BIOLOGY

Paper 0970/12
Multiple Choice (Core)

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

General comments

There was good understanding of: the human breathing system; aerobic respiration and the definition of a drug.

There was some uncertainty about: the fact that during transpiration water evaporates from the spongy mesophyll cells; motor neurones in a reflex arc; the colour changes of hydrogencarbonate indicator; the direction of impulses and the role of the retina.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 12**, **27**, **33** and **38**.

Comments on specific questions

Question 5

While many candidates selected correctly, some candidates appeared to make a mistake with the position of the decimal point.

Question 6

Some candidates did not use the features of osmosis to work out that the volume of water decreases and the volume of sugar solution increases.

Question 7

Many candidates understood that diffusion is the process that causes oxygen to pass from an alveolus in the lung to a blood capillary. Some candidates incorrectly selected assimilation.

Question 8

A minority of candidates were able to correctly identify the chemical elements in proteins.

Question 9

While many candidates selected correctly, some candidates did not know that cellulose is a large biological molecule that is made up of glucose molecules.

Question 10

Many candidates were aware that a change in pH and a change in temperature could cause an enzyme to denature. Some candidates incorrectly believed that a change in substrate concentration could also cause an enzyme to denature.

Question 11

Many candidates understood that many stomata and a thin leaf allow more diffusion of carbon dioxide into the palisade cells for photosynthesis. Some candidates incorrectly believed that thick leaves would allow more diffusion of carbon dioxide.

Question 12

This proved to be a demanding question with most candidates selecting incorrectly. The bacteria move to areas of high oxygen concentration. The oxygen is produced by photosynthesis.

Question 13

While many candidates correctly identified the premolar tooth, molar was a common incorrect response.

Question 14

A minority of candidates appreciated what is produced when amylase acts on starch. Amylase digests starch into simple sugars.

Question 16

Few candidates understood that during transpiration most water evaporates from the spongy mesophyll cells.

Question 17

Only a minority of candidates identified the tissue as xylem and the function as the transport of mineral ions.

Question 19

Few candidates selected the correct response. Some candidates incorrectly believed that platelets carry out phagocytosis.

Question 20

Most candidates knew the description of a transmissible disease. Some candidates incorrectly believed that it is a disease caused when a pathogen passes to the host's body only by direct contact.

Question 21

Most candidates understood that in expired air, the concentration of carbon dioxide increases and the concentration of oxygen decreases. However, there was some uncertainty about what happens to the concentration of water vapour. This also increases.

Question 24

A large volume of carbon dioxide will only be produced if sugar is also present with the yeast and water, hence the correct option is **A**.

Question 25

Very few candidates selected correctly. The use of the term ions appears to have caused some confusion.

Question 26

Most candidates were unable to identify the motor neurone in a reflex arc.

Question 27

Responding correctly relied on candidates knowing that both the pupil diameter and the heart rate would increase with an increase in adrenaline.

Question 33

Some candidates gave the correct response, but many found this challenging. It is important that candidates work methodically through this type of genetics question.

Question 35

While many candidates selected the correct option, **B**, some candidates incorrectly believed that blood groups are an example of continuous variation.

Question 37

Many candidates were unable to translate the information into a pyramid of numbers.

Question 38

Many candidates gave the correct response. A common error was not deducting the 5 kg per hectare at 30 days, to find the difference.

Question 39

Candidates needed to understand that carbon dioxide causes limewater to become cloudy and only the limewater in tube Y becomes cloudy because it receives expired air.

BIOLOGY

Paper 0970/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: the binomial system; respiration; the definition of a drug and the genetic modification of a bacterium.

There was some uncertainty about: blood flow through a villus; the fact that during transpiration most water evaporates from the spongy mesophyll cells and the excretion of ions.

It is important for candidates to work methodically through information provided in questions, such as in **Questions 30** and **38**.

Comments on specific questions

Question 4

Most candidates incorrectly believed that all plant cells possess both a cell wall and chloroplasts. The word ‘all’ in the question is particularly important here. Root hair cells, for instance, do not contain chloroplasts.

Question 5

Many candidates deduced the correct answer for the size of the bacterium. Some candidates appeared to have been confused by having to convert units from mm to m.

Question 7

While many candidates correctly selected option **B**, some candidates incorrectly believed that active transport always transports particles into cells.

Question 12

This proved to be a demanding question with most candidates selecting an incorrect option. The bacteria move to areas of high oxygen concentration. The oxygen is produced by photosynthesis.

