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FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned.**



BIOLOGY

GCE Ordinary Level

<p>Paper 5090/01 Multiple Choice</p>
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<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
1	B	21	B
2	A	22	D
3	C	23	D
4	B	24	C
5	D	25	D
6	C	26	B
7	B	27	B
8	C	28	D
9	B	29	B
10	A	30	D
11	B	31	A
12	C	32	B
13	B	33	C
14	C	34	C
15	B	35	D
16	D	36	C
17	A	37	A
18	B	38	C
19	B	39	B
20	B	40	C

General comments

This paper produced a good spread of candidates. The candidates' basic knowledge was good, but the paper also produced some surprises from topics which were presented in unusual forms. For example, the arm and its movements are usually very well known. Also turning the apparatus round in **Question 20** confused too many candidates. Along with the usual advice to "read the question" candidates should also "study the diagrams carefully".

Comments on specific questions

Questions 3, 5, 12, 24, 32, 33 and 38 mainly required knowledge and proved easy.

Question 1

Most candidates looked carefully and saw that the line **B** labelled the membrane and the line **A** was the cellulose cell wall.

Questions 2 and 4

The stem states that the external solution was dilute and the diagram has the cell solution marked concentrated, so water uptake is by osmosis and mineral ions will be absorbed by active transport.

Question 6

The 0.04% line is horizontal, so, although the light increases, the rate of photosynthesis does not. The 1% line shows that more CO₂ would increase the rate.

Question 8

The experiment is on the effect of CO₂, so the only factor to alter must be CO₂ Key **C**. **A** shows the effect of temperature, **B** oxygen and **D** light.

Question 9

Vitamin deficiencies are usually well known. Vitamin D helps Calcium and Phosphorus metabolism and hence bone and tooth formation.

Question 13

It was pleasing that so few chose option **C**, but the pulmonary pressures are far lower than the systolic pressure in the aorta.

Question 14

Although urea is synthesised in the liver, it is excreted from the kidneys, so the lowest concentration must be in the renal vein.

Question 15

This was a longer question, although well within the time available. Of the four activities, the goal (even if scored by the opposition!) will give the greatest increase in pulse rate. Walking into the stadium will have a higher rate than waiting beforehand. Clearly the graphs must be curves, rather than the lines in **C** and **D**.

Question 16

Fibrinogen is converted into the fibrin network, to which red cells stick. So the key must be **D**.

Question 18

The cell **X** has cilia, so its function is movement of mucus (Key **B**). The second cell down in the diagram is a goblet cell, which does secrete mucus, (option **D**) but that is not the question. The name "goblet" is not on the syllabus, but the function is and should be known. All living cells exchange gases, but none of the ones in the diagram is phagocytotic.

Question 19

Only option **B** shows the arm extended. Options **B** and **D** show rotation of the shoulder. This topic is usually well known, but interpreting the words caused a number of errors.

Question 20

The diagram is reversed from the usual text book format!

Question 25

Fungi have no chloroplasts (**A** and **B**), but their nuclei are surrounded by membranes.

Question 27

This was another surprise. The stem refers to green plants, so clearly light is necessary. Too many of the weaker candidates chose option **D**.

Question 28

Many bacteria are not parasitic – e.g. those involved in nitrogen metabolism in the soil and in rotting. Although they do have DNA, it is not found in a nucleus as in higher organisms.

Question 29

The *not* in negative questions are always *emboldened*. Draining swamps will reduce mosquito egg laying (**A**). Sleeping under nets prevents being bitten (**C**). Insecticides will kill mosquitoes (**D**).

Question 34

Skin cells are diploid, as are all body cells other than gametes, which are haploid.

Question 35

The two black-haired pigs must be heterozygous, so the probability of any of their offspring being red-haired is 0.25.

Question 36

Normally, breast milk is best, for the reasons alluded to in options **A**, **B** and **D**, but the quantity taken is not normally measurable other than by weight.

