BIOLOGY (US)

Paper 0438/07
Coursework

General comments

Only a very small number of candidates were entered for this Paper.

Overall, centres chose suitable tasks for assessment, and used the generic criteria to construct appropriate mark schemes. Once this has been done successfully, the assessment of the work falls naturally into place and generally requires no adjustment by the external moderator.

It is still very noticeable that, frequently, the standard of graphing is well below that which would be expected of candidates at this level. Candidates are often not supplied with graph paper, instead being expected to construct their graphs on lined paper or simple squared paper. The construction of well-designed, accurate graphs is an essential component of displaying results. It allows trends and relationships between variables to be seen clearly, and is a way of communicating results to others. Candidates are expected to be able to select the appropriate type of graph to draw (bar chart, histogram or line graph), to label each axis fully, to select a suitable scale for each axis, and to plot points or bars precisely. They should use a ruler and sharp pencil for drawing the axes and bars, and either draw lines between points with a ruler or draw a carefully positioned line of best fit on a line graph.

BIOLOGY (US)

Paper 0438/11
Multiple Choice (Core)

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

General comments

The paper provided a good balance of questions and challenge at this level. Some misconceptions exist about the roles of photosynthesis and respiration, the meaning of genus and species, the position of the cell membrane and the cell wall in a plant cell, and the difference between an organ system and an organ. Few were familiar with the role of pectinase and that it is tar in cigarette smoke that causes cancer. It is important that candidates study graphs and the information given carefully. The use of dichotomous keys and the role of the xylem were well understood.

Comments on specific questions

Question 1

While most candidates gave the correct response, a significant number indicated that chlorophyll is used for respiration, suggesting some misconceptions exist.

Question 2

The majority of candidates showed a good understanding of the binomial system, only a few were unable to distinguish between a genus and a species.

Question 3

The majority of candidates showed a sound understanding of how to use a dichotomous key.

Question 4

Although some candidates were able to work out the correct labelling of a plant cell, the question, on the whole, proved challenging. Some were unsure of the positions of the cell membrane and the cell wall.

Question 5

Most candidates correctly identified the different levels of organisation. Some appeared to be unfamiliar with the term *organ system*.

Question 6

Many found the calculation challenging.

Question 7

Many candidates correctly identified the direction of diffusion of oxygen.

Question 8

The type of pressure required in cells to support a plant was correctly identified by many candidates. A common error was to select 'pressure inwards on the cell vacuoles' helps to support plants.

Question 9

Many candidates appreciated that a protease acts on a protein (the chain of amino acids), the commonest incorrect response was the protease acting on an amino acid.

Question 10

Many candidates did not appear to know the role of pectinase and most commonly option chosen was 'amylase.'

Question 11

Many candidates correctly identified the optimum pH for stomach enzymes as pH2, although a slightly smaller number of candidates opted for pH7.

Questions 12, 14, 16, 17, 20, 22, 24, 26 and 28

Candidates showed a good understanding the topics in these questions.

Question 13

Similar numbers of candidates were choosing each option, indicating that the fact that chlorophyll contains magnesium ions was not well known.

Question 15

While many candidates appreciated that starch is broken into simpler sugars in the mouth, some believed that it was fats that were broken down into fatty acids and glycerol.

Question 18

The role of the xylem was very well understood by most candidates.

Question 19

Although some candidates correctly identified that an ECG is performed on the heart, many opted for the brain, colon or ear, suggesting that this was not well understood.

Question 21

Similar numbers of candidates identified 'mucus and stomach acid' (the correct answer) and 'mucus and white blood cells' as chemical barriers to the transmission of disease.

Question 23

While many candidates opted for the correct answer, some did not appreciate in which bottle anaerobic respiration occurred, with enough carbon dioxide accumulating inside it to inflate the balloon.

Question 25

Some candidates were able to answer this question correctly but a similar number thought that the kidney makes urea and that urea is excreted from the bladder.

Question 27

This question was well-answered by many candidates who understood the order of the structures involved in the reflex pathway.

Question 29

Most commonly, candidates opted for 'nicotine' as the cancer causing substance in cigarette smoke which was incorrect.

