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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
Paper 1 - Multiple Choice

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

General comments

The questions that needed thought rather than recall caused more problems than in previous years, although many candidates performed very well. Candidates must, as ever, be reminded to read the questions in detail. This was particularly true this year, with a couple of common errors being due to key words in the stem being common missed. For example, in **Question 7** the stem says that the leaves are green in the centre and white at the edges. The areas are also labelled, but still 10% of candidates missed it. The same applies to **Questions 39** and **40**. "Read the question" is just as important at the end as at the beginning.

Comments on specific questions

Questions 1, **2**, **8**, **11**, **19**, **20**, **22**, **23**, **25**, **26**, **30**, **32**, **33**, **37** were simple knowledge and proved easy.

Question 3

Water potential is now well understood, as is osmosis.

Question 4

Generally well known, but enzymes are not affected by the reactions they catalyse.

Question 5

Lots to read, but the time is balanced by the shorter, simple knowledge questions. The egg white is labelled cloudy, so it will become clear if the enzyme is active. Protease in the stomach is active when acidified, so only tube three will be clear.

Question 6

The graph is still rising, even at point **C**, so light is still limiting photosynthesis there too.

Question 7

The stem reads *either/or*. Chlorophyll needs magnesium and proteins need nitrate.

Question 9

Simple knowledge, but the properties of lipase were less well known.

Question 10

The negative stem was clearly understood. Health problems and diet are well known.

Question 12

The figures show that fatty acids and glycerol are absorbed slightly slower when oxygen is available, so their uptake cannot be active and must just be due to diffusion. Option **A** requires *all* products to be absorbed by *both* processes.

Question 13

In the vascular bundle, the large thickened tubes – Option **C** - must be the xylem.

Question 14

High humidity (Option **A**) will decrease evaporation and hence transpiration.

Question 15

Always confusing, the pulmonary artery carries *deoxygenated* blood *away* from the heart (to the lungs). This question should have given a clue to the next one too.

Question 16

Since urea is removed by the kidneys, the low urea level shows that vein 1 must be the renal vein. The high oxygen concentration must be the pulmonary vein.

Question 17

Many candidates confused anaerobic respiration in yeast, which produces CO_2, with muscle tissue anaerobic respiration, forming lactic acid, which does not. $C_6H_{12}O_6$ produces lactic acid 2x $C_3H_6O_3$ (although this biochemical detail is not expected in the syllabus).

Question 18

Option **D** was too popular. Forming nerve impulses requires energy (Option **D**) and our resting metabolic rate is largely due to the activity of nerves in the brain. Tissue respiration (Option **C**), however, supplies energy – usually in the form of ATP - for the other processes.

Question 21

It is a popular myth that capillaries can move through the skin (Option **C**). They do, however, dilate if blood is directed to them (Option **B**).

Question 24

Another question where candidates seemed to miss key words. If the sensory neurone is cut at X, then no impulses reach the spinal cord and no response will occur. If there were no cut, then Option **D** would be true.

Question 27

All the energy that passes through higher levels must pass through the producers first, but much energy is lost at each stage.

Question 28

A very simple diagram, but carbon compounds can only pass from plants to animals if they are eaten (Option **B**), in one or more stages.

Question 29

During one year, the total mass of the organisms that develop in each level must be the plants. Candidates may have been confused by thinking of large animals that live for more than one year, but the question refers to just one year's growth.

Question 31

As with all negative stems, the word **not** is always printed in bold, since it is obviously very important. Option **B** was too popular. If people who have malaria are isolated and not bitten by female mosquitoes, then the disease cannot be passed on, so Option **B** *would* be effective. The disease is not spread by sewage treatments.

Question 34

The time when a woman ovulates is usually very well known, but it was surprising that only half the candidates correctly chose Option **A**.

Question 35

Similarly, the menstrual cycle begins with the breakdown of the uterus wall (Option **A**). Perhaps this topic or the precise words used, are not as well known as they should be.

Question 36

Although jars 3 (no CO_2) and 4 were correctly chosen by most candidates, it was odd to see so many suggesting that germination is more likely in jar 1, with no oxygen.

Question 38

Blood groups are well known to be distinct and are therefore examples of discontinuous variation, but so are the two conditions in cattle – they either have horns or not.

