

BIOLOGY

Paper 5090/01
Multiple Choice

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	B	21	C
2	D	22	C
3	D	23	C
4	C	24	A
5	B	25	C
6	D	26	C
7	A	27	C
8	B	28	C
9	B	29	D
10	B	30	D
11	C	31	A
12	C	32	A
13	D	33	A
14	B	34	B
15	C	35	C
16	A	36	A
17	D	37	C
18	A	38	B
19	D	39	C
20	C	40	C

General comments

This paper spread out candidates well. Questions relying on pure knowledge are mostly well answered, but candidates must take more time thinking about questions which need the application of knowledge. As ever, it is essential to read all the words of the stem of a question so as to avoid errors. See questions 4 and 8 and many others.

Comments on specific questions

Questions 3 9 11 12 16 18 19 21 22 23 24 26 27 30 36 38 and 40 proved to be straightforward.

Question 1

Root hair cells have no chloroplasts.

Question 2

Active transport requires energy, so will not occur without oxygen.

Question 4

Option D was too popular. It shows the substrate after it has been split. However, the stem refers to 100°C, which would alter the shape of the active site and inactivate it.

Question 5

At low light intensities the rate of photosynthesis increases in proportion, so light is limiting. At high light intensities, increasing light intensities have no effect, so the two levels of carbon dioxide must be the limiting factor.

Question 6

Stomatal guard cells do contain chloroplasts.

Question 7

Photosynthesis will be highest and hence oxygen production at midday, (Key A) despite option C being in the middle of the graph.

Question 8

At first glance, the absence of the green plants suggests that there is no oxygen, but the air bubbles and the large surface area will allow sufficient oxygen to dissolve, so the key must be food.

Question 10

The pancreas (option C) produces protease, but at a higher pH. The stem refers to the acid (Key B) in the stomach.

Question 13

Cell X is a vessel, so no carbohydrates would be detected.

Question 14

Tissue fluid, containing dissolved oxygen and nutrients, leaks out, under pressure, from capillaries and bathes cells. Large protein molecules cannot leave the capillaries. White blood cells are amoeboid and do move through tissues, producing immune reactions, rejecting grafts and foreign materials and accumulating as pus.

Question 15

The single heartbeat shown takes 0.6 seconds, so 10 beats will take 6 seconds and 100 will take 1 minute.

Question 17

Breathing out is normally passive and both named muscles relax.

Question 20

Since dialysis fluid contains no urea, the blood at X will have lowest urea.

Question 25

Lowering the body occurs if the biceps relax. The triceps stay relaxed. The shoulder must rotate, since it cannot extend.

Question 29

Light energy captured by photosynthesis, enters as carbohydrate and the amino acids are synthesised from sugars. Energy is lost as heat eventually and is not recycled.

Question 31

The vast majority of energy is at the start of a food chain. Only a very small proportion passes to the higher levels.

Question 32

Vector refers to carrying of the parasite, which is effective because the mosquito flies and can find and distribute the parasite. Laying many eggs is no guarantee of getting the parasite to its next host.

Question 33

The question is about eutrophication, which can be caused by excess nutrients causing extra plant growth. When the plants die, they rot and the decomposing bacteria use too much oxygen, causing aerobic organisms to die.

Question 34

Gametes are haploid and will have 10 chromosomes. Asexual cells are produced by mitosis, which copies the normal 20 chromosomes.

Question 35

Diagram P shows seeds distributed by an explosive fruit (3). The paths in Q are followed by an animal carrying a hooked fruit (1) and the wind distributed fruit, 2 is blown downwind in diagram, R.

Question 37

Gaseous exchange occurs where the foetal tissue is in contact with maternal tissue. This is at C, where the placenta is formed of both tissues. The umbilical cord, A carries gases, but does not exchange them.

Question 39

The heterozygous F1 generation should produce a ratio of 3 red to 1 white flower, although in the small sample of plants being considered, the ration is 2 to 1.

