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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

Paper 5090/01
Multiple Choice

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

General comments

The paper separated candidates well this session. Their knowledge continues to be good, although there were still some surprises – especially **Question 1**, which looked familiar, but had an original slant. Candidates should realise that standard diagrams can lead them in many different directions.

All guidance on exam papers urges candidates to “Read the question” and this applies to **Question 2**. An alternative may be that candidates do not understand a term or its particular use. This may apply to the phrase “limiting factor” in **Question 6**, although it is in the syllabus and means exactly what it says.

Comments on specific questions

Questions 5, 8, 9, 12, 13, 20, 24, 25, 26, 29, 33, 35 and 37 mainly required knowledge and proved easy.

Question 1

The question is asking where the starch is – obviously the chloroplasts – option **C** – but this is not a simple one-stage question.

Question 2

The stem refers to the low concentration of glucose in the intestine, so uptake of glucose must be by active transport, rather than diffusion, against the increasing concentration gradient.

Question 3

The stem gives the clue that the external solution is “strong”, so water is going to move out of the cell by osmosis.

Question 4

The phrase “lock and key” was well known, but candidates did not associate the specific shape of the substrate molecules, fitting into the enzyme molecules, with the shape of the key fitting into the lock.

Question 6

If a factor is limiting, then as it changes, so does the overall rate of the reaction. At **X**, as light intensity increases, so does the rate of photosynthesis, so light must be limiting. CO₂ was a popular wrong choice. There are situations when CO₂ is limiting, but not at low light intensities.

Question 7

The familiar diagram was simplified and shows that many candidates were not familiar with a TS dicot. leaf. There are no chloroplasts in the upper epidermis, although they are found in stomatal guard cells.

Question 10

The question is slightly longer than most but other simpler questions such as **Question 9** compensated for the time needed. The material is familiar and the better candidates soon worked out that with no enzyme (tube 1) or just saliva tube (4) there will be a negative Benedict's test.

Question 11

Almost all the candidates knew that the ink is transported in the xylem, but not all knew that the xylem, like the wood of a tree, is in the middle, not on the outside.

Question 15

Option **C** was oddly popular – there is no direct link between the leg and the liver. Another opportunity to read the question fully.

Question 16

As we breathe in, both sets of muscle contract and any candidate could have felt their diaphragm descending if they had taken a deep breath during the exam.

Question 17

The stem refers to yeast. Lactic acid is produced by our muscles, but not yeast.

Question 18

The kidneys remove excess water from the blood, so the urea will become most concentrated as it leaves the organs.

Question 19

The loss of faeces from the gut, as an example of excretion, is a popular error. CO₂ is a waste product of metabolism and it is excreted. There is a minimal quantity of urea in sweat and of degenerate haemoglobin in faeces, but in each case the major function of these process is not excretion.

Question 21

Ciliary muscles relax when focusing at a distance, which may help to explain why close vision can cause eye strain. As the elastic, fluid-filled eye will enlarge the ciliary muscle ring, the ligaments pull the lens into its thinner, long vision, shape.

Question 22

Relay neurons are found in the spinal cord and brain and connect sensory to motor neurons, so **A** is correct. **B** and **C** refer to sense organs only and option **D** is too vague when compared to **A**.

Question 23

Emphysema and cancer are both well known consequence of smoking, but cancer is the uncontrolled division of the cells and not loss of elasticity. Read all the question!

Question 27

Blood glucose does fluctuate gently in normal people. The rise is due to sugar intake. Insulin (option **B**) would lower the level. A diabetic's blood glucose (option **C**) would show a rise, but it would not fall over the next half hour. Exercise (option **D**) would lower blood sugar.

Question 28

Bread making will produce CO₂ and alcohol, the acids produced during cheese making help to coagulate the cheese.

Question 30

Circle 3 or 4 must be the atmosphere and plants, since they exchange CO₂. Arrows from circle 4 going to 1, 2 and 3 show that 4 must be plants. Circle 2 must be animals since carbon compounds go from 2 to 1, which must be the decomposers.