Question 39

The stem states that the snails with S^nS^n do *not* survive. The next generation will only have snails with S^tS^t (one third) and S^tS^n (two thirds). Many of even the better candidates missed the lethal homozygous condition.

Question 40

Having the extra finger is a dominant condition with either genotype PP or Pp – shown dark on the diagram. Since person X has the normal condition he must have two normal, recessive alleles pp and so cannot pass on the condition to his offspring. Option **C** was too popular – it suggests the result of the inheritance of a recessive condition.

Paper 5090/02

Theory

Comments on specific questions

Question 1

(a)(b) Apart from the very occasional reference to oxygen, almost all candidates were able to begin the Paper with a correct answer with only slightly fewer being able to suggest an acceptable function for the syringe.

(c) Answers to this section were pleasing. Most candidates realised that it was specifically enzymes (and not simply the yeast) that were responsible for the reaction and also that high temperatures destroy or denature (rather than 'kill') enzymes.

(d) This section caused much more of a problem. Sugars **E** and **F** were suggested in roughly equal number, though of those correctly suggesting **E**, many realised that size of molecule was related to speed of reaction.

(e) Only the best were able to suggest that the yeast may not possess a suitable enzyme for breaking down sugar **G**.

Question 2

(a)(b) Whilst most knew that chromosomes are found in the nucleus of a cell, it was a little surprising to find so many failing to appreciate the significance of the non-matching last pair of chromosomes in the diagram. 'Female' was not an uncommon answer perhaps because of the 'X' shaped appearance of the chromosomes.

(c) This was well answered with most candidates knowing that a person with Down's Syndrome possesses an extra chromosome.

(d) Many knew that the chromosome number would be different and a significant number were able to identify that difference.

(e) It was pleasing to see so many candidates knowing that chromosomes must match in order to produce a viable zygote.

Question 3

(a) This question exposed those who had failed to learn the parts of the eye. Several identified **H** as the retina, when it specifically indicates the fovea, and 'blank' or 'black' spot were common attempts at identifying the blind spot.

(b) Answers included all possible combinations of near/distant vision, thick/thin lens, bright/dim light and large/small pupil. Iris and pupil were often confused and explanations often used information other than given in Fig. 3.1.

(c) Suspensory ligaments were often thought to be muscles capable of contraction, otherwise this section produced some accurate answers to one of the traditionally more confusing areas of the syllabus.

(d) 'Iris' and 'cornea' were fairly commonly thought to contain light-sensitive cells and many explanations in **(ii)** concentrated on describing what a blind spot is rather than why we are not aware of it

Question 4

(a) This usually presented few problems

(b) This section exposed many who do not believe that respiration occurs at all times in a living plant. Otherwise, the opening of the stomata in the absence or presence of light was often correctly related to the processes of transpiration and photosynthesis.

(c) Most candidates were able to link water shortage with a plant's need to conserve water - and thus the closing of its stomata. A few correctly explained the effect of changes in turgor within the guard cell on stoma size.

Question 5

(a)(b) Tooth identification was usually accurate as were the positions in the jaw occupied by the various tooth types.

(c) Molar or premolar were usually given as the teeth used for grinding, but in **(ii)**, explanations too often relied on a synonym for 'grinding' when Examiners were looking for a more detailed answer describing the breaking up of cells or the increase in surface area of the food (to facilitate chemical digestion).

(d) It was as pleasing to see so many candidates accurately stating the substrate and product of amylase as it was to see correct references to acidity in the stomach followed by the more suitable alkaline nature of the duodenum. Few, however, thought to mention the further addition of amylase from the pancreas.

Question 6

(a) Many were able correctly to distinguish between the two types of variation, but reference to the importance of genes and the relative affects of the environment were not commonly made. Some felt that 'continuous' was a reference to something changing throughout life - and gave age as an example.

(b) For many, this section proved extremely difficult. Many clearly did not understand the concept of the evolutionary process leading to separate species and those that had some idea struggled to express that idea in a sufficiently cogent and scientifically accurate form. There were valid references to mutation and to the advantage that variation can confer in different environments. The idea that changed circumstances lead to variation was a common misconception. Mention was made, though often obliquely, to gene recombination, but few referred to the necessary time scale or described how natural selection might lead to genetic isolation. It was common for candidates to believe that a different species is an organism with a different genotype.