BIOLOGY

Paper 5090/02

Theory

General comments

There were some excellent answers seen to questions in **Section B**, with a significant number of candidates scoring full marks. **Section A**, however, proved more of a challenge even to those who scored highly in **Section B**.

Comments on specific questions

Section A

Question 1

- (a) There was a great deal of information given about fat digestion when the question asked for details of fat absorption. When absorption was mentioned, it was widely believed that fats enter the hepatic portal vein. Even those who correctly mentioned their entry into the lymph system often went on to say that they then 'diffused' into the blood. 'Villi' was quite commonly the only mark scored.
- (b)(i) Apart from the occasional reference to amylase, this part posed few problems.
- (ii) The concept of enzymes requiring an optimum temperature was well understood.
- (c) The products of fat digestion were usually correct, even when mistakes may have been made earlier in the question, although sometimes only one of them was given.
- (d) Some candidates inaccurately answered in terms of water entering the 'sausage', since they are more used to seeing this type of apparatus used in an osmosis experiment.

Question 2

- (a) Transpiration was an almost universally correct answer, but the time of the day when the combined water loss from the plants is at its greatest caused considerable problems. A significant number gave two answers – one for each plant, whilst others were unable correctly to read the graph to obtain the answer (12:30). 10:00 was amongst the most common incorrect suggestions.
- (b)(i) Despite the prompt in (a) many lost sight of the fact that the question was about transpiration and answered in terms of the rate of photosynthesis. Increased light intensity, or increased temperature, were often correctly mentioned as factors which increase transpiration rate, and several spoke of the opening of stomata (though some talked inaccurately of the opening of the guard cells). Very few realised that the increased rate of water loss is associated with the increased rate of evaporation of water from the cells of the leaf.
- (ii) References to the plant being unable to replace the water it loses, and to the plant thus suffering a decrease in water content were rare, though several realised that the stomata would close and/or correctly referred to wilting.
- (c) Transpiration as a process that leads to cooling was mentioned, but, again, there was a failure to appreciate that it is reduced *evaporation* which results in the higher temperature.

Question 3

- (a) The blood vessels were usually correctly identified, but Q seemed to confuse a large proportion of the candidates, suggesting that they may have been more familiar with the textbook diagram of a heart than with an actual specimen. The commonest answer by far was 'fat'. A significant number of those who realised that the structure was an atrium, incorrectly identified it as the right atrium.
- (b) A common belief here was that the vein would have a larger lumen, indicating a failure to realise that only a vein with a lumen of the appropriate size would be chosen. Occasionally references were made to veins carrying deoxygenated blood, but most candidates managed at least one correct suggestion relating to thickness of walls, to the need to withstand a higher pressure, or the problem associated with the presence of valves.
- (c) (i) Common incorrect answers here were 'fatty acids', 'glycerol' and tar, though correct references to fats, cholesterol and to blood clots (or their constituents) were common.
- (ii) It was something of a disappointment that more candidates did not make the link between platelets and blood clotting. It was common to read suggestions that anti-platelet drugs might relieve pain or provide immunity to the stent.

Question 4

- (a) (i) 'Sunlight' and 'temperature' (unqualified) were common answers that were not considered acceptable.
- (ii) Although cotyledon (and, less frequently, endosperm) did appear, they were not as common as might have been expected.
- (iii) The presence of the testa was overlooked by all but the very best candidates. Despite the information given in the question, reference to water was common.
- (b) Although there were many good answers, a significant number chose to *describe* rather than *explain* the changes in mass. Only a few candidates began their answers with a reference to the digestion of (named) food storage substances. It was rare to see mention of these digested substances being translocated to the growing regions, but most knew that they are used for growth, and to provide energy.
- (c) There was a lack of careful thought in this part. The idea of how light would influence the rate was neither suggested nor explained. Many linked the reference to sunlight with photosynthesis, but were not able to deduce that this would reduce the rate at which the food storage region would lose mass – many saying it would lose mass more quickly. Several also, carelessly, suggested that both the radical and plumule would photosynthesise

Question 5

- (a) 'Ovum', 'ovary' and 'uterus' were all common, inaccurate answers.
- (b) Although mitosis was the correct answer (and is a term mentioned in the syllabus), a significant number of candidates opted for 'meiosis' (a term which isn't).
- (c) Implantation in the spongy uterus lining was a relatively logical answer that was surprisingly often overlooked by otherwise quite able candidates. References to fertilisation were commonplace.
- (d) Candidates usually correctly identified the gametes, but so often, they then failed to tie them up correctly in the boxes in the grid. Even when the gametes were correct, they often then failed to identify the individual with blood group O.