Question 15

There was some uncertainty about this question. Vessel **D** is the capillary that carries blood to the hepatic portal vein which goes to the liver. Some candidates incorrectly opted for the lymphatic vessel, option **C**.

Question 16

Only a minority of candidates knew that during transpiration most water evaporates from the spongy mesophyll cells.

Question 17

While many candidates appreciated that the tissue was the xylem and that it transports mineral ions, some incorrectly identified the tissue as the phloem.

Question 18

Many candidates understood that P (a lymphocyte) produces antibodies. Some candidates incorrectly believed that it carries oxygen.

Question 22

Many candidates understood that receptors in the brain detect increased carbon dioxide concentrations in the blood. Some candidates incorrectly believed that the receptors are in the lungs.

Question 25

Only a small minority of candidates selected correctly. The use of the term ions appears to have caused some confusion.

Question 27

There was confusion over which hormones increase blood glucose concentration. Adrenaline and glucagon increase blood glucose concentration.

Question 29

Many candidates understood that a disadvantage of sexual reproduction for a population in the wild is a reduction in reproduction if individuals are isolated. Some candidates incorrectly believed that a disadvantage is an increased likelihood of a disease affecting all individuals; this is a disadvantage of asexual reproduction.

Question 30

It was important that candidates worked through the information carefully and methodically to derive the correct answer.

Question 32

While many candidates understood that the gene for insulin is only expressed by cells in the pancreas, some candidates incorrectly believed that other body cells do not have the gene for insulin.

Question 34

Many candidates correctly selected option **A**. However, some candidates did not realise that meiosis is a source of genetic variation in populations.

Question 37

Many candidates understood that denitrification is the process that releases nitrogen gas into the air. Some candidates incorrectly believed that the process is nitrification.

Question 38

This was a demanding question. Only a minority of candidates were able to carry out the sex-linked cross to determine the correct answer.

BIOLOGY

Paper 0970/32
Theory (Core)

Key messages

Candidates need to read the question carefully, as it often contains specific information that must be used in the answer. Candidates often see one or two words and write everything they know about that topic, much of which does not answer the question and cannot be credited.

Command words such as 'describe', 'explain', 'suggest' and 'compare' require different responses from candidates. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practise the difference between 'explain' and 'describe'.

General comments

Many candidates were well prepared for the exam and had obviously referred to past papers and mark schemes when preparing. This type of preparation allows candidates to express themselves clearly.

Some candidates score well on the objective questions but are unsure how to express themselves clearly in the longer prose questions.

Comments on specific questions

Question 1

(a) (i) Few candidates knew that protease enzymes act in the small intestine. Most candidates recognised the main parts of the digestive system, particularly where salivary amylase is produced.

(ii) Many candidates stated that the acidic conditions will kill bacteria or pathogens present in food. However, some candidates thought that the acidic conditions were present to break down food without appreciating that the enzymes catalyse the breakdown, and the low pH is there to provide optimum conditions. Many thought that the acid neutralised the juices. The word 'germs' was not an acceptable alternative for bacteria and was not credited.

(b) (i) Most candidates recognised amylase as an enzyme and appreciated that it breaks down a food but less stated that this was starch. If they stated starch, most went on to add simple sugars. Maltase was given instead of maltose in a few cases. Some candidates simply identified carbohydrate or food/substances as the substrate and could not be credited as it was not specific enough.

(ii) Most candidates were able to state that enzymes are biological catalysts and that they increase the rate of a reaction. Few stated that enzymes are proteins. Some candidates stated amylase is a cell, it should be emphasised that the name of an enzyme can often be recognised as it ends in 'ase'.

Question 2

(a) Many answers stated chlorophyll rather than chloroplasts. Some also included reference to plant organs like the leaf, suggesting the question had not been read carefully.

(b) Candidates found this question demanding. The question asked for an explanation of the results for the white part of the leaf. Many candidates wrote about the green part which did not answer the

question. Many candidates recalled that iodine solution is the test for starch, but many thought that it tested for chlorophyll or ethanol. Fewer candidates made the correct reference to the lack of photosynthesis in their explanation. Some candidates stated that the yellow-brown colouration was due to that part of the leaf being dead after being boiled in ethanol. Many answers also described the results in terms of chlorophyll rather than starch.

