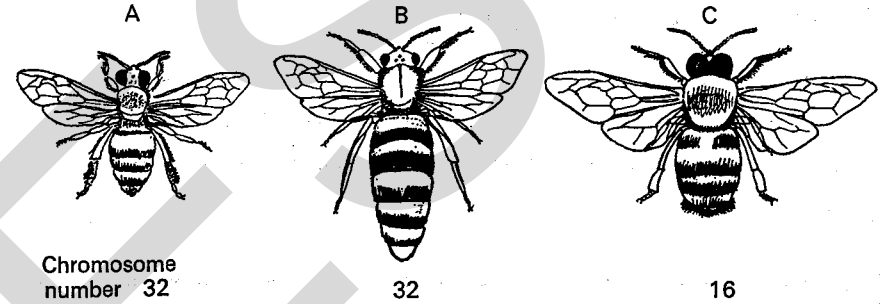


Fig. 2

Fig. 2 shows the different castes of the honeybee (*Apis mellifica*).

In some breeding experiments a yellow queen was mated with a black drone. The workers which hatched from eggs laid by the queen were yellow. Drones which hatched from eggs laid by the same queen were also yellow.

When a cross was made between a black queen and a yellow drone, the workers arising from the cross were yellow and the drones were black.

(a) Identify the castes A, B, and C.

A is

B is

C is

(b) How do drone bees arise? In your answer explain the significance of the chromosome number.

(c) In bees, is the black colour dominant to yellow, or vice versa? Explain your answer.

Give diagrams to show the genotypes of the parents, the gametes and the progeny of each cross.

B

D

(b) What is the reason for the weight loss at C?

.....

(c) What is the significance of the loss in weight during stage D?

.....

(d) Suggest a possible reason for the weight loss at E.

.....

(e) Suggest a possible reason for the weight loss at F.

.....

(f) What hormones are likely to be present in the insect's blood at G, H and I?

at G

at H

at I

(g) Is the insect whose changing weight is shown in the graph more likely to be a locust (*Locusta*) or a blowfly (*Calliphora*)?

Give reasons for your answer.

.....

(h) How is it possible for an insect, which has a hard exoskeleton, to increase in weight between moults?

.....

1 Which one of the following classes of substance is **not** thought to be a major component of the cell membrane?

- A phospholipids
- B sterols
- C proteins
- D polysaccharides

2 What is the most probable function of the Golgi apparatus?

- A to increase the area of the endoplasmic reticulum
- B to manufacture secretory products
- C to ingest external fluid droplets
- D to prevent digestion of the cell by its own enzymes

3 In mammals, which one of the following statements is true about **second** division of meiosis but **not** true about mitosis?

- A No crossing-over occurs.
- B The chromosomes divide into chromatids.
- C The chromatids separate at the beginning of anaphase.
- D The dividing cells are haploid.

4 Which one of the following tissues usually produces the cork cambium in a root?

- A pericycle
- B endodermis
- C cambium
- D cortex

5 If the spermatozooids of a liverwort contain 14 chromosomes per cell, which one of the following structures in the life-cycle of the same plant will contain cells with 28 chromosomes?

- A seta
- B antheridium
- C thallus
- D spore

- 6 In *Hydra*, which one of the following types of cell is found in the endoderm only?
- nematoblasts
 - interstitial cells
 - nerve cells
 - musculo-nutritive cells

- 7 At which point, and from which tissues, do lateral roots arise in the dicotyledonous plant?
- in the pericycle, opposite a protoxylem group
 - in the endodermis, opposite a primary phloem group
 - in the pericycle, opposite a primary phloem group
 - in the endodermis, opposite a protoxylem group

- 8 During asexual reproduction, the meganucleus (macronucleus) of *Paramecium*
- divides meiotically.
 - divides mitotically.
 - divides amitotically.
 - disintegrates.

9

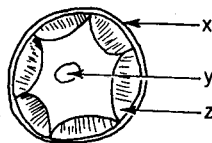


Fig. 1

The unicellular organism, *Pleurococcus*, is shown diagrammatically in Fig. 1. Select from the following alternatives the correct combination of labels.