Question 30

While most candidates correctly identified the 'contraceptive pill' as a means of preventing ovulation, some chose 'vasectomy.'

Question 31

It was not widely known that light is not always required for germination.

Question 32

Many candidates were familiar with the sequence of processes involved in labour and birth.

Question 33

Many candidates were able to derive the correct answer from a heterozygous cross.

Question 34

Many candidates were aware that a gene codes for a protein, although some believed it to be the chromosomes or an amino acid that does this.

Questions 35, 36 and 37

These questions were well understood by most candidates.

Question 38

Although some candidates opted for the correct answer, others did not realise that fertiliser would have the same effect on crop plants and plants in the lake.

Question 39

While many candidates were able to interpret the graphs on the depth and rate of breathing correctly, a similar number interpreted the depth of breathing as decreasing instead of increasing.

Question 40

Many candidates correctly identified the cause of increasing atmospheric carbon dioxide levels. The commonest incorrect response was pollution of air by sulfur dioxide.

BIOLOGY (US)

Paper 0438/21
Multiple Choice (Extended)

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

General comments

The exam paper provided a balance of questions and challenge at this level. The meaning of the term 'metabolism' was unfamiliar to some candidates. The use of ligase enzymes in genetic engineering was not widely known. The effect of placing cells in a solution which has a higher water potential was well understood, as was enzyme action and enzyme specificity. Most candidates had a clear understanding of discontinuous variation. Candidates must study graphs and information given carefully.

Comments on specific questions

Question 1

While most candidates selected the correct option, some believed that the term for all the chemical reactions that occur in cells is 'respiration.'

Question 2

The majority of candidates selected the correct option.

Question 3

Although this question was well-answered, some candidates appeared not to convert the length of the image to the same units as the actual length of the mitochondrion.

Question 4

This question was well answered, although some were unable to differentiate between the terms organ and organ system.

Question 5

While many candidates selected the correct option, some did not appreciate that increasing the concentration gradient across a membrane will increase the rate of diffusion.

Question 6

The effect of placing cells in a solution which has a higher water potential than the cells was well understood.

Question 7

The action of enzymes was very well understood by most candidates.

Question 8

While most candidates were able to identify the base in the diagram of the DNA molecule correctly, some identified it as an amino acid or a protein.

Question 9

The relationship between enzyme specificity and the shape of an enzyme's active site was well understood by most candidates.

Question 10

While many candidates selected the correct option, a minority were not aware of the role of pectinase in the production of fruit juice.

Questions 11, 12, 13, 14, 16, 18, 21, 24, 25 and 30

These questions were correctly answered by a large number of candidates.

Question 15

While many candidates were able to deduce the correct answer, a similar number of candidates did not realise that carbon dioxide is being produced because the rate of reaction is greater than the rate of photosynthesis.

Question 17

Most candidates selected the correct option; some identified the capillary as a lymph vessel.

Question 19

Many candidates selected the correct option.

Question 20

While many candidates identified the correct muscle actions required for inspiration.

Question 22

This proved to be quite a challenging question with only some candidates being able to use the information to draw the correct conclusion.

Question 26

This question required both an understanding of the structures found in a reflex arc and an appreciation of the direction of the impulse and hence the neurotransmitter. Some candidates were able to relate the two sets of information and selected the correct option.

Question 27

While many candidates responded correctly, some believed that it was antibodies or memory cells that trigger an immune response.

Question 28

Many candidates responded correctly, although some candidates believed that oxygen or a suitable temperature were not necessary for germination.

Question 29

While many candidates selected the correct option, some believed that an adaptive feature of sperm cells is the presence of a jelly coat.

Question 31

Many candidates were aware that a length of DNA that codes for a protein is a gene but some students opted for amino acid or chromosome.

Question 32

Most candidates were able to work out the sequence of events that leads to protein synthesis.

Question 33

Discontinuous variation was well understood by the majority of candidates.

Question 34

While many candidates appreciated the fact that people that are heterozygous for sickle-cell anaemia have a resistance to malaria, some believed that heterozygous individuals are more likely to suffer from malaria.