(c) Most candidates stated the correct answer at least once. Many candidates stated that the green area would turn blue-black suggesting they were focused on the presence of chlorophyll and had not appreciated the absence of carbon dioxide. Some confused the colours with those from other tests, such as Benedict's and biuret.

(d) (i) Most candidates correctly identified the use of nectar and cellulose. Many did not recall the use of sucrose. Some candidates drew more than one line from or to a box.

(ii) Very few candidates could state the elements, with most stating a molecule. Those that did state individual elements often added nitrogen into the list. It is useful to recall that carbohydrate elements spell 'CHO' and protein elements spell 'CHON'.

Question 3

(a) (i) Many candidates confused the atrium with the ventricle. A few candidates mixed up the right and left side of the heart.

(ii) Most candidates were able to label a valve, although the names of the valves varied greatly. Incorrect labels often pointed to the blood vessels.

(iii) Many answers stated the two vessels on one side of the heart, either the right or left side rather than two arteries.

(iv) Most candidates were able to state the septum as the part that separates the left and right sides of the heart.

(v) Many candidates correctly stated muscle.

(b) (i) Responses were not always clear. Occasionally candidates just listed all the figures from the graph but without any further development. Some candidates did not follow the key supplied and interpreted the data for the wrong sexes. Most candidates were able to gain credit for the trend that males had higher incidences of CHD but many also spent time describing possible reasons why male data is higher. Some figures were read incorrectly from the graph. Very few candidates stated that the greatest difference was at 75 – 84. Candidates should always comment on significant differences when comparing two sets of data.

(ii) Most candidates correctly recalled the risk factors, particularly smoking and stress. Many candidates misread the question and often referred to the consequences of CHD rather than the risk factors for it. Many also used the risk factors stated in the previous question.

Question 4

(a) (i) Nearly all candidates achieved a mark, either for line one or two, and those achieving two marks did so for both. Far fewer put two ticks in the last line as they assumed that only one tick per row thus missing out on marking point three.

(ii) Most candidates were awarded both marks. Very few forgot the arrows, and just used a hyphen or had the arrows in the wrong direction. Some candidates did not understand the instructions and made a food chain from an alternative web.

(iii) Candidates typically suggested shark, implying that they do not fully understand the concept of trophic levels. Other incorrect answers included octopus or animals outside the web.

(b) Many candidates knew the word decomposer, though some incorrectly stated scavenger or algae.

(c) Most candidates stated the Sun or sunlight and were awarded the mark. Plants or producers were common incorrect responses.

(d) Some candidates did not read the question carefully enough and responded to other questions, such as 'humans and the ecosystem/biosphere' or 'how humans can improve ecosystems'. Some candidates were awarded full marks on this question through clear and explained answers.

Question 5

(a) Most candidates connected antibiotics with killing bacteria although a few also stated they killed viruses.

(b) (i) This question was well answered with most achieving both marks. A common error was multiplying the answer by 1000 suggesting the question stem of 'per 1000 people per day' was not understood. The second mark could be scored from workings if the calculation was correct, but the values chosen were incorrect.

(ii) This was well answered with most candidates achieving this mark. The bar chart was often marked to show candidates had accurately read each of the bars.

Question 6

(a) (i) Very few candidates were awarded this mark. Common incorrect answers included palisade and vacuole.

(ii) Many candidates correctly stated root hair cell but some missed out the hair and just stated root cell which is insufficient. Describing the adaptation proved difficult and most candidates stated the function of the cell, not how it is adapted.

(iii) Osmosis and diffusion were credited. There were many incorrect answers, the most common being absorption.

(b) The uses of water in plants were well known.

(c) The environmental factors that affect the rate of water loss were well known with many candidates being awarded both marks.

Question 7

(a) The oviduct was generally identified correctly but the ovary was frequently identified as the ovule. The function of the ovary was generally known with many candidates able to list a function.

(b) This question was well answered with many candidates scoring full marks. Incorrect answers included ciliated cells as a specialised plant cell.

(c) A wide range of suggestions were given. Cell division was the required answer, but mitosis and meiosis were also credited.

(d) (i) Many candidates simply added label lines to the terms already on the diagram. Some label lines did not touch the structure that was being identified.

(ii) The vast majority of candidates correctly identified the sperm cell.

Question 8

(a) (i) Nearly all candidates were awarded one mark. The last two answers were mostly correct.

(ii) Most candidates selected the correct term (nutrition) but sexual reproduction and egestion were commonly circled. Transpiration was rarely chosen as candidates recognised it as a plant process. A few candidates circled more than one term.