- x = plasma membrane, y = chloroplast, z = cytoplasm.
 - x = plasma membrane, y = nucleus, z = chloroplast.
 - x = cell wall, y = nucleus, z = chloroplast.
 - x = cell wall, y = chloroplast, z = cytoplasm.
- 10 Which of the following plant structural materials is found mainly in cork cells?
- cutin
 - suberin
 - cellulose
 - lignin

- 11 The locust and the cockroach have wings on the
- prothorax and mesothorax.
 - prothorax and metathorax.
 - mesothorax alone.
 - mesothorax and metathorax.
- 12 Which one of the following phrases describes the oospheres (eggs) of both mosses and ferns?
- protected by a layer of sterile cells
 - borne on multicellular stalks
 - produced by apical cells
 - formed at the same time as antheridia
- 13 What is the function of the region marked X in Fig. 2?

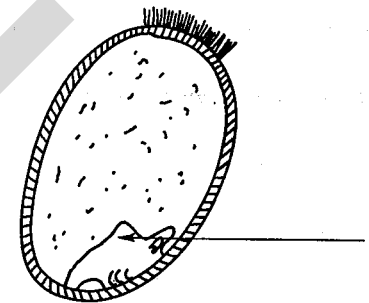


Fig. 2. L.S. (diagrammatic) through fruit of monocotyledon.

- protection for the radicle
 - protection for the plumule
 - production of enzymes
 - production of coleoptile
- 14 Which one of the following structural features is possessed by both annelids and coelenterates?
- radial symmetry
 - mesoderm
 - coelom
 - enteron
- 15 An increase in the osmotic pressure of the blood stimulates the hypothalamus, thereby causing feelings of thirst. Which of the following would not be expected to make someone feel thirsty?

- A eating a lot of fat
- B swallowing sea-water
- C sunbathing in Morocco
- D suffering from diabetes

16 In herbivorous animals there is usually a part of the gut specially developed for growth of certain types of bacteria. Which one of the following statements most accurately describes the importance of these bacteria?

- A They are present to aid the production of nitrogenous compounds not normally present in sufficient quantity in the normal diet.
- B They are necessary because the animal itself has no enzyme system capable of hydrolysing the starch content of the food.
- C They possess an enzyme capable of hydrolysing the cellulose content of the normal diet.
- D They possess an enzyme system capable of converting cellulose to starch.

17 To how many ova does the mammalian primary oocyte give rise?

- A one
- B two
- C three
- D four

18 The minimum light intensity in which a plant can survive, but not grow appreciably, is known as its compensation point. Which of the following would you expect to find under these conditions?

- A no net gas exchange
- B no transpiration
- C no photosynthesis
- D no respiration



Fig. 3

The drawings in Fig. 3 above are traced from photographs of 3 sets of runner bean seedlings 11 days after germination. The cotyledons were cut off each seedling as soon as the radicle was 1 cm long. Two sets of seedlings were grown in full culture solution, and one of these sets was kept in the dark. The third set was grown in the light in a culture solution lacking calcium.

Which of the following states correctly the conditions in which each set of seedlings was growing?

- A *P* - full solution, light; *Q* - full solution, dark; *R* - lacked calcium
- B *P* - full solution, light; *Q* - lacked calcium; *R* - full solution, dark
- C *P* - full solution, dark; *Q* - full solution, light; *R* - lacked calcium
- D *P* - lacked calcium; *Q* - full solution, dark; *R* - full solution, light

24 Which one of the following hormones leads directly to an increase in the lactic acid content of the blood and a fall in the glycogen content of the liver in a mammal?

- A oestrogen
- B insulin
- C adrenaline
- D thyroxine

25 Astronauts often experience feelings of nausea, due to

- A constant stimulation of the sensory hairs of the organ of Corti, caused by excessive noise,
- B distortion of the *tympanum* caused by a drop in atmospheric pressure,
- C distortion of the *fenestra ovalis*, caused by vibration,
- D constant stimulation of the maculae of the utriculus, caused by weightlessness.

Study the information below; then answer questions 26–28.

A large pot plant was placed under a bell-jar in the middle of a laboratory at 08 00 hours on a dull day. Air was drawn continuously through the apparatus. From 08 00 hours to 14 00 hours atmospheric air was used; after 14 00 hours the carbon dioxide content of the air was increased to 0.3%. From 11 00 to 14 00 hours the bell-jar was covered with a black cloth. Four discs of equal area were cut from each of 100 leaves, as shown in the table below. The hundred discs in each set were then dried to constant weight.

	Set W	Set X	Set Y	Set Z
Time of cutting disc	08 00	11 00	14 00	17 00
Weight of 100 dried discs (expressed in g)	0.7	0.75	0.52	0.57

26 Which of the following best explains the difference in weight between X and Y?

- A Water is lost by transpiration at a faster rate in the dark than in the light.
- B The blackout prevented photosynthesis from taking place.
- C A greater mass of substances was lost from the leaf than was made in it.
- D Respiration proceeds at a faster rate in the dark than in the light.

