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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

General comments

Candidates showed a good level of knowledge in the exam. Questions which needed two stages of thought caused more problems, but discriminated well (e.g. **Question 7**). There were signs that the later parts of the exam needed more attention than the beginning and it must again be stressed that every word of the stem and all the information given must be considered before choosing the response e.g. **Questions 39** and **40**. The advice – "Read the question" is still fundamental.

Comments on specific questions

Questions 1, **5**, **8**, **9**, **10**, **11**, **12**, **13**, **15**, **18**, **21**, **24**, **32**, **36** and **37** mainly required knowledge and proved easy.

Question 2

Minerals move from low to high concentrations, so the process must be active.

Question 3

Studying the axes shows that no length change occurs at 0.3 mol, which must therefore be the cells' water potential.

Question 4

Germinating seeds do not normally photosynthesise.

Question 5

Stomata are well understood, but very little gas exchange occurs through the thick cuticle waxy shown in the diagram.

Question 6

Since the CO_2 concentration is rising, the plant cannot be photosynthesising, so it must be in darkness.

Question 7

The experiment is investigating the need for CO_2. All the distractors were popular. Option **A** shows the effect of the glass dome, **B** the effect of O_2 and **D** the effect of light.

Question 8

Some absorption does occur in the ileum, but far more comes from the colon.

Question 13

Option **C** is the xylem, which transports water, not sugars and amino acids

Question 14

Fibrinogen is the precursor of fibrin and red cells stick to the fibrin network, so **D** is the only possible sequence.

Question 16

Fluid only flows from high pressure to low, so the capillary pressure must be the highest in the diagram, although all the pressures are much lower than in an artery, which is not shown.

Question 17

When breathing out, the diaphragm rises.

Question 19

Since CO_2 diffuses from the capillary to the air space in the alveolus, there must be a concentration gradient and the CO_2 level must fall as the blood flows past.

Question 20

This is an original diagram, but since there is only one bone shown, it must be the humerus. This was well deduced by most candidates.

Question 22

The diagram shows temperature information, so the hypothalamus is the coordinator.

Question 23

Adrenalin increases the blood glucose, but fewer candidates knew that the glycogen level must consequently fall.

Question 25

The stem refers to *cold* and most candidates knew that the hair erector muscles must contract, but too many did not realise that the surface capillaries must get smaller, thus avoiding some heat loss.

Question 26

The graph shows the pupil diameter increasing with time, so the light must be getting dimmer, slowly.

Question 27

Respiration is a process that releases energy making it available to the organism. The CO_2 is a waste product and cannot be used, since yeast does not photosynthesise. Option **D** was too popular, but is not an answer to the question, since fermentation and respiration are the same process in this situation.

Question 28

Option **D** was popular, but although the animals will need oxygen, the plants, if illuminated, (option **B**) will provide food for the whole food chain.

Question 29

Biomass is lost due to CO_2 and H_2O lost from respiration (option **D**), mainly from the grass. Digestion unlinks monomers from polymers – e.g. starch to maltose – but no mass is lost. Candidates choosing option **A** may have been thinking of egestion. Option **B** was oddly popular, but usually involves an increase in mass.

Question 30

In the scheme shown, far more energy is lost from producers than secondary consumers.

Question 31

The malarial parasite reproduces sexually in one of its hosts – the mosquito, although this know beyond the syllabus and is not required, since the vector is definitely the mosquito, so D must be the ke

Question 33

Decomposers use dead and decaying organisms as food and produce ammonium compounds. Converting nitrate ions to nitrogen gas (option **B**) cannot be the key, although it was a popular error.

Question 34

The stem refers to "just before fertilisation". Although pollen carries the male gametes (option **A**) they move down the pollen tube and are delivered to label 3.

Question 35

Option **D** labels the chorion, not the placenta (option **C**). Option **A** – the umbilical chord – is essential to the exchange of gases, but is not the site of gas exchange.

Question 38

Option **D** *is* homozygous, but the I^O allele is recessive.

Question 39

This is a deceptively simple question and most candidates misread the stem, chosing option **B**, but the stem refers to only the recessive offspring. *All* of them *must* be homozygous – probability of 1.00 – or the recessive phenotype will not be seen.

Question 40

Since Q has some white offspring, he must be heterozygous. P has four brown and no white offspring, so is "most likely" – the phrase in the stem – to be homozygous dominant.