(b) (i) Most candidates correctly performed the calculation.

(ii) Most candidates identified the correct range.

(iii) Discontinuous was an incorrect answer but was seen quite often.

(c) The majority of candidate selected the correct description of variation.

BIOLOGY

Paper 0970/42
Theory (Extended)

Key messages

Answers to some questions suggested that candidates did not always understand the command words used in the paper. In **Questions 1(c)(ii)** and **4(b)**, candidates missed marks for giving descriptions of data rather than explanations. Descriptions of the command words can be found in the syllabus.

Care should be taken when writing responses. Some candidates left out a key word; for example, stating that 'at high temperatures substrate molecules can fit into the active site of an enzyme', instead of writing that '… molecules cannot fit into …'. When asked to compare, candidates should use comparative words, such as larger, longer, higher, etc.

Candidates should be advised to check their answers thoroughly. Often candidates wrote about the water potential of the salt solution and/or the red blood cells in **Question 2(c)(ii)**, but thereafter referred to a water concentration gradient instead of a water potential gradient.

General comments

There were many well written responses to all the questions on the paper with some candidates showing impressive knowledge of topics from across the syllabus.

Many candidates used 'it' in their answers without making it clear what this meant. In **Question 2(c)(i)**, for example, it was not clear whether 'it' referred to the tomato plant or to the water lily plant. Candidates often used incorrect terminology. Examples in **Question 4** on photosynthesis were 'production of food in photosynthesis', 'chlorophyll trapping energy' rather than light energy and the use of the simplistic term 'fair test' to explain why carbon dioxide is provided to plants in excess.

When candidates are asked to describe data, they should describe patterns or trends using some of the data to illustrate the pattern. Candidates should also take care to answer the exact question being asked. For instance, **Question 2(b)(ii)** specifically asked about the large air spaces in the spongy mesophyll and not about other adaptations of water lily plants, such as very broad leaves. **Question 4(c)** asked why carbon dioxide was supplied in excess, not why was carbon dioxide was supplied.

Some responses revealed misconceptions. In **Question 2**, many candidates stated that stomata are for taking in water and/or nutrients. Many candidates thought that antibodies have receptors or active sites rather than antigen-binding sites. Protein carriers were often thought to be molecules that carry proteins.

Care should be taken when spelling biological terms. Platelets, haemoglobin, oestrogen, and enzyme-substrate complex were often misspelt. Some candidates confused the identities of antibodies and antigens and wrote antibiotics instead of antibodies.

Comments on specific questions

Question 1

(a) The majority of candidates identified the substance in red blood cells that combines with oxygen as haemoglobin.

(b) Platelets was the most popular answer for the component of blood that promotes blood clotting. Fibrinogen and fibrin were also accepted.

(c) (i) A large proportion of the candidates calculated the percentage increase in the mean diameter of red blood cells that were immersed in the 0.8% salt solution. A common error was to round the results of the calculation to 9.33% rather than to 9.3%. Some candidates confused two significant figures with two decimal places. Other candidates used the mean final diameter after two minutes as the denominator in their calculation or chose to use the percentage concentration (0.8%) as the denominator. The error carried forward rule was applied to these calculations so candidates could gain some credit for correct rounding to two significant figures.

(ii) There were many excellent answers that explained the change in mean diameter of the red blood cells in the 1.8% salt solution. Candidates compared the water potential in the cells with the water potential in the salt solution and then explained that water would have moved down a water potential gradient from the cells by osmosis, often adding that the water passes through the partially permeable cell membrane. Many described the results rather than explain them. Many candidates wrote that the water potential of the red blood cells was higher than the water potential of the salt solution and then said that water moved out of the cells down a concentration gradient or a 'water concentration gradient'. Many also stated that water moved from a high water potential to a low water potential without mentioning which part of the system - red blood cell or salt solution - had the higher water potential. Some thought the decrease in size of the red blood cells was due to loss of oxygen from the cells.

(iii) Candidates who referred to water potential in **1(c)(ii)** often stated that there would not have been a water potential gradient between the red blood cells and the salt solution with a concentration of 0.9%. Incorrect answers included the salt solution and the red blood cells having the same 'water concentration'. Candidates should be discouraged from using the term 'water concentration'. A few candidates stated that no osmosis took place, rather than explaining that there was no net movement of water molecules.