27 What would you have expected to happen to the discs between 14 00 and 17 00 hours?

- A an increase in weight the same as that between 08 00 and 11 00 hours
- B a smaller increase in weight than that between 08 00 and 11 00 hours
- C a larger increase in weight than that between 08 00 and 11 00 hours
- D a loss in weight similar to that between 11 00 and 14 00 hours

20 In a burrowing earthworm, those parts of the animal that are moving forward have

- A the longitudinal muscles contracted and the circular muscles contracted.
- B the longitudinal muscles contracted and the circular muscles relaxed.
- C the longitudinal muscles relaxed and the circular muscles relaxed.
- D the longitudinal muscles relaxed and the circular muscles contracted.

21



Fig. 4

Fig. 4 represents a length of myofibril which has been isolated from a muscle preparation. It can be seen to be made up of alternating dark (A) and light (I) bands. If the lengths of these bands are measured in a relaxed myofibril and then again in a myofibril which has been made to contract by the addition of ATP, which one of the following gives a correct description of the observations?

- A A remains unchanged, I remains unchanged.
- B A remains unchanged, I shortens.
- C A shortens, I remains unchanged.
- D A shortens, I shortens.

22 In an experiment, the respiratory quotient was found to be 0.7. Which of the following is the most likely type of respiration and substrate?

- A aerobic respiration of carbohydrate
- B anaerobic respiration of carbohydrate
- C anaerobic respiration of fats
- D aerobic respiration of protein

23 Which one of the following observations indicates that photosynthesis is responsible for the substances present in the sieve tubes of the phloem?

- A Transport of materials in the phloem increases with increasing temperature, reaches a maximum at 25 °C, and then falls off.
- B Sieve tube contents are found to vary according to a twenty-four hour cycle.
- C Stems placed in an environment with no oxygen do not transport materials in the phloem.
- D Sugars are transported up and down the plant so that young leaves, roots and developing fruits can utilise these sugars.

Study Figs 6 and 7; then answer questions 30 and 31.

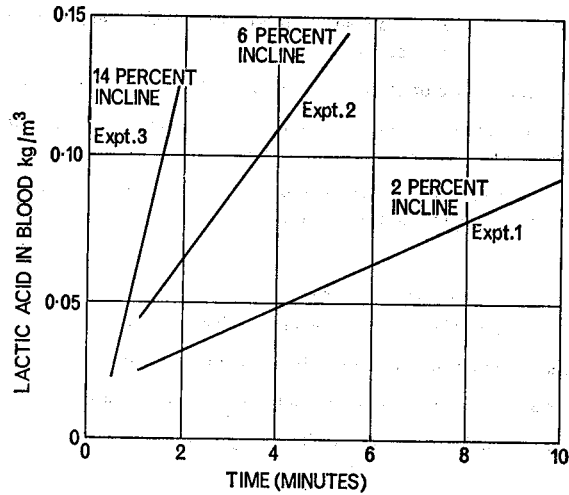


Fig. 6. Treadmill speed = 12 km/h.

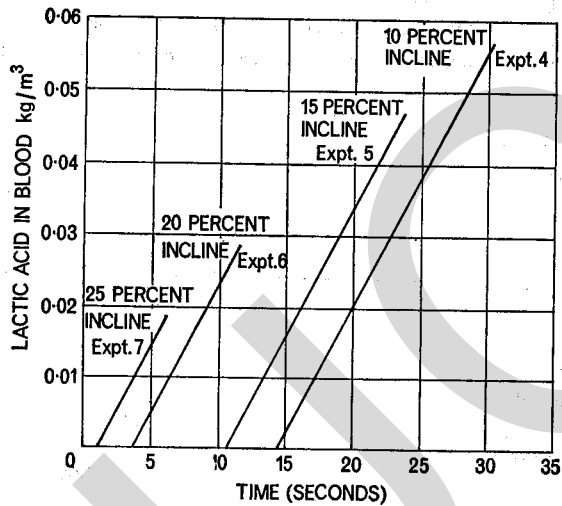


Fig. 7. Treadmill speed = 18 km/h.

- 28 Which of the following hypotheses best accounts for the observed results in Z?
- A The light intensity is so low that it is a limiting factor.
 - B Too little carbon dioxide is available to the plant.
 - C The metabolic rate drops because carbon dioxide causes anaerobic respiration.
 - D The discs had not been left long enough to dry before they were weighed.