Question 31

Malarial control is largely mosquito control. Option **B** aims to stop them entering houses. Options **C** and **D** stop them laying eggs and hence stops larvae from hatching. The key – **A** – is a good idea, but has no effect on malaria transmission.

Question 34

Option **C** was far too popular. The stem refers to groups of cells that can be grown into identical plants. Only cells from the original plant could do this – option **D**. Pollen and pollen tubes (options **A** and **B**) will not develop on their own. **C** may be fertilised, develop into a seed and eventually germinate into a new plant, but it will not be identical to either parent.

Question 36

Although the fertile and non-fertile periods do vary from woman to woman, the options given are normal. After ovulation, from day 14 onwards, is the most likely fertile period and during menstruation, from day 1 onwards, is the least fertile time.

Question 38

Anaemia is due to iron-deficiency, but sickle-cell anaemia is a genetic problem.

Question 39

Candidates choosing option **C** are confusing genotype (the alleles possessed) with phenotype (what it looks like). Options **A** and **B** were correctly rejected, but **C** was far too popular.

Question 40

Alleles are alternate forms of a gene, so options **A** and **D** are wrong. If **C** were correct, the genotype would have two alleles for each of the two different genes.

Paper 5090/02**Theory****General comments**

The paper spread candidates out across a good mark range. Answers scoring highly were often written for all **Section B** questions, though **Section A** appeared to present rather more of a challenge to many candidates. It was in the application of knowledge that some weaknesses were exposed with candidates tending to display a sound grasp of basic facts but then failing to use their knowledge adequately to *explain* a situation.

The suspicion was that insufficient reference was made to the wording of the question whilst the answer was being written.

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

- (a) Although quite often accurately answered, 'stoma' was sometimes offered for **A** and 'xylem' for **C**. Those not entirely sure that **C** was phloem, suggested 'vascular tissue' which was considered by Examiners to be insufficiently precise. Inaccurate answers indicated that a significant number of candidates were not familiar with a diagram of leaf structure.
- (b) This was correctly answered by the considerable majority, but Examiners looked for a specific, suitable reference to carbon dioxide rather than for a more general mention of gaseous exchange. Some answers referred solely to oxygen and failed to gain credit.
- (c) Although this was usually well-answered, a statement describing leaf structure in one type of leaf does not show how it differs from another leaf. Some candidates, who may well have correctly appreciated a difference, thus fell short of stating it. Despite the label on the diagram, several thought that the water surface was the lower cuticle and thus implied that the leaf was upside down.
- (d) The link between the need for stronger xylem in a land plant in order to provide support was correctly made by many candidates but some disregarded the structure reference in the question. Several also pinned their faith on answers considered in terms of turgor rather than the properties of xylem.

Question 2

- (a) A statement of the trend shown by the graph was quite commonly given. Few, however, referred to the greatest rate of change being between 2 and 4 arbitrary units or to the fact that the degree of change levelled off towards a light intensity of 10 arbitrary units.
- (b) The commonest error was to offer accommodation as the answer, otherwise, reflex action was usually correctly stated.
- (c) A significant proportion of candidates failed to appreciate that this response is brought about as a result of impulses, generated by the retina being sent along neurones. Many also described the process of accommodation rather than the iris response. Those who accurately spoke of the iris sometimes, inaccurately, referred to longitudinal muscles.
- (d) Vague statements such as 'damage to the eyes' were fairly common and there were occasional references to the inadvisability of albino people exposing their skin to bright sunlight, but many managed to appreciate the effect of an iris (or choroid) which lacked pigment.

Question 3

- (a) A few failed to realise that only one of the two chromosomes would appear in an ovum and thus reproduced a copy of Fig. 3.1, but, otherwise, a chromosome with all the various and acceptable combination of genes was commonly given by those who understood the question. Those who did not quite often drew genes with one half shaded and the other half left blank.
- (b) Mutation was almost universally stated, though just a few cited 'environment' as the cause without a more specific reference to chemicals or to radiation.
- (c) This was rarely a problem with just a very few giving I^A and I^A as the two alleles or stating genotypes rather than alleles.
- (d) There was a confusion here between the use of the term blood group and allele which led to such statements as 'blood group AB is dominant'. Importance was given to the co-dominance of I^A and I^B , rather than to the dominance of both over I^O . Candidates should also remember that a genetic diagram without any explanation is unlikely to gain full credit.