(d) There were many correct answers that identified the lack of a cell wall as the reason why the red blood cells burst in pure water. The presence of a cell wall around plant cells was accepted as an alternative. Many gave the impression that red blood cells have cell membranes, but plant cells have a cell wall instead of writing that plant cells have both a cell membrane and a cell wall. Some candidates stated that plant cells have cell walls but said that they are a barrier to movement of water. Some also stated that vacuoles in plant cells prevent them from bursting by taking up the extra water.

(e) Transport, solvent, photosynthesis and turgidity or support were the most common correct responses for this question on the uses of water in plants. Many candidates wrote growth, but this answer required more detail, such as stating that water is required for the elongation of cells.

Question 2

(a) Most candidates stated that an adaptive feature helps an organism survive in its environment, but many did not state that it is an inherited feature. In fact, many answers suggested that adaptive features are gained by an organism during its lifetime in response to changes in its environment. Candidates should be aware that they will not gain credit if they use the term that they are explaining in their answer, in this case 'adapt'.

(b) (i) Palisade mesophyll, spongy mesophyll and air space were the expected answers for the labels on Fig. 2.2. Many candidates identified the part labelled **C** as a vacuole or as stomata rather than an air space. Xylem and phloem were also given. Mesophyll was sometimes written for both **A** and **B** which was insufficient to gain credit. Candidates who thought that **A** was the upper epidermis then often identified **B** as palisade mesophyll and **C** as spongy mesophyll which did not gain any marks.

(ii) Many wrote about the air providing buoyancy for the leaves, but very few stated that the leaves had a reduced density or even that the air spaces were large. Few stated that the air spaces help the leaves float on the surface of the water. Common answers did not address the question about adaptation of the hydrophyte and wrote about the role of air spaces in the leaves of all plants in providing interconnecting spaces for gases to circulate throughout the leaf and providing surfaces for diffusion of gases into and out of the mesophyll cells. A few candidates wrote about other adaptations of hydrophytes, such as their broad leaves and features of roots and stems.

(c) (i) Many answers simply stated the values from Table 2.1 without any comparison. Better responses stated that tomato plants have more stomata on the lower epidermis of their leaves than on their

upper epidermis and that water lily leaves have many more stomata on the upper epidermis than the tomato. Few made the obvious statement that water lilies have more stomata than tomato plants. Some candidates manipulated the figures given in the table to qualify their qualitative descriptions. For example, some stated that the water lily leaf has 47.5 times as many stomata on the upper epidermis compared with tomato.

Explanations were often not expressed very well. Strong responses explained the distribution of stomata on tomato leaves in terms of reducing the loss of water by transpiration and the distribution on water lily leaves as an adaptation to living on the surface of water with gas exchange for photosynthesis only possible on the upper surface facing the air. Many candidates thought that the water lily has such a high stomatal density on the upper epidermis as it needs to lose water by transpiration.

(ii) Most candidates gave guard cells as their answer. Incorrect answers included stomata cells, goblet cells and epiglottis.

Question 3

(a) Many candidates identified the vesicles and the synapse correctly in Fig. 3.2. Candidates often wrote neurotransmitters in vesicles for structure **X** which was accepted. Synaptic gap and synaptic cleft were accepted as alternatives to synapse for **Y**.

(b) Candidates who read the information in the question and looked carefully at the diagrams of the junctions between the neurones wrote good answers to this question as they followed the instruction to use what they could see. Most candidates described how the events shown at the junction in the person with Parkinson's disease differ from those in the person who does not have the disease. A smaller number described what happens in Fig. 3.1 and then said that this does not happen in Fig. 3.2. It was often possible to give credit when the comparison with Fig. 3.2 was made clear. Weaker responses did not deal with the stages in transmission of an impulse across a synapse. Most candidates stated that movement in people with Parkinson's is slow and reaction time to stimuli is longer. Reducing reaction time was an incorrect answer that was seen occasionally. Also, a number of candidates stated that the transmission of impulses in the post-synaptic neurone would be slower rather than less frequent.

(c) There were many good answers to this question. Candidates identified a variety of differences between nervous control and hormonal control. The use of nerve impulses, their speed and their length of effect were the features most commonly seen. Some candidates also gave the equivalent points for hormonal control. Features of hormonal control without any comparison to the nervous system, if appropriate, were also credited. Candidates should know that hormones control more features than reproduction and/or blood glucose concentration. They should also know that neurones control features other than movement.