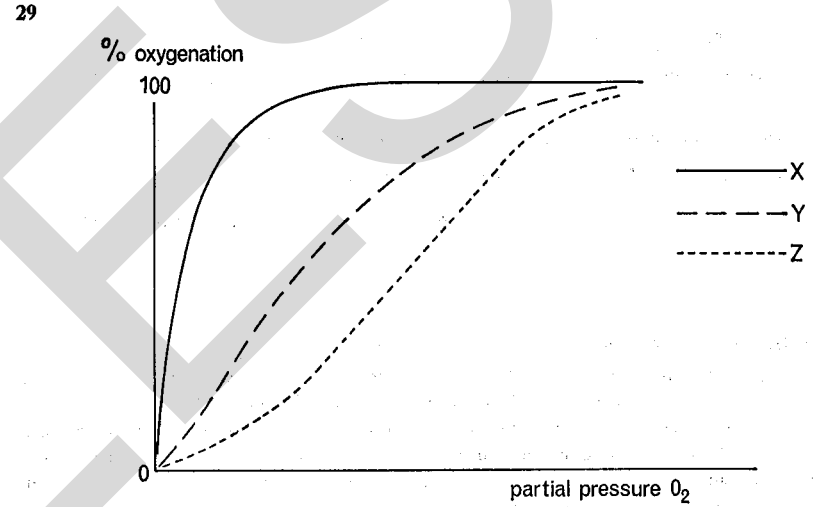


Fig. 5

Fig. 5 represents the dissociation curves of three types of respiratory pigment (mammalian) in the absence of CO₂ and at constant temperature. The three types are adult, and foetal haemoglobin, and muscle myoglobin. Which one of the following gives the correct title for each curve?

- A X = adult haemoglobin, Y = myoglobin, Z = foetal haemoglobin
- B X = adult haemoglobin, Y = foetal haemoglobin, Z = myoglobin
- C X = myoglobin, Y = adult haemoglobin, Z = foetal haemoglobin
- D X = myoglobin, Y = foetal haemoglobin, Z = adult haemoglobin.

Fig. 8 shows the relationship between body volume and concentration of sea water in the absence or presence of cyanide for a marine protozoan. Which of the following is the most complete explanation of the differences between the two graphs?

- A With cyanide, the organism is taking up water at a much faster rate, because its metabolic processes are stimulated by the cyanide.
- B The organism has a contractile vacuole which is actively pumping out water using energy produced by respiration, and this is inhibited by cyanide.
- C Since the body weight increases even without cyanide, the contractile vacuole is not a perfect osmoregulator.
- D The organism is capable of controlling body volume in dilute sea water, but its influence between 75–100% is limited.

34

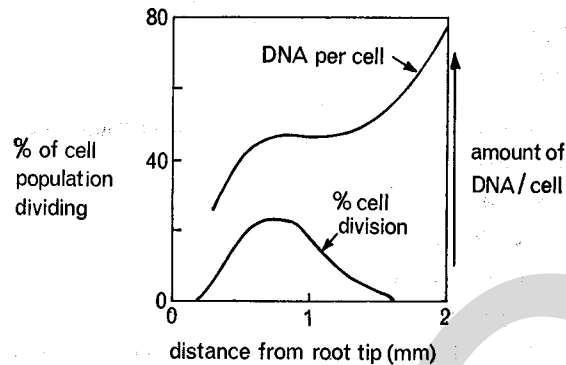


Fig. 9

Data from an investigation into root tip activity in onion are shown in Fig. 9. If the first rise in DNA is correlated with an increase in cell divisions, which of the following could account for the second rise in DNA?

- A fewer cell divisions
 - B cell elongation
 - C polyploidy
 - D protein synthesis
- 35 Which of the following is an example of discontinuous variation in humans?
- A skin colour
 - B haemophilia
 - C intellect
 - D height

30 In Fig. 7 all the experiments produce parallel lines, while in Fig. 6 all three lines are at different angles to the horizontal. What is the most likely explanation of this?

- A Experiments 4–7 were all carried out on the same person, while experiments 1–3 were carried out on different people.
 - B A maximum rate of glycolysis was reached between experiment 3 and experiment 4.
 - C The subjects in experiments 1–3 had been subjected to varying diets, while those in experiments 4–7 had received the same diet.
 - D The experiments were carried out on successive age groups, puberty occurring between the age ranges for experiment 3 and 4.
- 31 Why are the lines for experiments 4–7 of different lengths?
- A The glycogen reserves are smaller in older subjects.
 - B Exhaustion occurs more quickly on steeper inclines.
 - C Lactic acid builds up more quickly on steeper inclines.
 - D Blood sugar levels are higher in younger subjects.