Question 4

- (a) 'Community' was a fairly common inaccurate alternative to ecosystem, but this part was commonly answered correctly.
- (b) Apart from the very occasional indication of energy flowing in the wrong direction, this part was answered well other than by those who offered their own food chains unrelated to the one in the figure.
- (c) The block for birds was sometimes drawn in (ii) equal in width to the block for the tree, but otherwise this part presented few problems for the candidates.
- (d) Those understanding (c)(ii) above were almost universally able to add a block for the parasites larger and next to the birds. A very few failed to take sufficient care to ensure that the rest of their pyramid was similar to that shown in (c)(ii).

Question 5

- (a) Apart from a few wild guesses, this part often provided three sound marks for the candidates.
- (b) This was a relatively easy mark, but there was just the occasional reference to possible absorption through the walls of the colon.
- (c) Carelessness lead a few candidates to state that the highest concentration was reached in 2 minutes (or, even, seconds), in 4 hours or in 2.2 hours (reading the wrong axis) and it was, most probably, a failure to appreciate the significance of the data that allowed them to state that the drug is absorbed most rapidly in the ileum.
- (d) Candidates often experienced difficulty here in using the information in Fig. 5.3 to assist them with their answers. It was regularly incorrectly stated that the drug needed to be 'digested' and that the acid-resistant layer was there to prevent digestion of the drug rather than to protect the drug from the effects of stomach acid and prevent the drug from being released until it has moved through into the small intestine where conditions would no longer be acidic.
- (e) There were fairly regular references to the pill sticking to mucus in the oesophagus and stomach, even though it was covered by the acid-resistant coat. Many who, perhaps, realised that the pill's movement would be affected by sticking to mucus released in the ileum never actually stated that the ileum releases mucus.

Section B**Question 6**

- (a) Although there were, again, many accurate answers describing how the heart keeps blood flowing in one direction, there was a significant number of candidates who devoted their time to explaining the structure of the heart and the direction in which blood passes through it rather than explaining how the heart keeps the blood flowing in one direction. Atrio-ventricular valves were mentioned, but often not with reference to their opening to allow blood to pass, then closing to prevent backflow. Mentions of the aortic valves were comparatively rare and even more so, were references to the tendons holding the atrio-ventricular valves and their function. Many implied that the heart beats only once – with no indication that the cycle is repeated (or, indeed, that the contractions of the chamber walls are co-ordinated). Many appear to believe that the two sides of the heart operate separately – the right side followed by the left side. Without sufficient attention to the requirements of the question, several gave accounts of the valves in the veins.
- (b) Some answers confused cause and effect ('the ventricle walls are thicker to withstand the higher pressure') and just a few answers referred only to the need for artery walls to withstand pressure, but otherwise, this part was well-answered.

Question 7

This was a relatively straightforward question that produced some excellent answers.

- (a) There was the expected occasional statement that candidates believe that plants 'photosynthesise during the day and respire at night', but it was usual for answers generally to be quite accurate. The only points missed with any degree of regularity were the relevant stomatal movements and the fact that photosynthesis does not occur in the absence of light and that its rate outstrips the rate of respiration during the day.
- (b) Most knew that an increase of carbon dioxide levels would result in an increased rate of photosynthesis, but several then became sidetracked and spoke about the effect on the rate of transpiration of a lack of soil water rather than the effect on the rate of photosynthesis. Credit for the effect of water deficiency on guard cells and stomata could still be obtained.