(d) (i) Few candidates gained credit for this question as they misunderstand the word 'determine'. Rather than referring to sequences of amino acids and base sequences of DNA and/or mRNA they stated that receptor proteins have a specific shape that is complementary to that of the neurotransmitter. Candidates who understood the question often stated that the sequence of amino acids is determined by DNA, or by mRNA, without stating that it is the base sequence on these molecules that is the determining factor. 'The base sequence of amino acids' was seen occasionally, rather than 'the sequence of amino acids' determining the shape of the protein receptors.

(ii) Many candidates did not recognise the term protein carrier and thought that they transport proteins. Some candidates correctly wrote about active transport and transferring molecules or ions across membranes, into or out of cells.

Question 4

(a) Many candidates first wrote 37 and then crossed it out and wrote 40. Some did not realise their error and left 37 as their answer. 37 arbitrary units is the rate of photosynthesis at 40 °C, so these candidates must have taken their answer from the wrong axis in Fig. 4.1.

(b) Most responses described the pattern shown on the graph and gave little or no explanation. The effect of temperature on the rate of photosynthesis can be explained in terms of the activity of enzymes in green plant cells. Few candidates realised this and they did not apply their knowledge of

enzyme activity to the question. Strong responses referred to the increase in kinetic energy as the temperature increases to 40 °C and its effect on the frequency of collisions between enzyme molecules and substrate molecules. Only a minority identified temperature as the limiting factor at these temperatures. Almost all those who attempted an explanation stated that enzyme molecules are progressively denatured as temperature exceeded 40 °C. Few explained that this involves changes in shape of the active site so that substrate molecules can no longer fit. A few explained changes in terms of production of oxygen or stated that at high temperatures stomata may close so reducing the uptake of carbon dioxide.

(c) Many candidates answered this question by stating that carbon dioxide is a limiting factor of photosynthesis. Many stated that without enough carbon dioxide the results would be unreliable or inaccurate. This alone was not given credit, it was necessary to say that only one variable, temperature, was investigated. If carbon dioxide was not in excess it would not be possible to interpret the results to understand the effect of temperature alone. Many did not realise that the emphasis of the question was on the word excess and answered that carbon dioxide is a reactant of photosynthesis which is why it was supplied.

(d) Most responses explained that some of the oxygen produced by the leaf is used in aerobic respiration. The mark was awarded for simply stating that it was required for respiration.

(e) There was some confusion between chlorophyll and chloroplasts. Many simply wrote that chlorophyll gives plants their green colour. There were many good answers stating that chlorophyll absorbs light energy and converts it to chemical energy.

Question 5

(a) Candidates could gain marks by referring either to a characteristic of the circulatory system of fish or of mammals. The most common answer was that fish have a single circulation and mammals have a double circulation. Candidates who did not use the terms single and double often described the single circulation as 'blood travels through the heart once' and did not add '… in each circuit of the body'. Another error was to state that fish have two chambers… without adding '… in the heart'. Many candidates gave two separate statements about the same feature, for example writing 'fish have a single circulation' on the first numbered answer line and 'mammals have a double circulation' on the second. Answers about the gas exchange system were common; for example, 'fish breathe through their mouth and mammals through their nose' and 'fish have gills and mammals have lungs'. Answers about mammals had to make it clear that they were about mammals; candidates who wrote 'they' followed by a mammalian feature did not gain credit. Many thought the blood pressure was the same at each point in the circulation of a fish. A few used the terms systemic and pulmonary in their answers about the circulatory system of mammals.

(b) Most candidates stated an advantage of the double circulation as the separation of oxygenated and deoxygenated blood. They often added that pressure of blood pumped to the body is high, but fewer added that blood pumped to the lungs has a lower blood pressure. Good answers referred to the fast removal of waste products from respiring tissues and the efficient filtration of blood as it flows through the kidneys. Vague answers referred to more oxygen gained rather than faster transport. Some candidates stated that there are different pressures for the two circuits but did not explain the advantage of this. Some wrote that the double circulatory system allows all organs to receive blood, but this is a feature of all circulatory systems.

(c) (i) A small number of candidates wrote the names of structures that they identified rather than the letters from Fig. 5.1.

(ii) Many identified blood vessel **X** on Fig. 5.1 as the hepatic portal vein. Common incorrect answers were hepatic vein, aorta, vena cava and renal vein.