Question 40

Eye colour is not the simple “blue or brown” that some texts suggest, but there are only a few genes involved, it does conform to “discontinuous”. Gender and blood groups are less controversial and clearly height and weight are continuous.

<p style="text-align: center;">Paper 5090/02 Theory</p>

General comments

Section A allowed candidates to display their knowledge over a wide range of syllabus topics and many showed impressive competence and versatility. The compulsory questions in **Section B** were generally well answered, but many found it somewhat less easy to score well on **Question 8**.

Comments on specific questions**Section A****Question 1**

Candidates were asked to apply their knowledge to an unfamiliar situation and many were able to do so with success.

- (a) Bacteria, or a correctly-named bacterium, were the expected answers. 'Fungus' was a fairly common inaccurate suggestion with 'yeast' being the most common error.
- (b) Despite the instruction in the question, few made reference to specific information in Fig. 1.2 in their answers and those that did often failed to read accurately from the graph. Some did not think carefully enough before stating that it was the addition of the enzyme that lowered the pH. Only a few indicated that the enzyme would work best in acidic conditions.
- (c) Several failed to recognise the clue that only in the stomach would acidic conditions be found, and therefore 'mouth' and 'duodenum' were the most common of the inaccurate answers.
- (d)(i) The significant feature here was to indicate that the product contains vegetable rather than animal fat. It was not uncommon for there to be an implication that there would no longer be any fat in the product – clearly not an accurate understanding of the process described.
- (ii) Most candidates were able correctly to equate large quantities of cheese in the diet with obesity and circulatory disorders.

Question 2

- (a) Although the wrong type of blood vessel was occasionally suggested for the blood capillary, this part posed few problems.
- (b) This part called for a clear understanding of the process of inspiration and then some careful thought. Unfortunately, it was rare indeed to find a candidate who opted solely for boxes two and three, with those who knew that processes two and three were relevant also going on to suggest a further process.
- (c) This was well-answered. There were accurate references to dissolving, diffusion, combination with haemoglobin and a comprehensive list of structures through which the oxygen passes.
- (d) It was pleasing to see how many candidates were able to make the correct deductions here and score all 3 marks. The commonest misunderstanding was to suggest that the % of oxygen in inspired air would be affected, while some wrote vaguely about the '% of air' breathed in and out.

Question 3

- (a)(i) Almost always correct, apart from the few who confused chlorophyll with chloroplast.
- (ii) Again, no problems for most candidates though a few suggested various elements including nitrogen.
- (b)(i) There were no difficulties in identifying the gas, though a few suggested that the process might be respiration.
- (ii) The main problem here was to give an answer which related to photosynthesis/respiration and plants/animals in general. 'Air' was mentioned, as well as 'humans', but it was common to see sound answers covering the main points of oxygen being provided for fish respiration, food being provided for the fish and their waste carbon dioxide being absorbed. Other accurate references were also made to the provision of shelter and of possible importance in fish reproduction.
- (c) Those who do not read the question carefully were sometimes caught out here, since references to 'humans' were seen. Also, fungi were suggested as were plants (root hairs). Most, however, correctly identified the organism, though identification of the cell was not always accurate ('sensory neurone' and 'part of the brain' were sometimes suggested).

Question 4

- (a) A few candidates were unable to appreciate that the diagram showed pollution and thus suggested answers such as 'ecosystem'.
- (b)(i) From a wide range of acceptable answers, most candidates were able to select one harmful gas.
- (ii) Not so impressive was the knowledge shown about the effects of the chosen gas (e.g. carbon monoxide quite often being linked with acid rain).
- (c)(i) Candidates struggled to find two possible reasons for plants growing well downstream from point X. Examiners were looking for reference to nitrates, fertilisers, cow dung or sewage, but answers often attempted to involve the factory and, sometimes, pesticides.
- (ii) Those who appreciated that bacteria decompose sewage were usually able to complete the story referring to the use of oxygen by the bacteria for their respiration depriving other organisms of oxygen for theirs. Many, however, were attracted by the idea, irrelevant in this instance, of algal bloom and then opted for the bloom keeping out the sunlight. It was quite common to read that bacteria are the product rather than the cause of decay.