Question 8 Either

- (a) Candidates' minds were well-stocked with information for this question. However, not always was the size of the ovum related to its initial provision of nutrients nor was the release of only one ovum at a time related to the limited space available for the subsequent development of the embryo. Nevertheless, most of the remaining points available were regularly made and high marks were obtained.
- (b) Full marks were the norm here, though there were a few candidates who mentioned the menstrual cycle but omitted to say exactly when in that cycle abstinence from copulation should avoid pregnancy. That the cycle is unpredictable was almost universally understood. Some, unfortunately, violated the rubric by opting to answer part (b) from **Question 8 Or**.

Question 8 Or

- (a) Although this might have been expected to be the less popular and the more demanding of the optional **Question 8s**, those who attempted it often did well. A few candidates continue to believe that the pollen grain is the male gamete and a few remain confused over the exact location of the female gamete. Otherwise, candidates explained well the need for high numbers of male gametes to overcome wastage as well as the need for an agent to transfer the male gamete within the pollen grain to the stigma. Only the better answers referred to the movement of the male nucleus within the pollen tube or to the fact that the female gamete has no need to move since it is already positioned where further development will take place after fertilisation.
- (b) A very few were guilty of misreading the question and gave advantages of sexual rather than asexual reproduction. For the vast majority, however, this part posed no problems with all advantages being regularly mentioned.

Paper 5090/03 Paper 3 – Practical Test
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General comments

It was pleasing to be able to provide candidates with an animal specimen on this occasion and the prawn was well received by most Centres. The Examiners realised that Crustacea are not on the syllabus and hence required observational features only, with no labelling. The marks for both questions were readily accessible and good marks were scored by many candidates.

Comments on specific questions**Question 1**

Solutions that represented the urine of four persons, three of whom had certain diseases, were provided for analysis. The usual food tests were expected with the addition of a test for the presence of bile salts using sulphur powder, as was explained on the question paper.

- (a)(i) The completion of Table 1.1 allowed candidates to record, briefly, the techniques that they would follow in performing these tests. These were well known and afforded easy marks, though practical details such as adding the named solution to the one being tested were sometimes deficient. The use of a water-bath was mentioned by most, and this was welcomed from the safety aspect. Most of the 'results expected if not present' were, creditably, clear statements of what would be seen, usually in terms of the colour observed, rather than that 'nothing happened'. There was only slight confusion of reagents; this usually involved not heating the Benedict's solution, or heating, unnecessarily, during the biuret test. A significant number of candidates were confused by the 'how treated' line and answered in terms of the medical treatment of the condition, e.g. injection of insulin for diabetes, or dialysis for kidney disease.
- (ii) The vast majority completed this section accurately.
- (iii) Even those who gained full marks for (ii) were capable of interpreting their results incorrectly. Solutions **A** and **D**, from kidney disease and liver disease, were those most frequently confused.
- (b) Variable, but there was an overall realisation that fats, emulsification and lipase were involved. There was a good deal of confusion between the small droplets resulting from emulsification and molecules, as they were frequently called. Similarly the effect of bile was often thought to be enzymic. The digestion of protein or carbohydrate was also mentioned in a number of cases. However, many correctly alluded to the process of emulsification affording greater surface area in the fat for the action of lipase in the digestive process.

Question 2

- (a) There were many excellent drawings of the specimen which, with the guidance of Fig. 2.1, was nearly always correctly orientated. Even when the candidate found it difficult to produce a realistic drawing the Examiners were able to apply the necessary criteria in order to assess accuracy of observation and award marks. The marks were awarded in two categories. First, a number of features concerning the body structure were judged. These were the general proportions, tapering abdomen with progressively longer segments and the fact that the abdominal segments were shown to be completely separated from each other. Only a few candidates successfully showed the large gill cover as a distinct feature.

Secondly, the appendages were considered for accuracy of observation. These comprised the pairs of thoracic legs, often shown nicely jointed, followed by the eye and the multiple structure of the tail. The antennae should also have been shown, either as more or less complete structures or, where the specimen was less intact, the characteristic base where they were attached to the head. Many candidates fared better in representing this base, than in drawing the complete structure which was often drawn rather haphazardly.

Many candidates spent time in measuring the specimen and their drawing and then in calculating the magnification of the drawing. This would have been specified on the question paper if it had been required. Luckily, however, there did not appear to be a serious shortage of time for the completion of the paper as a whole.