Question 7

(a) That sperms are manufactured and stored in the testes was common knowledge, but that the testes manufacture hormones responsible for secondary sexual characteristics was regularly omitted.

(b) Although the question specifically asked for the part played by the uterus in the development of the embryo, much time was spent describing the introduction of sperms and subsequent fertilisation. Thereafter, answers tended to lack sufficient detail - with references to any *named* nutritional/excretory/respiratory chemicals being much more the exception than the rule. The terms placenta, uterus, amniotic fluid and umbilical cord were often interchanged and embryo, fetus and zygote were regularly confused. Surprisingly, even though reference was made to the uterus contracting during the expulsion of the embryo, few thought to mention that its walls are muscular.

Question 8

Either

(a) Many candidates believed that bacteria have a nucleus, but, otherwise, most of the relevant features of bacteria were mentioned. Candidates sometimes failed to reap reward for considerable effort because they did not restrict themselves to the 'general characteristics' as required by the syllabus. Instead, they made references to features found only in some bacteria (e.g. flagella).

(b)(i) There was a singular lack of detail in this section with confusion over the roles of bacteria in decomposition, nitrogen fixation and nitrification. The fact that proteins in dead organisms are broken down into amino acids and then to smaller nitrogen-containing ions was rarely mentioned. Neither was there any regular understanding that it is through bacterial respiration that carbon dioxide is returned to the atmosphere.

(ii) Some good answers were seen to this section - with reference to a suitable temperature being the most common omission. Many, however, felt that yeast is the organism responsible for the curdling of milk.

Or

This question was very rarely attempted, and then usually only by the weaker candidates.

(a) This section provided a few marks with all the main features of fungi being mentioned - but rarely more than two by any one candidate.

(b) Very little knowledge of this part of the syllabus was displayed. A few knew that penicillin is manufactured using fermenters, but, even then, it was common for candidates to confuse the name of the fungus and the antibiotic it produces. The manufacture of single cell protein was an almost completely closed book.

Paper 5090/03

Paper 3 - Practical Test

General comments

The questions required careful reading by candidates so that precisely correct responses could be made. It was evident that this was not carried out by a significant proportion of the entry and resulted in the rather low mark distribution. There were a number of easy marks to be gained simply by following the instructions.

Comments on specific questions

Question 1

This question was concerned with water relations in plant tissue; it required an understanding of osmosis and involved the construction and interpretation of a graph.

(a) Candidates were provided with four solutions covering a range of concentrations. They were required to cut four pieces of potato tuber accurately to a length of 70 mm. Strips of the prescribed length were not always forthcoming, for no reason that was discernible from the Supervisor's report. The strips of tissue were immersed in the solutions for at least 25 minutes after which they were re-measured and their lengths recorded in Table 1.1. The table had then to be completed by calculating the change in length.

A minority recorded their results in cm - despite the headings in the table - and became confused at a later stage. Many did not indicate whether the changes were gains or losses, causing problems in plotting the graph.

(b) There was often a poor choice of scale for the graph, especially for the *y*-axis, resulting in the graph being squashed at the top of the grid, making it difficult to draw a curve. The axes were generally well labelled though in some it was difficult actually to read the captions. The minus signs on the lower part of the *y*-axis, needed to be especially clear. It was also essential for the Examiner to be able to see the plots, which should have been both clear and precise; preferably ringed dots, or fine-lined crosses.

(c) This was well done by most of those who had obtained reasonably accurate results; the concentration should have been 0.3 mol per dm^3, though Examiners did accept reasonable readings that were accurately taken from the graph, provided that units were included, which was by no means always the case. When the experiment had not worked out so well problems arose, such as the curve crossing, or being on, the axis twice. Readings were often given without units, which are always essential in this kind of exercise; some bore no relation to the graph and others gave a range, which again, was not acceptable.

(d) The process of osmosis was generally very well explained, especially when this was done in terms of water potential. The correct explanation was often unnecessarily preceded by an account of what had taken place in the previous, 0.8 mol per dm^3 solution, frequently taking up four of the six lines allocated for this answer. Candidates who answered with reference to 'concentrations' had to make is very clear whether they were referring to solute or solvent, though terms such as hypo- and hypertonic solutions were sometimes used successfully. There were numerous references to cells bursting and to the movement of 'water potential'.