Question 5

- (a)(i) Superior and inferior venae cavae were confused, as were pulmonary arteries, pulmonary veins and aortae. Nevertheless, it was quite common to award all three available marks in this part.
- (ii) 'Muscle' was the type of tissue but it was not suggested quite as often as might have been expected. 'Heart' or 'cardiac' was not thought to be sufficiently precise. The coronary artery was more often correctly suggested as the blood vessel with a fairly common incorrect answer being pulmonary artery.
- (b) This was one of the least reliable areas of candidates' knowledge. The semi-lunar valves were the most accurately positioned, though they commonly appeared in the venae cavae or pulmonary veins. The atrio-ventricular valves were sometimes placed in highly improbable positions (such as projecting from the inner ventricular walls, near the apex of the heart). They were also shown crossing either the atria or the ventricles, not having any attachment to the walls or each existing as a single structure.
- (c) It was relatively rare to find a candidate who knew the sequence in which the events occur in the heart which, perhaps more than anything, indicated that there are inaccuracies in the understanding of how the heart operates. The sequence for which Examiners were looking was 1, 4, 2, 3.

Section B**Question 6**

Some candidates clearly had no grasp of the process of accommodation whilst others confused the muscles involved in accommodation with those used in the iris response. For such candidates it was difficult to find marks, whilst others had precise and accurate knowledge of both processes and had no problems scoring highly for this question. It was relatively common for candidates to believe that a more concave lens has a longer focal length and to see reference to the belief that the lens 'becomes (more) concave'. It was common for candidates to appear to believe that both the lens and the pupil were muscles, able to contract. Many spent much time on describing the situation before the changes took place rather than concentrating on the changes. It should be understood that, except when specified, marks can be awarded either in the text or on a diagram. Many candidates wasted time by repeating on a diagram what they had already said in the text, or vice-versa.

- (a) The commonest errors were to refer to the contraction rather than relaxation of the ciliary muscles and to believe that suspensory ligaments contract. Also, a mark was sometimes lost by a repetition of the wording of the question, saying that the described process helps a person to see the aeroplane rather than to link that with the process of focusing on a distant object.
- (b) This was generally well answered, though the muscles involved were only occasionally referred to as iris muscles. The relevance of the change in light intensity was often missed.

Question 7

- (a) Although it was stated that there were only four marks available for this part, many candidates wrote at length about the female reproductive system and its function from the moment of ovulation to the birth of the baby. Such candidates scored their four marks early in the piece, but even they, along with those who were more focused on the requirements of the question, still managed to display only a slender grasp on the meanings of many of the terms used. 'Ovule' appeared almost as regularly as ovum, zygotes were believed to implant, and often in the placenta. The cells of the blastula, if they divided at all, sometimes did so by meiosis.
- (b) Examiners were looking here for an indication of how the diet of the pregnant woman relates to the developing embryo, and they were generally encouraged by the answers seen. Much precise information was given, but weaker candidates referred to increasing the amount of, for example vegetables, eggs and milk, without an explanation of why that would be important in the mother's condition.

Mother/baby bonding was often mentioned here, even though the question was specific to the advantages of breast milk rather than to breast-feeding, but this did not stop most candidates finding two or three totally acceptable examples.

(either) Question 8

- (a)** It was rare to find a candidate who gave a full answer to this part, with references both to lignified xylem and to osmosis and turgor in cells. Several felt that xylem vessels are turgid because of the water they contain, while others were wary about suggesting whether it is the xylem or the phloem in the vascular bundles that provides the support.
- (b)** There was often a problem with explaining what wilting is, though there was some latitude on acceptable terms to describe the process. It was not as common as might have been expected, to read that wilting occurs when water loss by a plant exceeds water uptake, and several candidates found difficulty with the connection between transpiration and humidity – an appreciable number believing that transpiration rate increases with increased humidity.