Question 6

- (a) This was accurately answered by the majority of candidates, with the most common misconception being that water moves by active transport.
- (b)(i) With the exception of those who spoke of water, this was otherwise well answered. There was a predictable number who failed to suggest an importance for the transported substances.
- (ii) This part was generally less well answered. References to carbon dioxide and to oxygen were not uncommon, and, perhaps influenced by **Question 1**, a number offered the uptake of fats. Minerals and vitamins were often mentioned, as was the suggestion that the circulatory system is an example of active transport. References to the uptake of substances by selective reabsorption in the kidney were accurately described by some of the better candidates. Again, the importance of the substances was often omitted.

Question 7

- (a) It was common for candidates to begin their answers with references to sensory receptors in the skin detecting a change in external temperature, while the question asked for what happens *after* the body temperature has fallen. There were the customary misconceptions relating to capillaries constricting, to blood vessels moving deeper into the skin and to heat being trapped by the hairs (rather than the trapped air acting as an insulator). References to the evaporation of sweat were rare – not so to the mistaken belief that ‘no sweat’ is produced.
- (b) This was always going to be a difficult concept for candidates to put into words, and it is to their credit that they often did so very well. Examiners offered a little assistance by accepting a specific example to illustrate their ideas, but were not able to extend that latitude to answers that were really no more than a definition of homeostasis. Weaker candidates often omitted this part.

Question 8 Either

- (a) Some candidates lost sight of the requirements of the question and gave an account more of the symptoms of malaria rather than how mosquitoes are able to transmit the disease. Details of the life cycle of *Plasmodium* in the human body were common. There was confusion over the pathogen responsible for malaria, some saying it is a virus, and many believing it to be a bacterium. Few references were seen to the behaviour of mosquitoes relevant to their ability to transmit pathogens – such as their attraction to the warmth of bodies and their habit (in the case of *Anopheles*) of biting at night, or that the mosquito is a human parasite.
- (b) This part often scored full marks, though an appreciable number had no more than a vague idea of possible symptoms that could have related to any number of diseases. Many descriptions seemed more associated with gonorrhoea than with syphilis. Only a few mentioned the importance of early diagnosis or that the tertiary stage may be delayed for several years.

Question 8 Or

This was, by far, the less popular of the two **Question 8s**.

- (a) Even otherwise competent candidates displayed a common misunderstanding of the process of artificial selection. Their general belief is that parents are taken each showing a different characteristic. Their offspring will then show both characteristics. The concept of taking *one* characteristic shown by *both* parents, then breeding and selecting for the best examples of that characteristic over many successive generations rarely came across in answers. There was some degree of confusion with genetic engineering.
- (b) Those who realised that asexual reproduction provides a large number of organisms, in a relatively short period of time and that all possess the same desired characteristic were able to score well. Such candidates were often able to support their knowledge with a valid example. However, several appeared to read ‘asexual’ in the question as ‘sexual’ and spoke about reproduction by seeds – unfortunately with no reward.

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Paper 5090/03

Paper 3 - Practical Test

General comments

A number of marks were readily accessible in both questions with **Question 1** particularly reflecting candidates' familiarity with the food testing reagents. Thus, a total mark below 10 was very unusual and there were a good number of scores in the high thirties. It should again be stressed that the ability to follow instructions very carefully is always rewarded by a few marks that might otherwise have been thrown away. It was clearly vitally important that the major drawing required for **Question 2(a)** was thoroughly labelled, yet a few completely unlabelled answers were presented.