Paper 5090/02

Theory

General comments

Candidates found it difficult to score marks in the mid or high 40's in ***Section A***, though full marks were gained by some candidates for all questions in ***Section B***. A common failing was for answers to lack the use of candidates' critical faculties. They contained a great deal of irrelevant, though accurate information whilst weaker candidates often used the correct terms but without showing a real comprehension of their meaning.

Comments on specific questions

Section A

Question 1

(a) Most were able to deduce from the appearance of the muscles that the bolus was moving from right to left.

(b) Those who thought that the bolus was moving in the opposite direction were still allowed credit so long as their explanation was correct for the direction of movement. The better candidates appreciated the antagonistic nature of the circular and longitudinal muscles, however, those less certain of their facts had circular and longitudinal muscles contracting at the same time. Almost all knew that muscles push food along the intestine.

(c) The characteristic appearance of the walls of the colon was not recognised by a signi[illegible] of candidates, who opted for duodenum or ileum.

(d) 'Microvillus' was a common misidentification of the villus, but most were able to suggest th[illegible] feature of a large surface area was common to both regions of the intestine. Many failed to cla[illegible] whether they were describing region **J** or region **K**.

Question 2

(a) Enzyme and substrate were often confused and it was evident that many had heard of the 'lock and key' hypothesis, but did not understand the concept. **N** was quite often identified as 'lock and key'.

(b)(c) Whilst almost all realised that an enzyme remains unchanged after a reaction, only a small proportion understood that heat supplies more energy to the molecules causing them to move faster. It was the rare exception to find a candidate who realised that denaturing is permanent.

Question 3

(a) Answers were often either totally accurate or totally confused – a common situation with genetics questions. A mark was often carelessly lost by those candidates who gave the ratio as 3 : 1 without identifying which represented the pea comb.

(b) For a relatively difficult concept, this section was often well answered, with full marks being quite common. Clearly, some were unfamiliar with the appearance of human X and Y chromosomes – often referring to the X chromosome as the 'female' chromosome.

Question 4

(a) 'Diffusion', 'photosynthesis' and (commonly) 'osmosis' were regular options to the correct answer 'transpiration' which was suggested by the majority.

(b) This section was well answered, though a few thought that **Y** might be a root hair.

(c) A relatively common misconception here was that light would affect the apparatus. A number also gave unqualified references to humidity and temperature – and paid the penalty for so doing.

(d) Some referred here to increased condensation on the bag rather than to the more relevant increased humidity of the air in the bag, but a significant number believed that the bag would increase temperature and thus increase the rate of transpiration. In **(ii)**, they then expanded that idea, suggesting that a black bag would increase the temperature yet further. Very few realised that decreased light would cause stomata to close.

Question 5

This question was poorly answered. It may be that candidates were struggling to cope with a food web set out in a slightly unfamiliar format, with the decomposers apparently occupying a 'top' position.

(a) This was usually accurate, but in **(b)**, all but the very best missed the fact that the decomposers (organisms **X**) would exist in the greatest numbers.

(c) If **X** were believed to be top carnivores, credit was duly given, but very few identified the birds of prey as being likely to exist in the smallest numbers. Caterpillars, mice and small birds were all equally popular incorrect answers.

(d) The better answers here referred to the recycling of carbon dioxide and/or mineral ions, but even those who realised that **X** were decomposers usually failed to give any accurate detail of the role played by decomposers in the food web.

Question 6

(a) This question was a useful discriminator since almost all mentioned that the energy used b is in the form of light and that the plant in some way uses chlorophyll to build molecule carbohydrate. Some forgot to mention that the process is called photosynthesis, even though t may have provided a level of biochemical detail in their answers which stretched beyond what i expected at this level. An appreciable number mentioned that the light energy is converted to chemical energy and stored, though few said where it is stored and yet fewer went on to explain how it is later released. In attempting to make this point, it was extremely common to see the inaccurate statement that 'energy is used for respiration'.

(b) A substantial number failed to link magnesium with chlorophyll production, but those who did usually managed to produce a comprehensive answer to this section. Few made any reference to plants needing to absorb magnesium before they can use it.

Question 7

(a) Full marks were often scored here, though it was surprising to see how many began their accounts with air entering the trachea, but then omitted any reference to capillaries or to how oxygen is carried in the blood. Only a very few made mention of the significance of tissue fluid in transporting oxygen to the cells.