(or)

- (a)(i)** It was slightly surprising that a greater proportion of candidates did not refer to roots holding the soil, though most realised that removal of trees would lead to soil erosion. Few, however, thought to say that the reason for this would be that there would no longer be trees to protect the soil from wind or rain. The value of rotting leaves in binding soil was also rarely mentioned.
- (ii)** A problem here was that candidates described water loss by trees but often did not make it sufficiently clear what effect deforestation would have on the climate. There always has to be a limit on how far an Examiner can go in interpreting the candidate's meaning from the information provided. A link was usually made with loss of trees and increased temperature, but this was the only mark scored in some cases. It was common to see evidence of the mistaken belief that 'trees attract clouds'.
- (iii)** There was a temptation to describe the carbon dioxide/oxygen balance here rather than the loss of homes, food and livelihood which was the more expected approach. Limited credit was given to those candidates who took the view that deforestation attracts building and development, and is therefore an advantage, even if only in the short term.
- (b)** Most candidates explained that seeds have their own stored nutrients, and several went on to indicate that conditions for germination include oxygen, water and a suitable temperature and do not include nutrients. They were rewarded accordingly.

<p style="text-align: center;">Paper 5090/03</p> <p style="text-align: center;">Paper 3 – Practical Test</p>
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General comments

There were a number of examples of candidates losing marks because of poor technique, not least in failure to follow the instructions in the questions. Comparisons also tended to be somewhat inadequate, both in terms of similarities and differences, all of which should be visible in the specimen or Fig. The spaces or lines provided, together with the mark allocations, should be more carefully considered when questions are being answered. Labels are essential when a large labelled drawing is asked for; this appears to be very obvious, yet there are always a significant number of candidates who disregard the instruction. Also many of the labels that were used were unrealistic; for example, the names of parts of a fruit applied to vegetative structures to which they bore no resemblance.

Comments on specific questions**Question 1**

- (a) Specimen W1 was a small bulb which candidates were required to cut in half longitudinally and then to make a large, labelled drawing of one of the cut surfaces. This was very well carried out by the great majority except that the labelling was frequently inaccurate, as mentioned earlier. The swollen scale leaves were usually shown properly connected to the basal disc but the thin outer scales were only rarely represented.
- (b)(i) Specimen W2 had then to be compared with the root section shown in Fig. 1.1. Candidates struggled to find realistic points of similarity with very few mentioning that both were roots and both were transverse (or cross) sections. Consequently there was a central vascular structure, surrounded by a plain cortex in each, and these were the main points of comparison that were made. References to cell walls, nuclei and mitochondria were common but not acceptable.
- (ii) The fact that Fig. 1.1 was a photomicrograph showing typical low power magnification should have provided a good, initial contrast to the life-sized piece of carrot. That cells were clearly visible only in this specimen was similarly rarely mentioned. Examiners usually found a mark in the contrast that was made between the small, or thin, region of conducting tissue of Fig. 1.1 compared with the corresponding wider zone of W2. Many candidates got into difficulties by referring to colour and texture which were not valid comparisons in this case.
- (c)(i) The majority of candidates were able to describe the black, or blue-black, colouration that occurred and better answers went on to mention the distribution of the starch that was responsible for the colour. To describe the positive result of this test as 'blue' was not acceptable because of the risk of confusion with other food tests. The majority of candidates were awarded two marks in this section, for either the positive or the negative result, adequately described.
- (ii) The test for reducing sugar was very well described by the vast majority. Heating with a water-bath was the practice generally adopted, which is good. Perhaps a little more regard for stating approximately how much Benedict's solution was used might have been beneficial.
- (iii) Most candidates had a good idea of the purpose of this procedure though there was some confusion as to how the cell contents got into the water, with osmosis and diffusion frequently being implicated. Very few mentioned the breaking open of the cells to allow the contents to escape.