- (b)(i) Some extremely well-displayed tails were seen but others did not follow the instructions and drew the last third of the body. Consequently the tail fan was too small to show the required detail. This was especially true when the drawing was made from a lateral aspect, rather than from the ventral side. Very few noted the small, terminal cerci and the ciliation on the margins was sometimes missed, despite being readily visible through the lens that was provided.
- (ii) Many marks were lost for reasons that could readily have been avoided. The instruction to rule a line across the drawing in (i); inaccuracy of measurement and not giving the correct units accounted for many such losses. It is again stressed that mm. are by far the most manageable units of measurements. Although Examiners are adept at picking out the working, they should not have to do this, especially as candidates are instructed to show their working *clearly*. A few answers that were otherwise correct were invalidated by units of measurement being added, like 'x 2.5 mm', for instance. But fewer instances of answers spoiled by excessive rounding up or down, or by more than two places of decimals, were noted. However, a number of candidates omitted the 'x', or times sign from otherwise correct answers.
- (c)(i) When the chemical formulae were used for the equation it did need to balance! Thus, the marks were more easily obtained by those who gave the word equation. Many gave both versions; they did not incur a penalty.
- (ii) Candidates were asked to suggest how to set up an aquarium for the study of living prawns. The most surprising thing to emerge was the failure of the vast majority to mention the need for sea-, or saline water, but it may be that the term 'fresh' water was wrongly used in some cases when it was meant to imply newly collected sea-water. The need for aeration or oxygenation, by pump or by the photosynthesis of green plants in the light, was a key point. So, too, was some mention of temperature being controlled at a value similar to that of their natural marine habitat. Many were mistaken here in relating the temperature to that of enzyme optima, some 35°C – 40°C. The need for food might have been related to the provision of a respiratory substrate and the frequently mentioned need to clean the tank, to prevention of fouling the water. Thus, where only three marks were allocated for a question that was relatively open-ended, some amplification of each point was expected.

Paper 5090/06

Alternative to Practical

General comments

The Examiners' intention was, as usual, to reward those candidates who showed that they had performed, or at least witnessed, experimental practical work. It was particularly pleasing to see higher marks being gained by some regions that had performed much less well in former years. Marks were often lost through failure to follow quite elementary instructions, for example in not making 'small, clear crosses' in **Question 2 (c)** and in not labelling their drawing in **Question 4 (a)**.

Comments on specific questions

Question 1

This question required interpretation of Fig. 1.1 which was a drawing of a potato plant that was complete with the original tuber as well as a number of small, new tubers which were identified as storage organs.

- (a)(i) Candidates should have explained how a small sample of a tuber was cut off and either crushed, or treated on the cut surface with iodine solution. The outcome of the test was not required. Frequently a leaf was tested, anticipating the next section, as a more thorough reading of the question paper would have indicated.
- (ii) Preparation of a green leaf for the starch test does not include a preliminary destarching process by the exclusion of light. A quick dip in boiling water followed by heating in ethanol, to decolourise the leaf and a final dip in water to soften it, was all that was needed. Credit was given for mentioning the use of a water-bath to heat the ethanol.

- (b)(i) The wording of the question showed that more than one substance should have been mentioned, namely water and mineral salts. The tissue involved was xylem, rather than a vessel, or cell of any sort. Use of these substances, in photosynthesis or transpiration, for instance was well appreciated though some digressed, describing osmosis or diffusion.
- (ii) Phloem, often inaccurately named, was known to transport sucrose by fewer candidates. Glucose or starch were favourite substitutes. And despite the hints on the Fig. the storage of starch was not universally stated. There were many acceptable references to the storage product being used as respiratory substrate.
- (c)(i) The vast majority gave asexual and a few mentioned vegetative reproduction which was also acceptable.
- (ii) The genotypes should have been described as identical or the same. Terms that were more vague, such as 'like', 'similar', or 'resembling', were inadequate. Weaker candidates mentioned terms like characteristics, homozygous or dominant, which were meaningless in this context.