Question 35

Some candidates did not appreciate that in the nitrogen cycle, nitrogen fixation occurs by the action of bacteria and lightning.

Question 36

This question was answered correctly by the majority of candidates.

Question 37

While many candidates were able to interpret the graphs on the depth and rate of breathing correctly, some interpreted the depth of breathing as decreasing instead of increasing.

Question 38

Few candidates knew how ligase enzymes are used in genetic engineering.

Questions 39

Most candidates were able to answer this question correctly.

BIOLOGY (US)

Paper 0438/31
Theory (Core)

Key messages

Read all questions carefully and answer the question asked. See **Questions 4(b)** and **7(a)(iii)**.

Command words such as 'describe', 'explain', 'suggest' and 'compare' require different responses. Candidates should be encouraged to identify the differences in requirement for command words and in particular the difference between 'explain' and 'describe' questions.

Where a description of a graph or table of data is required, it is expected that data will be quoted (with units where appropriate) in the description given. Many candidates are able to do this effectively.

Where numbered answer lines are given there should be only one response on each numbered line.

General comments

Many excellent scripts were seen and a good understanding of many areas of the syllabus was shown.

Comments on specific questions

Question 1

The majority of candidates gave the correct response.

Question 2

(a) The best responses were able to provide an accurate definition.

(b) (i), (ii) and (iii) These questions were answered well by the majority of candidates.

(iv) Most candidates answered this question well, and many gave a complete explanation and made reference to the correct feeding relationships. A common error was to describe the effect on organisms other than the starfish and the limpets

(v) Some candidates were able to provide the correct responses but some found this a challenging question.

(c) Many were able to correctly identify the principal source of energy. Common errors were producers, algae, phytoplankton, and water.

(d) Many candidates showed a good understanding of the water cycle. Most correctly identified B and D, fewer could identify process C. A common misconception was to identify A as evaporation.

Question 3

(a) The majority of candidates showed a good understanding of this topic. Less confident responses were unsure of how to classify female sterilisation, vasectomy and IUD.

(b) Many candidates provided good responses to this question. A common error was to substitute 'enzymes' for 'hormones'.

(c) (i) This proved challenging for many with only a few able to correctly state the full name.

(ii) A good understanding was shown by the majority of candidates. Common correct responses were sharing needles and sexual intercourse.

(iii) A good understanding was shown by the majority of candidates. Common correct responses were not sharing needles, the use of condoms and avoiding blood to blood contact.

Question 4

(a) The petal was correctly labelled by most candidates. Identification of the stigma was challenging for some.

(b) This proved to be challenging form some candidates. A common error was to provide features of the flowers rather than the pollen.

(c) A few candidates were able to correctly identify the process involved.

(d) This was well answered. Functions of the ovary and petal were common correct responses.

Question 5

(a) (i) Some were able to correctly identify the structure. Common errors were to identify tissue A as epidermis or cuticle and cell B as a stoma(ta).

(ii) This was well answered by the majority of candidates.

(b) Most candidates answered this question well. Cell wall and permanent vacuole were the most frequent incorrect responses.

(c) Many were able to recall the reactants for photosynthesis. Some responses provided only one reactant or gave the products of the reaction.

(d) Some were able to describe good explanations for their choice of leaf and made reference to the diagram provided.

Question 6

(a) This was well answered by most candidates. In general candidates were familiar with alcohol and tobacco, less so with the effects of heroin.

(b) (i) and (ii) The majority of candidates were able to give good responses to these questions.

(iii) This question asked for a description not an explanation. Many were able to provide a good description and included a data quotation in their response.

(c) This proved to be a challenging question with some giving specific examples of infections rather than the type of microorganism that is affected by antibiotics.

Question 7

(a) (i) Well answered by most candidates.

(ii) A challenging question for some. A common error was to give the value per ten minutes rather than per minute.

(iii) Some candidates provided good responses. A common error was to describe transpiration rather than the movement of the air bubble.

(b) Most responses identified where water enters a plant, fewer could recall the process involved.

(c) This proved challenging for many. Better responses showed a good understanding of what processes were involved and where in the plant they occurred.