The idea that the pieces of carrot would obscure the result of a test, hence the advantage of pouring off the liquid, was only rarely mentioned.

Question 2

- (a)(i) Candidates were required to make a neat, temporary preparation of a piece of specimen W3, *Selaginella* or something similar, on a microscope slide, and then to make a labelled drawing as a record of their preparation. This proved to be an easy and rewarding exercise for those who clearly had experience of this type of practical work. As already stated, there were those who did not fully complete the process. A common omission was not to include the microscope slide in the drawing and a few attempted perspective drawings, often including a lens as well as the other apparatus. It was expected that the outlines of slide and cover glass would be ruled and rectangular.
- (ii) A principal requirement, usually described here, was to prevent the inclusion of an air bubble beneath the cover glass. Tilting the cover and lowering it gently with a mounted needle was a good answer, as was a description of how an excess of water was prevented, usually by judicious blotting. Tidiness of the bench or workspace, as frequently mentioned, was not relevant. Credit was also given when specimen W3 was *Elodea*, or another species of similar size, and it needed to be cut to a suitable size for mounting which was often briefly and satisfactorily described.
- (b) Many candidates thought that the use of iodine solution necessarily involved the starch test. If the instructions had been followed it would have been observed that the filter paper absorbed the water, drawing it out of the preparation. This caused the inflow of iodine solution to replace the water and a degree of staining was evident as the iodine solution encountered the specimen. Many thought the movement of the liquids was due to diffusion, or even to osmosis.
- (c)(i) The specimen should then have been examined with the hand-lens so that the characteristic arrangement, in *Selaginella*, of the four rows of leaves of unequal size could be drawn. Good drawings were not common, with the small leaves particularly being indistinctly shown. Other specimens features that could be observed were credited, with leaf arrangement, mid-ribs, toothed leaf margins and tapering leaves being the features most commonly given. Most drawings, though by no means all of them, included a ruled line as required for the next part of the question, calculating the magnification of the drawing.
- (ii) Dimensions were generally well recorded with the correct units, mm or cm, clearly stated. When cm were used it was necessary for the measurement to be stated as, and accurate to, 0.1 cm. However, checking revealed that a number of these measurements lacked the necessary degree of accuracy. Magnification was well stated, with only a few candidates spoiling their answer by giving units, e.g. 'x 4.5 cm' or too many places of decimals.
- (iii) Perhaps it would have been more instructive for candidates first to examine the specimen on a white tile before looking at their mounted preparation. They would then have appreciated the advantages of greater manoeuvrability, ease of staining and having a thin specimen in a single plane. The main object of this exercise was to enable microscopic examination, an idea put forward by about half of the entry. The full four marks allocated here were rarely awarded.

Paper 5090/06 Alternative to Practical

General comments

As always, it was the intention of this paper to encourage and to reward candidates' experiences of practical work. The advantage of having this experience was well shown in the answers to **Question 1**, for example, especially when good examination technique was evident in the way the parts of the question were tackled in the correct sequence.

Following instructions and making sensible use of the information provided by the allocation of space and marks made a great deal of difference to performance.

The candidates appeared to have enough time to complete the paper.