(d) There were some good answers to this question giving details about deamination and the production and fate of urea. Candidates were often unsure about the role of deamination, although there were plenty of good answers stating that excess amino acids are broken down to release the nitrogen-containing part of the molecule that is converted to urea. Strong responses explained that urea passes from the liver into the blood plasma so it can be excreted by the kidney. However, some candidates must have misread the question as they gave details about filtration and formation of urine in the kidney. Other candidates concentrated on other excretory functions of the liver such as breaking down lactic acid, alcohol, hormones, dead red blood cells and about the production of bile.

Candidates who wrote about bile also described its functions in digestion. Credit was given to production of bile as it contains the bile pigments which are excretory substances. Descriptions of emulsification were unnecessary and not credited.

Question 6

(a) Oestrogen and progesterone were seen very often. Common errors were to give one or both of the pituitary hormones, FSH and LH. 'Proestrogen' was seen quite often and not credited.

(b) Most candidates identified the placenta as the organ that antibodies cross to reach the fetus. The umbilical cord was also accepted. Uterus was a common incorrect answer.

(c) (i) Many candidates identified 6, lymphocytes, 56 and 3 as the answers needed to complete the passage. The most common incorrect answer was the third answer that simply required an addition. White blood cell was often seen instead of lymphocyte.

(ii) Some answers were rather vague, stating that breast milk contains antibodies that fight pathogens or fight disease. These answers were not credited. Many also stated that breast milk contains nutrients without making it clear that it contains all the nutrients that are required. To gain a mark for antibodies, candidates had to explain that these are provided at a time before the baby has made enough of its own to provide immunity to the diseases it may encounter. Many answers made it clear that the type of immunity provided by maternal antibodies is passive immunity. Another feature that was mentioned was the forging of bonds between mothers and their babies. Breast milk is not free from bacteria as stated by some candidates.

(iii) Many candidates stated that babies can gain antibodies in formula milk. Candidates should know that antibodies, being protein, will be digested in a baby's digestive system before they can be absorbed and provide passive immunity. Stronger responses described injections of antibodies which put these molecules into the blood system (artificial passive immunity). Many stated that active immunity would be provided with memory cells but did not say that this would occur following an infection. Some candidates wrote antibiotics when they clearly meant antibodies.

(d) There were many good explanations of the importance of the shape of an antibody. Candidates wrote about the antigens on the surface of pathogens and the need for antibodies to have a complementary shape to these antigens. This is so that they can bind together to form antigen-antibody complexes that lead to the destruction of pathogens, often by phagocytes. The term 'specific' was used very often in a correct context. A number of candidates confused antibody-antigen binding with substrates binding to active sites. A common error was writing about the antibodies killing the antigens.

(e) Carbon, hydrogen, and oxygen were the three elements required here. Some candidates used the chemical symbols, C, H and O, and these were credited. Candidates often added nitrogen to the list or gave nitrogen as an alternative to one of the three elements common to proteins, carbohydrates, and fats.

BIOLOGY

Paper 0970/52
Practical Test

There were too few candidates for a meaningful report to be produced.

BIOLOGY

Paper 0970/62
Alternative to Practical

Key messages

Candidates should practise identifying the independent, dependent and variables that need to be kept constant in an investigation. They should also practise reaching a conclusion from their results that refers to the aim of the investigation.

When drawing graphs, candidates should be careful to use an even scale even if the data points are not evenly spaced. Some candidates drew a non-linear scale by evenly spacing the values and ended up with a straight line.

Candidates are advised to show their working for calculations. This ensures that partial credit can be awarded even if a mistake is made during the calculation.

General comments

Many candidates demonstrated good mathematical and drawing skills. Graphs were generally drawn well.

Many candidates found the table design difficult. Candidates should practise drawing different sorts of tables, choosing the best headings for the data, and including units in the heading of the table.

Candidates should be familiar with all the food test reagents described in the syllabus. Many were unfamiliar with the method for the emulsion test.

Comments on specific questions

Question 1

(a) (i) Most candidates drew a table with at least three columns and a header line. However, many candidates did not design their table so that they could get the mark for the headings. A heading was needed for the dimples 1 to 6, and a heading was needed above the results, usually the iodine colour for test-tubes **W** and **C**. These headings were often omitted or were incorrect, such as dimples labelled as test-tubes. The data in the body of the table must match the headings. Where time was used as a heading, often the heading mark could not be awarded due to the units of 's' being included in the data cells of the table.