(e) The use of other, intermediate, solutions, (especially some close to the critical concentration), more strips of tissue and straightforward replication were the expected suggestions. Many of the answers dealt with increasing the accuracy of the experiments that had been described, by taking greater care in preparing the solutions for example, rather than attempting to increase reliability by means of an extension programme. Some just mentioned the use of a control which, without amplification, had little merit.

Question 2

This was the familiar type of exercise in observation and recording by means of labelled drawings, followed by a comparison and ending with a structured attempt to make a scientific estimation by sampling.

(a)(i) Drawings of the two specimens, slices of kiwi fruit and cucumber, were very well done. Good size, with accurately observed and clearly drawn detail were generally evident. A number of seeds were usually shown attached to their funicle, for instance. There was, however, an instruction that only a sector should be drawn in detail, intended to save time for the candidates, which was almost entirely ignored. It was also very surprising that the hairy outer surface of the kiwi fruit should be drawn smooth by so many, as was the failure to represent the clearly visible vascular bundles in the cucumber. Labelling was good, and it is pleasing to note that there were fewer unlabelled answers this time. Some label lines did not indicate clearly the feature in question; this was especially true of the placenta in the cucumber.

(ii) It is always good to select the more obvious and varied features. Thus, they both contained seeds, both had a pericarp and both were succulent (juicy and, even, 'fleshy' were allowed in this context). Many good candidates tended to try to be over- complicated, leading to obscurity.

(iii) Similar comments would apply here. It was essential that the two contrasting features on each line were positive statements of differences that were visible for the same structure. Good examples included many and small seeds as opposed to few, larger ones; black seeds compared with green; brown, rough or hairy outer surface contrasting with green and smooth.

(b) Candidates were guided step by step through the stages of this section of the question. After counting the number of seeds in each of two quarters of the slice of the kiwi fruit they should then have calculated the mean of these figures and multiplied the mean by four, to obtain a value for the number of seeds in the slice. Many candidates arrived at this figure by counting the seed content of all four pieces of the slice. Figure 2.1 showed that ten slices could have been obtained from the whole fruit. Multiplying the total for the slice by ten would then give a figure for the fruit as a whole. But the more percipient candidates, and there was a good number of them, realised that it would have been unlikely for ten completely identical slices to be obtained from each fruit and therefore suggested that some allowance was necessary. This was generally along the line that the slices that were taken from the ends of the fruit would contain fewer seeds. So, some deduction was suggested.

In practice, the total for the slice was often given as the final answer - the first sentence of the introduction to part **(b)** thus being ignored. Also, it is expected that spaces that are left for working to be shown should be occupied by clearly set out stages in the calculation. Such working can often yield a mark, even when the final answer is incorrect.

Paper 5090/06

Alternative to Practical

General comments

A striking feature of this examination was the way in which many marks were lost by the failure of candidates to follow the instructions that were set out in the Question Paper. Many of the shortcomings that have been mentioned in previous reports were again in evidence. The Examiners tried, as usual, to reward those candidates who showed that they had performed, or at least witnessed, relevant practical work.

Comments on specific questions

Question 1

This was a question on osmosis and associated phenomena; it also touched on an aspect of nutrition.

(a)(i) It was expected that the drawing would exceed the grid lines, both vertically and laterally, showing that the cell had increased in size. Care should have been taken to reproduce the layers comprising the structure of the cell, in reasonable proportions. However, having made a perfectly adequate drawing almost 50% of the candidates did not give it any labels. There were also some who drew a plasmolysed cell.

(ii) The explanation of osmosis - often referred to, quite correctly, as endosmosis - was generally very good, especially when it was given in terms of water potential. Those who referred to 'concentration' were required to establish very clearly whether they were dealing with concentration of a solute, or of the water.

(b) This section proved difficult. The idea of different regions of the stalk expanding to different extents as they became turgid was not widely understood. Only a few answers mentioned the relatively inelastic cuticle or epidermis in this respect. A common mistake was to refer to the increase in mass, caused by water uptake, to bend the stalk. There were also references to phototropism.

(c) The main dietary components of a sample of celery were given. Candidates were asked to comment on the nutritional benefit of eating celery. Many correctly picked out the fibre and commented on its role in preventing constipation. Some referred to the peristaltic functioning of the intestine but sometimes this was spoiled by alluding to 'excretion' and 'waste products'. Vague references to helping in digestion were not acceptable. The term fibres, in the plural, was frequently used, and was accepted, but not when it was said to relate to blood clotting!