32 A tall white-flowered plant was crossed with a tall red-flowered plant. The F₁ generation contained progeny in the following ratios:

3 tall Red:3 tall White:1 short Red:1 short White.

Which of the following best describes the genotype of the parental tall red-flowered plant?

- A TTRR
- B TTrR
- C tTrR
- D ttrR

33

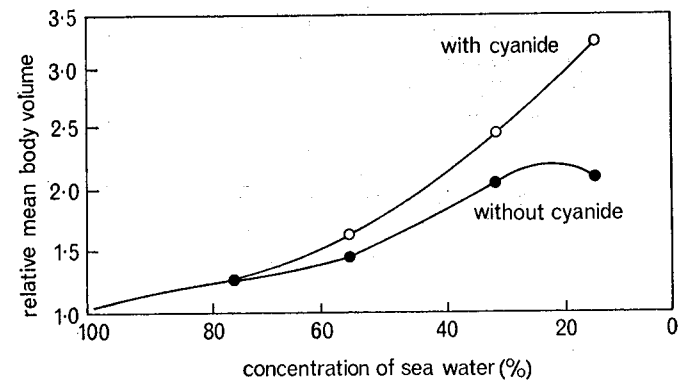


Fig. 8

39 Which of the following additional properties can be deduced for these soils from the data given?

- A Garden X will drain less quickly than Y after a storm.
- B Garden Y will need more watering than X in a short dry spell.
- C Addition of lime will improve the drainage of Garden Y more than of X.
- D Addition of compost will improve garden X but not garden Y.

40 Which of the following statements about the vegetation in the two gardens is in accord with the information given?

- A The main weeds in Garden X were monocotyledons.
- B The dicotyledons come into leaf later in X than in Y.
- C Almost all the plants in Garden Y had very deep root systems.
- D The lawn of garden Y was smothered with moss.

36 In Johannsen's classic experiments on the inheritance of quantitative characters, *Phaseolus* seeds from a single plant were sown in two different plots, *x* and *y*. Plot *x* plants produced seeds of average mass 0.40 g; Plot *y* plants produced seeds of average mass 0.70 g. If a seed from Plot *x* were sown in Plot *y*, what would be the expected average mass of its progeny seeds?

- A 0.40 g
- B 0.70 g
- C something between 0.40 and 0.70 g
- D impossible to say without an additional piece of information

37 A relationship between two different species in which one species benefits while the other receives neither benefit nor harm is described as

- A commensal.
- B symbiotic.
- C saprophytic.
- D parasitic.

38 The light energy received by pastureland is used in the following ways:

- (i) in the evaporation of water,
- (ii) transmitted to the ground,
- (iii) reflected by the leaves,
- (iv) 'locked up' in new growth,
- (v) released in respiration.

Which of the following gives the correct sequence in order of *decreasing* quantities of energy?

- A (iv) (iii) (ii) (i) (v)
- B (i) (iv) (v) (ii) (iii)
- C (i) (ii) (iii) (iv) (v)
- D (v) (iv) (iii) (ii) (i)

Study the information below; then answer questions 39 and 40.

The table shows the results of various measurements made on the soils of two country gardens at opposite ends of the same town. Both gardens had a southerly aspect, had the same degree of shelter and were at the same altitude.

	Garden X	Garden Y
Percentage of total particle weight formed by particles of size		
0.1 mm diam. or more	50	20
0.002-0.1 mm	35	50
0.002 mm and less	15	30
Air content (% of total volume)	18	5
Humus content (% of total weight)	6	6

BIOLOGY**870/0****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. How are birds adapted for their aerial way of life?
2. What problems were faced by vertebrates in the transition from water to land, and how did they solve them?
3. Discuss the ways in which turgor pressure is used by plants.
4. Compare the ways in which plants and animals obtain energy. What effects do the differences in the methods used have upon the ecological relationships of plants and animals?
5. Describe the growth of a large tree from a seed, and show how the problems arising from the great increase in size are overcome.
6. Survey briefly the ways in which plants and animals reproduce, indicating those features that contribute to the efficiency of the process.
7. How far does knowledge of events occurring within single cells go to explaining the functioning of entire organisms?
8. Discuss those aspects of biology that you consider to be important subjects of study for Man nearing the end of the twentieth century.