(b) Most spent time explaining how a double circulation system works before they got round to answering the question. Few answers went beyond mention of the mixing of blood and the deficiency in oxygen supply to the cells. It was hoped that blood pressure differences would be appreciated and also that there would be more references to the possibility of deoxygenated blood entering the left side of the heart and oxygenated blood entering the right side.

Question 8

Either

Not the popular option but often answered well by those who attempted it.

(a) All relevant points were made with a reference to pH being the least common. There was some understandable confusion between the name of the fungus *Penicillium* and the name of the antibiotic it produces and plenty of suggestions that *Penicillium* is a bacterium.

(b) The fact that antibiotics may be successful in helping to cure a bacterial infection when the immune system can no longer cope was not often mentioned, but that such conditions may be cured more quickly with the aid of antibiotics was well known. Most of the disadvantages of antibiotic use were mentioned, but surprisingly few referred to possible allergic reactions. There was some confusion between antibiotic and analgesic.

Or

This question was answered by many who may have seen what they thought was something of a 'soft option' but their answers exposed a considerable lack of precise knowledge.

(a) Candidates of average to lower ability found extreme difficulty in linking the effects of smoking – which for the most part they knew well – to the precise component in cigarette smoke which causes each of them. Thus reference to nicotine causing lung cancer and to tar forming deposits on artery walls were not uncommon. The adverse effects of carbon monoxide were usually well understood.

(b) The question asked about the dangers of heroin abuse, but rather than concentrate on the effects of heroin on a person's health, many chose to give extensive and largely unprofitable accounts of the withdrawal symptoms experienced when heroin is not available to an addict. There was, however, generally sound understanding of the problem by the more able performers.

Paper 5090/03

Practical Test

General comments

Many marks were lost through the familiar failing of candidates not following the instructions sufficiently carefully; the failure to label their drawing in **Question 2 (a)** was a glaring example, but there were more subtle instances, as will emerge later in this report.

Despite the instruction on the front of the Paper, several instances of the use of correcting fluid were noted. This was not only a waste of valuable time but it might also have cost marks because an answer that is crossed through will still be marked, provided it is legible, if there is no subsequent amendment.

Comments on specific questions

Question 1

(a) Three test-tubes were provided for each candidate. They contained hydrogencarbonate indicator solution that had been prepared as specified. A fresh, green leaf was suspended in each of the first two test-tubes and one of these was covered in aluminium foil so that no light entered.

(i) Blowing through a straw into solution T3 should have caused the solution to become yellow; this was generally achieved.

(ii) The majority of candidates explained this in terms of the carbon dioxide content of T1 though a few said that the amount of carbon dioxide was inadequate.

(iii) Having been told that the change in colour was due to the presence of carbon dioxide in exhaled air, candidates were asked to explain why the solution in T1 was also yellow. Many correctly stated that in the absence of light the leaf contained in the test-tube would not be able to carry out photosynthesis, thus, the carbon dioxide produced by respiration would not be removed by photosynthesis and would therefore cause the indicator to become yellow.

(iv) By contrast the change in T2, in which the indicator solution was red or purple, was understood by the better candidates to be due to the photosynthetic activity of the leaf which removed the carbon dioxide in the presence of light. A common error was to ascribe the change to the presence of oxygen, or, less commonly, starch. A few candidates said that the leaf received carbon dioxide from the indicator solution.

(b) Prepared leaves, L1 and L2, were provided. Both had had their chlorophyll removed. L1 had previously been kept in darkness so that it contained no starch.

(i) Completion of Table 1.1 was very straightforward though care was needed with the wording, especially for the observation on L1; negative phrases like 'nothing happened' were not acceptable.

(ii) In relating the results from Table 1.1 to answers in **(a)** it was necessary simply to compare L1 with T1, neither having made starch by photosynthesis, in contrast with L2 and T2. Those candidates who did not mention T1 and T2 did not score marks so easily, nor did those who said that the starch test provided no supporting evidence!

(c) The concept of the contents of T3 acting as a control, or standard for comparison, was well understood, but only a few candidates went on to explain that this permitted the investigation of a single variable.

(d) This section, dealing with a suggested extension of the experiment, was not well answered. In many cases the term 'light intensity' was not understood and there were, in any case, very few suggestions as to how the intensity of the light might be altered, or varied. Many answers were confined to reviewing the evidence from the original test-tubes showing that photosynthesis will only occur in the presence of light. Other answers suggested using an experiment with an aquatic plant producing bubbles of oxygen at a rate determined by the distance away of a light source. This was partially accepted because of the variation in light intensity but it did not fulfil the main criterion of using the current experiment. Other suggestions involved using the starch test rather than the hydrogencarbonate indicator.