Question 2

This question dealt with the presentation of biological data.

(a)(i) This required the construction of a line graph from the data in **Table 2.1**. The graph was very well drawn and accurately labelled by the majority of candidates. The idea of using the captions from the table for labelling the axes seems to be catching on! A straight line was not acceptable for the curve; it did not adequately represent the data. There were very few cases of the axes being reversed.

(ii) Most candidates recognised that the amount of oxygen absorbed increased with time. Some made the mistake of simply describing the shape of the curve without referring to oxygen uptake while only the better candidates stated that the rate of oxygen uptake decreased, rather than uptake alone.

(iii) The majority read off the correct figure of 32, but of those, a fair proportion did not mention the units. A common error was the subtraction of 32 units from 40 units - the amount absorbed at 40 minutes - giving the answer as 10 units.

(b)(i) The frequency diagrams were not well constructed by a great majority of candidates. Axes were reversed, bars were not correctly labelled (in the middle) and the bars were not uniformly wide. In many cases only an irregular line graph was drawn.

(ii) There was a general failure to describe a significant distribution pattern. Overall numbers of nests were discussed, rather than the distribution of egg numbers per nest. All too few mentioned the idea of a normal distribution.

(c) Many candidates did not appreciate that the ten markings around the circles from which the pie charts were to be drawn did, in fact, match the percentages quoted in **Table 2.3**. Consequently much time was spent in calculating the sizes of sectors in the 360° circle - and the subsequent plotting was often not sufficiently accurate. It was expected that the convention of starting the pie chart at 'twelve o'clock' would be followed, and then proceeding - in either direction - in decreasing order of size. The sequence should have been the same in both charts, despite reversals in relative size of the components. A significant minority drew pie charts that did not occupy the whole of the circle.

Question 3

Photographs of two leaves showing significant differences were provided for comparison. The caption stressed that these compound leaves were composed of a number of leaflets.

(a) Three visible features were required. This clearly precluded acceptance of the fact that both of them were green. Readily discernible were the leaflets, petiole (or leaf stalk, but not stem), and spines on the petiole. Reference to the similar slender shape of the leaflets was also accepted. Venation was not deemed to be sufficiently visible. A number of candidates described differences in this section.

(b) Contrasting pairs of differences, positively stated, were required here. The palmate, as opposed to the pinnate shape (though not in these terms!), the number of leaflets - despite them often being called leaves -, relative length of petiole, and straight, contrasting with curved, leaflets were all acceptable. The Examiners decided that there was no consistent contrast regarding the spines on the petiole. The main problem encountered in this section was the lax terminology, with terms like stem, branch, shoot, midrib, petiole being used in a haphazard way, obscuring the candidates' intentions.

(c) The intention was that the spines should have been referred to as deterrents to grazing animals. A variety of expressions were accepted though many thought that this was a form of predation. But the mention of spines triggered off the idea that animal dispersal, or even pollination, was involved. The idea of the presence of spines in some way limiting water loss through transpiration was also accepted.

Question 4

Concerned the calculation of the degree of magnification of a single seed after it had been drawn from the photograph, **Figure A1**.

(a)(i) Some accurate and carefully drawn diagrams were seen but these were in the minority. Many candidates drew the whole fruit, contrary to instruction, others included imaginary internal structures such as radical and plumule. There was also a good deal of unnecessary shading. Most of the diagrams were a sensible size however.

(ii) An exercise of this type is set in this examination nearly every year, yet there remains an obvious and surprising lack of familiarity with the technique. Two measurements were required; these would most conveniently have been made, and recorded, in mm, as is constantly urged. Yet many candidates used cm but did not give the first decimal place, which is the accepted degree of accuracy. Some inverted the expression 'size of drawing over size of subject', thus obtaining an unrealistic answer. A moment's thought would have shown that 'x 5750' was not a suitable answer, however derived! Candidates should not give more than two decimal places when stating the magnification, nor should rounding off be overdone, thus, a calculated 2.17654 is best stated 'x 2.2' though x '2.18' would be accepted.

Many answers showed that an allowance had been made for the fact that **Figure 4.1** was printed at an enlargement of x 1.5 and this was given credit. The instruction 'Show your working clearly' was not often followed with the degree of clarity that was hoped for.