(d) Many correct responses were seen.

Question 8

(a) Well answered. A common error was to name specific foods rather than the component groups to which they belonged. For example a named meat was given rather than protein.

(b) Some candidates were able to recall the specific part of the alimentary canal.

(c) Some candidates were able to correctly identify the structures labelled on the excretory system diagram. The spelling of words like ureter and urethra must be accurate.

(d) The majority of candidates answered this question well.

BIOLOGY (US)

Paper 0438/41
Theory (Extended)

Key messages

- Some candidates continued their responses in the blank spaces on the question paper or in extra booklets. In some cases, these candidates did not indicate which question they were continuing. Candidates should always state where they have continued an answer and also write the question number (e.g. **1(d)(ii)**) at the beginning of their continuation answer.
- Data quotes should be given as a value with a unit, e.g. 110–122 GJ per ha rather than 110–122 energy yield / GJ per ha.
- Key terms are defined in the syllabus. It is expected that candidates will know these definitions. This paper asked for two definitions: allele (question **3(c)(i)**) and sustainable development (question **5(c)**). Very few candidates knew the second of these.
- Candidates are advised to read questions carefully and answer without repeating information already given as marking points are not available for the information given in the question stem.

General comments

Many candidates should be congratulated for their clear and precise responses to extended questions, particularly those involving data analysis and interpretation (questions **5(b)** and **2(c)**). However, some responses did not include units when quoting data in answer to question **2(c)**.

Some responses used the term ‘affect’ instead of ‘increase’ or ‘decrease’. ‘Affect’ on its own does not imply a directional change.

The calculation in question **5(b)(iii)** proved challenging for many. Candidates should be encouraged to check their answers to ensure that they are realistic, given the context.

Very few candidates identified the genetic cross in question **3** as a test cross, although many completed the steps of the genetic diagram in **3(c)(iii)** correctly.

Comments on specific questions

Question 1

(a) Many candidates knew that villi are responsible for absorption. Some gave further detail by stating that they provide an increased surface area for absorption.

(b) Interpretation of the images of villi, specially the section in Fig. 1.2 proved challenging for some candidates. Candidates were asked to identify and describe two of the labelled components of a villus. Fig. 1.2 was often identified as a cell and hence labels **P**, **R**, and **S** were incorrectly identified. **S** was most commonly identified as a membrane and **R** as the nucleus. These responses indicate the importance of candidates reading the question carefully. Where answers did relate to the villus section the most common responses included the lacteal (**Q**) and the blood vessel (**R**). Identifications of **P** as a goblet cell and **S** as the epithelium of the villus were seen more rarely. Candidates often knew the function of particular parts of the villus even though they were unsure of their names.

(c) (i) This question was answered well. Most responses included reference to dehydration and watery faeces, with candidates generally using the correct terms. Only a few noted that minerals would also be lost in cases of severe diarrhoea.

(ii) Descriptions of this treatment were accepted providing that it was clear that both water and minerals would be required.

(d) (i) A common error was 'red blood cells'.

(ii) Some candidates were able to name the process.

(iii) Many candidates gave correct examples. A common error was to state the name of an organelle rather than a molecule.

Question 2

(a) Many candidates gave the correct response. Some responses were overly complicated and tried to devise complex apparatus that would measure 'breathing output'. Some confused pulse rate or heart rate with breathing rate.

(b) Many responses referred to high breathing rates *after* exercise in their hypothesis, rather than stating that physical activity causes the rate to rise. The most straightforward answers stated that 'physical activity would cause an increase in breathing rate and that when exercise stops the rate decreases'.

(c) The question asked for both a description *and* an explanation of the data. Many good responses were seen which gave an excellent interpretation of the decrease in carbon dioxide concentration after exercise. The best responses referred to oxygen debt and the breakdown of lactic acid. A very small number of responses did not provide units when comparing the data.

(d) (i) The risk factors for coronary heart disease (CHD) are listed in Section 9.2 of the syllabus. These could have been used as the basis for responses to this question. People with CHD are at increased risk of having a medical emergency should they undertake vigorous exercise especially if they do not normally undertake much exercise at all. The researchers could ask a health professional to assess her state of health by investigating the various risk factors, such as high blood pressure and high concentration of cholesterol in the blood.