Comments on specific questions

Question 1

- (a) Despite the allusion to the time factor in the stem of the question very few candidates gained more than one of the marks for the fact that there was a black, or blue-black reaction. Blue alone was not acceptable as it is too unspecific in describing food tests. A few mentioned the delay in the development of a discernable change and even fewer attempted to describe a pattern of distribution. The vascular bundles were worthy of observation, for instance.
- (b)(i) and (ii) This food test was generally well described though some candidates omitted to heat the reactants – and it was expected that this should be carried out in a water-bath, as the syllabus prescribes.
- (c) The relationship between the terms carbohydrate, starch and reducing sugar was not well understood. Thus the investigation that was proposed was often quite unclear. Some merely described what possible changes might occur, with no attempt to outline an experimental procedure. Others suggested that the tests for starch and for reducing sugar should be carried out, and even on samples of different age, but there was no logical follow-up. There were hardly any suggestions as to what transformations of carbohydrate might take place as ripening progressed. We expected that the general assumption might be that starch was converted to reducing sugar as the fruit ripened. A few candidates, not knowing what to do, suggested tasting the fruit at different stages, or noticing the changes in the colour of the fruit as it ripened.
- (d)(i) Some candidates found this question quite difficult to answer, especially if they thought, quite wrongly, that the bananas had viable seeds as well as the cucumber. Many answers suggested that inhibition of germination took place in the banana.
- (ii) Candidates seemed to be quite unaware of how bananas propagate. When they accepted that it was not by seeds many mentioned the term 'budding' but did not in any case know what would be involved in that process. All that was required was a brief indication that a sucker, or similar part of a stem was planted as part of a vegetative or asexual reproductive process.

Question 2

- (a)(i) The great difficulty for the Examiners, when using a flower of a certain type for a specimen, was well shown on this occasion. Probably less than 50% of candidates were provided with a specimen from the family *Bignoniaceae* as specified. The most popular flower was *Allamanda* which, while being large and clear, is not zygomorphic. Marking was made as fair to the candidates as possible, however, with many of the same criteria being applied.

Drawings were mostly of good size and clarity but labelling was variable in extent and accuracy – and very occasionally omitted completely. Terms such as ‘pollen tube’ were evident from time to time, with no justification. The marks were awarded for petals and sepals (corolla and calyx), anther and filament (or stamen) and stigma and style. The majority scored two of these three.

- (ii) Some evidence of extra detail or greater clarity was expected from the use of the hand lens. Pollen grains, or some structural detail of the anther or its attachment to the filament might have been seen, recorded and labelled.
 - (iii) There were still plenty of candidates, good ones included, who ignored the instruction to indicate where they measured on the drawing and so lost the measuring mark, which is a pity. Of those who do follow the instruction, some indicated an unrealistically small distance – less than 5 mm for instance - by electing to measure the ‘wrong’ axis. It was, however, pleasing to see that the vast majority of answers were correctly calculated and accurately expressed, both in terms of sign and expression of decimal places.
- (b)(i) Choice of features was often poor, frequently concerning nothing more than the size difference in another guise. Yet there were clear distinctions in the colour of the flowers, as well as shape and position of the reproductive organs. It was vital that on each line the two sides of Table 2.1 were completed with relevance to the same feature.
- (ii) It was generally recognised that W3 was an insect pollinated flower. W4 was variously described as being wind or animal pollinated and quite often the word ‘dispersed’ was used, followed by an indication that the pollination process was being confused with seed dispersal. The term ‘self pollination’ was sometimes applied to either W3 or W4 and various parts of the flower were said to be light and/or small, to assist in pollination.

Many candidates would have completed Table 2.1 more accurately if they had answered **Section (ii)** first; their theoretical knowledge being better than its practical application!

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Paper 5090/06

Alternative to Practical

General comments

The Examiners tried, as usual, to reward evidence that candidates had performed, or at least witnessed, practical work. There were also familiar indications as to how carefully they had read and followed the rubric. This was especially evident in **Question 1(b)** where there was an important distinction between features that were visible on the Figs. and those whose presence was inferred.