Comments on specific questions**Question 1**

- (a) Most candidates responded correctly by referring to the exposure to boiling water causing the chemical processes in the leaf to stop. Only a few said the enzymes were 'killed' though it was acceptable that the cells were killed. A significant minority thought that removal of chlorophyll took place at this stage.
- (ii) There was good general awareness of the safety procedure of heating ethanol over a water-bath. A number took their answer too far at this stage, however, not having followed the reasoning to the end of the question.
- (iii) It should have been clear, from the mark allocation, that two effects were required here. The loss of colour or removal of chlorophyll was usually given but the accompanying properties of brittleness and hardness of the leaf were often omitted. Changes to brown were not accepted. Several answers said that the leaf became soft at this stage. There were also those who, having got out of phase, referred to the changes in colour due to the addition of iodine solution.
- (iv) In practical terms, what was expected here was a brief immersion in water, then the softened leaf being spread out in a dish or on a white tile and the addition of iodine solution. The third of these points was awarded more frequently than the two preceding treatments.
- (b) Although many candidates responded fully and correctly, a number reversed **A** and **B**, or did not sufficiently stress the conditions that were expected. In addition to stating that exposure to (sun)light was the principal difference, good candidates also mentioned the need for carbon dioxide availability. A fair number remembered that a minimum of 48 hours in darkness was advisable to ensure the destarching of a leaf.
- (c) Good candidates appreciated that the starch had been converted to some form of sugar which was then used in respiration (rather than as energy for respiration), or was translocated away from the leaf. Weaker answers simply said the starch had been used by the plant, but a purpose was not suggested so this answer was unsatisfactory. Others missed the point that starch was initially present and simply said that no photosynthesis was possible in the absence of light.

Question 2

- (a)(i) A xylem vessel was generally indicated, clearly and accurately, in the manner requested. A number of candidates made no attempt here, and a few labelled Fig. 2.1.
- (ii) It was generally recognised that the xylem in Fig. 2.1 was being seen longitudinally while Fig. 2.2 was a transverse section. Many referred to them being 'larger' or 'smaller' rather than to difference in magnification. Credit was given for stating that entire or separate cells were shown in Fig. 2.1.
- (iii) Interpretation and quality varied considerably in this drawing. Only the area of the stele was required. Many included the entire section and tried to represent a lot of the cells. It was expected that the xylem would be shown to be clearly tetrarch – which it was in many – and that the diagram would give a reasonably accurate idea of the shape and proportion of this tissue. The labels required were for xylem and phloem; both marks were awarded to fewer than half of the candidates. And again, a significant minority attempted no labelling.
- (iv) This was generally incorrect, most identified it as a stem, or even a leaf.
- (b) Generally well answered with candidates showing a good appreciation of the essentials of the structure of plant cells. Many mentioned the lack of various typical organelles in the xylem, but perhaps a more complete approach was from those who also knew about lignification and the elongated nature of the components of xylem vessels with their prominent tapered ends (which were well shown in Fig. 2.1), as well as the characteristic pits and lack of cross walls.
- (c) Dimensions were generally well recorded with the correct units, mm or cm clearly stated. When cm were used it was necessary for the measurement to be stated as, and accurate to, 0.1 cm. Some of the measurements were not those of the part that was drawn. Magnification was well stated, with only a few candidates spoiling their answer by giving units, e.g. 'x 3.5 cm', or too many places of decimals, or omitting the 'x' sign. The majority also remembered to allow for the x 100 magnification of Fig. 2.2 though a few allowed for x 250 – the magnification of Fig. 2.1!

Question 3

- (a)(i) The graph was very well drawn by most candidates and the instructions were all carefully followed. A few reversed the x and y axes but on this occasion hardly anyone attempted to produce a bar graph. Strangely, some transposed the labels of the axes but plotted correctly. The curves were produced equally well as lines of best fit, or by connecting the plots with ruled lines but one error that occurred a significant number of times was to produce the curves down to 0 on the axes, with no justification.
- (ii) The two differences that appeared to be most obvious – the horizontal nature of the curve for the cat, and the fact that it was higher at all values than that of the anteater, were by no means universally acknowledged. The gradual rise of the latter, with ambient temperature, was frequently mentioned.
- (iii) Good candidates noticed the linear nature of the curve for the lizard and its relationship to the ambient temperature. As above, it could also be pointed out that the temperature of the anteater was higher than that of the lizard at all ambient readings. Many answers suffered by attempting to be too complicated.
- (b) The essential link needed here was to relate the activity of the cat at low temperature with the ability of the cat to maintain a constant body temperature that is relatively high, and close enough to the optimum temperature of its metabolic enzymes. Its activities would then be independent of the ambient temperature. Many candidates approached this idea by writing about the fur on the cat providing insulation, so helping to achieve a degree of homeostasis.