Question 2

Fig. 2.1 was a photomicrograph of a section through the eye of a small mammal. While being reminiscent of the familiar textbook diagram it was sufficiently different to require a degree of interpretation. Thus, candidates who had never seen such a slide were not seriously disadvantaged.

- (a) Many were able accurately to identify the four labelled structures. The cornea was sometimes confused with the conjunctiva and the iris with the suspensory ligaments. The optic nerve was occasionally labelled blind spot; not really sensibly in view of part (c) of this question.
- (b) Lens and iris were the two structures that change shape in the normal functioning of the eye. Some others were described, unsuccessfully! The main problems related to the inability to describe changes that are apparently two-dimensional, like referring to the 'longer' lens or iris, from the thickening effect as the lens acquires a shorter focal length, for instance. Good candidates were able to describe the effect of the ciliary muscle contracting to allow the lens to become more convex and the circular and radial iris muscles contracting or relaxing to cause the pupil to dilate or become smaller. There was a good deal of confusion between these muscles! A common error was to describe the lens accommodating for long sight in part 1 and then, in part 2 to describe the reciprocal effect for near sight.
- (c) Not marking with a cross or not labelling X and Y were common errors. Inaccurate, apparently casual placement of these letters also incurred loss of marks. The site of the blind spot was much better known than that of the fovea.

Question 3

- (a) This was a familiar exercise in the construction of a graph. The graph was very well drawn by the vast majority of candidates with only a few not labelling the axes accurately or reversing the x and y axes. Very few bar charts were submitted on this occasion. The need for clear plotting should be stressed. Points are best indicated by means of fine lined crosses or by ringed dots; they would then show clearly on the completed graph. There were many good curves of best fit and equally acceptable were ruled connections between points. Freehand connections were not acceptable, however, nor was a mixture of ruled lines and curve.
- (b) Candidates were expected to appreciate that at a temperature of 60°C the enzyme would have been denatured or inactivated (but not 'killed!') and a reading within the range 0 to 10 arbitrary units was accepted. Units were very often omitted, or given as °C. It was not acceptable just to extrapolate the graph and to suggest a reading in the region of 12 a.u.
- (c) Many understood the need to use smaller intervals of temperature and expressed this in a variety of ways – perhaps without appreciating the practical difficulty of varying the temperatures by a single degree! Fewer identified a temperature range above and below 40°C, say from 30°C to 50°C. Other, unaccepted suggestions included varying the pH, or amount of enzyme, or simply repeating the experiment – without calculating a mean value, which was credited. Some simply assumed that the optimum would be 37°C.

Question 4

- (a) The photograph of a flower, Fig. 4.1, was sufficiently clear to allow the observations that the question required. The large, labelled drawing could equally well have been of the entire flower or of the protruding andrecium and gynecium. Stylised diagrams of flower structure as a whole, or of some part of a flower were not acceptable and one wonders how a candidate can possibly think that this answered the question.
- (b) A requirement of this section was that one of the anthers on Fig. 4.1 be indicated as being the subject of the calculation. Many omitted any indication at all while others suggested an entire stamen, or part of the gynecium. The length of the anther should have been recorded in the space provided and should have been of the order of 5 mm (0.5 cm). This should then have been related to the length of the drawing of the same anther, producing a magnification of something like $\times 2$. This should then have been adjusted to allow for the stated magnification of the photograph. Many candidates gained full marks for this procedure.

As usual a number of candidates neglected to label their drawing. A common mistake in labelling was to label anther and filament correctly but then to bracket these together as style or stigma.

There were the usual faults of including units of measurement in the answer (' $\times 2.5$ cm' etc.), and excessive rounding up or down, (more than 0.2). Nor is it realistic to give more than two places of decimal. When the expression before the final calculation was inverted the result could be an obviously unrealistic answer, e.g. magnification $\times 0.6$ when the drawing is obviously an enlargement. Candidates should be encouraged to make a final inspection of any calculation, in order to ensure that it is not wildly unrealistic.