(e) This section postulated the replacement of the leaves in test-tubes T1, T2 and T3 Many candidates thought that the beetles were added to the leaves rather than repla However, it was generally known that respiration was the physiological process involved a would produce carbon dioxide which caused the indicator to turn yellow. There was a disti between T1 and T2 in that the former contents were in darkness while those of the latter w exposed to light. It was expected that the point that this made no difference to the respiration o the insects might have been made more frequently than in fact occurred. There were also a number of imprecise references to breathing instead of respiration. A few candidates mentioned lime water turning milky, which was not relevant to this investigation.

Question 2

(a)(i) Nearly every Centre was able to supply a suitable winged fruit and the others, who supplied a winged seed, were not penalised. Much more commonly candidates penalised themselves by making no attempt to label their drawing – which was often perfectly adequate and, like the vast majority, suitably large and clear. The labels that were expected included the wing and the seed (or its location, through the pericarp). Credit was also given for some other visible botanical detail such as remains of style or calyx. '*Angsana*' was a popular choice for this specimen and it was surprising how many candidates thought that each fruit contained several seeds.

(ii) The calculation of the degree of magnification of the drawing – surely a familiar exercise – was generally well carried out. The statements of the width of drawing and specimen were usually clear, more often in cm than in mm, despite our previous recommendations, but this is acceptable provided that the value is expressed to 0.1 cm. Some candidates neglected to record their working and others spoiled their answers by placing a unit after the expression of magnification, thus 'x 2.4 cm'. There was also a fairly widespread tendency to round off excessively; 'x2' is not acceptable when the calculation gives 'x 1. 65', for instance. A few candidates read off an unrealistic string of figures from a calculator.

(b)(c) These were concerning seed dispersal and were not well answered in many cases. There was serious confusion between the processes of seed dispersal and pollination. Nor could many candidates relate structure to function.

Specimen S1 was winged and it should have been clear that this increased its air resistance, making wind dispersal more effective.

Fig. 2.1 showed the hooks that would attach the fruit to the fur of a passing animal. No one suggested how the fruit or seeds might subsequently become detached, though it was not essential for candidates to do so. More seriously, many postulated that the projections – even when recognised as hooks – were instrumental in wind dispersal. Sometimes they were said to attach to insects for pollination, despite being of the order of 1 cm across, as revealed by the scale of the drawing.

The test for reducing sugar on specimen S2 was almost invariably carried out successfully. The attractive appearance of the fruit was also noted and the attraction to animals was often clearly stated. Yet very many candidates neglected to say that this resulted in the fruit being eaten and very few followed up by stating that the seeds would not be digested and would therefore be deposited in the animal's faeces. Some of those who did pursue this line spoiled their argument by referring to the process as excretion, which was unacceptable. Again, insects were often involved. Some candidates described at length the significance of the food test they had just completed.

Paper 5090/06
Alternative to Practical

General comments

A complete range of marks, 0-40, was achieved. This was pleasing because it showed that all the knowledge and ideas required were accessible to candidates. Marks were lost quite frequently through failure to follow instructions and similar careless practices. It might also be mentioned that candidates would benefit by writing more legibly; ambiguous expressions are unacceptable, especially when they consist of a single letter or numeral.

Comments on specific questions

Question 1

This question concerned the structure of an insect pollinated flower, examination of pollen grains using a microscope, and recognition of the pollination processes for two illustrated types of pollen grain.

(a)(i) The majority of candidates had a good idea of the names of the flower parts. What confusion there was usually concerned the ovules being labelled seeds or ovary. The term stigma was generally given but pistil and carpel were accepted, as also were corolla and calyx for petal and sepal respectively.

(ii) The syllabus requires that candidates should have had experience in the preparation of temporary mounts, suitably stained if necessary, for examination with a microscope. In fact many candidates were quite unfamiliar with the names of such basic equipment as microscope slides and coverslips (or coverglasses). Thus, many suggested that pollen should be examined in petri dishes, or collected on sheets of paper.