Skill in drawing a graph and familiarity with the standard food tests were very productive in terms of marks.

Comments on specific questions

Question 1

Figs. 1.1 and 1.2 showed the structures of the flower of a Labiate and of a grass.

(a)(i) and (ii) Candidates were asked to label the structures in which reproductive cells were produced and many indicated, by means of clear label lines, an anther and the ovary in each of them. Some omitted the lines, or allowed them to end vaguely, but a significant number picked out the stigmas rather than the ovaries. Others made no attempt to label Fig. 1.2.

(iii) A common mistake was to refer to stigma and pollination.

(iv) Here and in **Section (b)** the visibility of the feature was vital; thus, colour and scent were not admissible. However, most candidates selected size of flower and location of its parts, internally or externally. It was important that both sides of the table referred to comparable structures at each of the three levels so that a valid comparison was made.

(b)(i) Candidates did not always realise that the agent of pollination was required. A few suggested self pollination while others referred to animal pollination but often went on to gain the mark by adding insect.

(iii) The size and conspicuous nature of the flower, or its petals, was generally mentioned, along with the relative enclosure of the reproductive structures as against their exposure in the grass.

(iv) There was scope here for the colour, guidelines on the petals, scent and nectar to be mentioned.

(c) The obvious methods for avoiding self pollination were single sex flowers, protandry and protogyny – though not usually in these terms! We also allowed reference to specified parts of the flower being cut out and to the relative positions of the vital organs within the flower. A number of less practicable suggestions included covering part of the flower with a plastic bag, or ‘removing pollen grains’.

Question 2

(a)(i) Very few candidates fully appreciated the relationship between there being only one hair follicle in the plane of section and the thin nature of the section itself. Credit was given to those who came close to the explanation by referring to the magnification of Fig. 2.1.

- (ii) The vast majority confused the sebaceous gland with a sweat gland and of those who did opt for the correct gland many merely gave a name for the secretion rather than an idea of its function, as required by the question. References to the hair being oiled, or kept supple, or to the antibiotic effect of the sebum were accepted.
- (iii) and (iv) While many candidates were able to identify where another hair almost became part of the section, some made the mistake of identifying the hair already drawn, or of drawing another hair on the diagram. There were very few correct identifications of an erector pili.
- (b)(i) The reason for the sweat gland's appearance on the drawing was very poorly understood. Only a few candidates stated that the gland was a coiled structure, or 'like a ball'. Many stated that the circular structures gave a larger surface area.
- (ii) Probably a small majority correctly stated mitosis. Commonly meiosis (or a meaningless hybrid of the two), cell division and epidermis, were the errors.
- (c)(i) Candidates either had a reasonably good idea of how to use the apparatus to best effect, or were totally confused. A number, unnecessarily, decided to test the two beakers in succession rather than simultaneously.
- (ii) The use of two thermometers, a stopwatch and replication were simple, but effective suggestions as to how to make the results more reliable. References to insulation (lagging), or 'different temperatures' were not acceptable.

Question 3

- (a) The graph was nearly always well drawn though some candidates did not label the axes. An attempted line of best fit or neatly ruled connections between the points was accepted, but some attempts to connect the points freehand were inadequate. Very few graphs had the axes reversed and hardly any bar charts were presented. Candidates clearly made good decisions here, regarding presentation.
- (b) Most candidates appreciated what was happening to produce both outcomes. There was the inevitable confusion between respiration and photosynthesis and the idea that plants start to respire at night was frequently encountered; few made the point that at low light intensity respiration exceeded photosynthesis. There were some attempts to involve 'soil respiration' or a leak in the plastic bag.
- (c) The two food tests were very well described. The advisability of heating the test-tube in a hot water-bath when testing with Benedict's solution was correctly mentioned by many, but a small minority spoilt their accounts by adding starch and glucose, respectively, when performing the tests.