(ii) Most candidates were aware of exercise lowering cholesterol and fats in the blood. Also that exercise is likely to reduce the problems of obesity, and reduce the risk of atheroma. Few mentioned lowering stress or lowering blood pressure.

Question 3

(a) Almost all candidates provided three features of flowers that would attract insects.

(b) The best responses described events following the dispersal of pollen grains from the anthers until fertilisation occurs. They described a pollen grain landing on the stigma, the growth of the pollen tube through the style towards the ovary and ovule and the fusion of the male and female nuclei. Some responses did not refer to fertilisation. Some appeared not to appreciate that the pollen tube delivers the male nucleus to the ovule and that fusion occurs when this nucleus leaves the pollen tube and enters the ovule.

(c) (i) The term allele was well known by most candidates.

(ii) This question proved challenging as few were able to identify this type of cross as a test cross.

(iii) The genetic diagram was completed correctly and in full in most cases. Candidates should take particular care to make upper case letters clearly distinguishable from lower case letters.

(iv) In contrast to **(c)(iv)**, many candidates gave confident responses to this question about the use of homozygous recessive plants (**tt**) in order to produce pure-breeding dwarf pea plants. They often stated that this is to ensure that a dominant allele (**T**) is not available to give rise to tall pea plants.

Question 4

(a) (i) Few candidates identified stem cells as the unspecialised cells that give rise to neurones.

(ii) Most candidates gave good responses to this question.

(iii) Many candidates gave a correct explanation.

(b) (i) The term motor neurone was known by many candidates.

(ii) An effector organ would generally be a muscle or a gland. Suitable examples of muscles or glands were accepted. The eye was sometimes given, but this was not accepted without some further qualification e.g. the muscles in the iris, as it is generally considered to be a sensory organ rather than an effector.

(c) (i) The mitochondrion (**E**) and the nucleus (**M**) were well known, the rest less so.

(ii) The majority of candidates correctly identified the brain or spinal cord.

(d) Neurotransmitters move across the synaptic gap by diffusion due to a concentration gradient from the side where the vesicles release neurotransmitters to the receptors on the post synaptic neurone. Many candidates mentioned the direction of the flow of neurotransmitters, but did not relate the movement to diffusion.

(e) Correct responses had to be comparative and include a reference to the speed of transmission and duration of effects. 'Nerves are faster and their effects do not last as long' was a typical correct response.

Question 5

(a) Most candidates gave a correctly balanced equation. A minority wrote a word equation.

(b) (i) Almost all candidates chose sugar beet and used the information provided to support their answer. Many excellent responses were seen.

(ii) Few candidates gave an example of a named molecule containing nitrogen. Suitable examples are DNA, RNA, enzymes and chlorophyll.

(iii) The calculation proved challenging for many with few correct responses. A common error was to give 0.002 GJ per ha.

(iv) Candidates could approach their answers to this question from the perspective of using algae for biofuel or using land crops for biofuel. Weaker responses discussed the role of fertilisers and eutrophication, which did not answer the question. Better response included references to crops as food and the amount of land required to grow them; deforestation to release land for growing biofuel crops and the disruption to food chains that this would cause.

(c) Few candidates knew the definition of sustainable development.

Question 6

(a) (i) In answering this question candidates were not restricted to structural features as they were in **Question 4(a)(ii)**. Protein coat and genetic material are listed as features of viruses in the syllabus and these were seen quite often. Candidates gave other features such as small size.

(ii) Many candidates gave excellent responses to this question. The best responses referred to antigens, antibodies produced by lymphocytes, memory cells and long-term immunity. Some also referred to programmes of mass vaccination.

(b) The drawings in Fig. 6.1 should have been helpful to candidates. Responses did not have to be restricted to features visible in the drawings of the viruses, so features other than shape and size were accepted. Examples included the type of genetic material (DNA or RNA), the type of organism that the virus infects and the types of disease that the viruses cause.