Candidates should have described how pollen might be brushed, by contact or by means of an instrument, from stamen to slide. A suitable mountant such as water or glycerol, or even a named stain like iodine solution or methylene blue, should have been placed on the slide, either before or after the pollen. A coverglass should then have been placed in position, carefully, in order to avoid air bubbles being trapped in the preparation. And, since the question went on to ask how the examination would take place, the slide should have been placed on the platform of the microscope, which should then have been focused on the specimens.

Many candidates described the examination of a single pollen grain and this was often cut in section. The pollen was frequently taken from the stigma and a second slide was used to cover the preparation on the first slide, the two often held together by elastic bands.

There were numerous references to using an electron microscope though it is suspected that an instrument with an integral light was the source of this idea.

(b) The pollen grains shown in Fig. 1.2 were adapted for insect pollination and wind pollination respectively. Visible structures were the spiky shape of the former and the air bladders of the latter. The spikes would favour the grain becoming attached to an insect, the bladders would provide buoyancy or increased air resistance during wind dispersal. The word dispersal possibly contributed to the widespread confusion between pollination and seed dispersal. The possible involvement of birds in pollination was noted in very few answers, perhaps surprisingly. The air bladders were said by numerous candidates to confer buoyancy during water dispersal; this was not accepted. Whether the pollen was sticky or light could not be deduced from the Fig. and, again, was not accepted.

Question 2

The basis of the question was a simple model of the gut showing how a diastatic enzyme would digest starch, allowing the resultant smaller, sugar molecules to diffuse through the wall of the gut, represented by a partially permeable tube.

(a) The two food tests were generally well described though there were a number of unnecessary allusions to their role in the experiment. The substrate for the starch test was sometimes heated. This invalidated the test unless subsequent cooling was mentioned. By far the safest form of heating for the reducing sugar test is by means of a water bath; candidates would be well advised to heed this advice. Some were so absorbed in their description that they omitted to include the test reagent.

(b) Completion of the Table was accepted either in terms of observations or conclusions. However, statements such as ‘no result’ were unsatisfactory.

(c)(i) The vast majority of candidates were able to describe how amylase or the enzy converted the starch to a sugar. This was variously referred to as maltose, glucose sugar and any of these terms was accepted.

(ii) Those who answered in terms of molecule size were generally able to describe how the sma sugar molecules diffused through the partially permeable wall of the tubing, unlike the larger starch molecules. There was confusion by candidates who referred to osmosis, thinking that only water could pass through the tubing. The term 'particles' was not acceptable for molecules.

(d) The more simple answers were generally best. The experiment could have been carried out with the test-tubes in a water bath to ensure uniform temperature but not the optimum for the enzyme. Boiled saliva, or an inert substitute might have been used as a control, or a reference to equal volumes of water or starch suspension might have been made. It was not adequate just to state that a control should be used.

Question 3

This was the usual type of graph question with a follow-up on the components of a reflex arc.

(a) There were many excellent graphs, either using a line of best fit, or joining the points with ruled lines. Both of these were acceptable, but compromises between the two were not good. By far the most common error was to transpose the axes; candidates should realise that the independent variable forms the *x* axis – and is usually written as the column on the left in the Table! The units were sometimes omitted, or confused between cm and mm. Another point of technique is that it is much more clear when the axes are labelled *outside*, rather than within the grid. Plots are best shown as small dots in a circle, or neat crosses, that is of the 'x' rather than the '+' variety.

(b) Values of 10-11 mm. were generally correctly read from the curve, with only a few candidates omitting, or confusing the units.

(c) The majority of candidates did not relate the experimental results to their knowledge of receptors in the skin. Many answers were nothing more than a recapitulation of the results, rather than being an interpretation of them. The evidence pointed to greater sensitivity in the finger tips. Therefore there were a greater number of receptors in the finger tips. Hence they were closer together and could distinguish the two needle points even when the needles were most close together. There were frequent references to numbers of neurones rather than to their receptive endings

(d) There were some very detailed, really excellent drawings representing a spinal reflex arc. It was, however, easily possible to score full marks in this section with quite a simple diagram showing a sensory neurone, with its cell body correctly in the dorsal root ganglion, a relay neurone and a motor neurone. Various suitable names for the neurones were accepted. For the fourth mark, a synapse could have been shown and labelled, appropriately in the gap between neurones, or arrows marked on the diagram to indicate the direction of conduction of the nerve impulse. Those who were less familiar with reflex structure tended to ignore the shaded area of grey matter and another fault was to take the impulse across the spinal cord so that it entered one side and left on the other side.