The results were recorded in a variety of ways. It was expected that candidates would record the colours: blue-black and yellow-brown, for each dimple. However, some recorded the results as positive or negative (for the starch test) or positive or negative for reducing sugars. If the correct pattern was given for the results in Fig. 1.2, then the mark was awarded. If the candidates added up the number of each colour and recorded these values as their result, a pattern could not be seen so they could not be awarded the final marking point.

(ii) At the start of the question, the first sentence reads 'candidates investigated the effect of temperature on the activity of amylase.' Therefore, the conclusion should relate temperature (the independent variable) to the activity of the amylase (the dependent variable). The conclusion should have been given as the greater the temperature, the greater the activity of amylase.

A significant number of candidates misinterpreted the results and thought that the amylase activity was highest at the cold temperature. Many others described the results rather than relating the results

to the aim of the investigation. Some said that starch broke down faster at higher temperatures but did not mention the enzyme.

(iii) The independent variable in the investigation was temperature. Candidates should be able to identify the independent and dependent variables in investigations. Some confused the dependent and independent variables. Others gave variables such as time, volume of amylase or volume of starch.

(iv) Candidates should be able to identify variables that are kept constant in an investigation. These should specifically relate to the investigation described. For example, time unqualified is insufficient for a mark, but time intervals of 30 seconds to collect samples is much more precise. Candidates should be encouraged to use the terms volume and concentration rather than amount. So, volume of amylase and concentration of amylase were both valid answers. Amylase / starch / iodine unqualified could not be credited. A common error was to say that the volume of water was kept constant. However, the method stated that the volume of water was approximate. The size of the test-tubes was not relevant.

(b) (i) This question required the candidates to understand the method and how the results were being obtained. The key part of the investigation is that samples were taken every 30 seconds. So, the investigation would only indicate if starch had been broken down after each 30 second interval, but not the precise time of the breakdown. Therefore, the expected answer should describe the idea that 30 seconds is a long time interval and it is impossible to know exactly when in those 30 seconds the starch was broken down. Very few candidates expressed this idea. Some described the idea that the colour change is subjective, and this was accepted.

Common errors included descriptions of human errors e.g. in using the stop-clock, not repeating the investigation, or comments on other errors such as the temperature not being controlled. Many candidates referred to problems with multitasking affecting accuracy or they misunderstood the method and stated that three minutes was not long enough for the reaction to take place.

(ii) The temperature of the water in the beakers was not controlled in any way. The method could have been improved by controlling the temperature. An answer describing how the temperature was controlled, such as use of a thermostatically controlled water-bath, was required. Very few referred to insulation, which was another alternative answer. Some described using a thermometer to measure the temperature, but not a method of controlling the temperature. A thermometer cannot control the temperature.

(iii) The test-tubes were left for three minutes so that the solutions in the test-tubes would reach the temperature of the water in the beakers. Very few candidates were able to articulate this idea. A range of answers were given including the idea that this was to allow the reaction to happen. Others said that this was to make the temperatures equal, but the temperatures of the contents of each test-tube should have been different. Many incorrectly referred to the enzyme being at its optimum or described the enzyme being adapted to the temperature rather than the starch suspension reaching the correct temperature.

Question 2

(a) Candidates were asked to plan an investigation to determine the effect of lipase concentration on the breakdown of fats in milk. They were told that fatty acids cause the pH of milk to decrease and that fats are broken down into fatty acids (and glycerol).

Overall, this question was answered very well, with many candidates achieving four or more marks, usually for identifying the variables that should be kept constant, repeats and safety. A few were able to describe using a boiled enzyme for a control. A wide range of pH indicators were suggested, the most common being universal indicator or a pH probe/meter. Many candidates referred to having the same pH but did not qualify this by stating initial. A few candidates mentioned the use of a buffer, either to measure pH or to maintain the pH (which would make the experiment invalid). Constant variables were generally described well. The most common given were the volume of milk and temperature.

A common mistake was to confuse concentration with volume. Some candidates said that different concentrations of lipase would be used, but described these as different volumes, e.g. 1 cm^3, 2 cm^3, 3 cm^3. Some candidates did not mention milk and gave a generalised plan using fat, rather than milk. Some candidates used the emulsion test as the dependent variable. However, this would not work

as the student is investigating the breakdown of fats in milk, and milk is already cloudy. Therefore, it would be difficult to see any change caused by an emulsion. Those that read the introduction carefully, would have realised that an indicator could be used to measure the pH after a set time.

(b) The emulsion test was known by some candidates. However, many knew that ethanol had to be added to the sample but did not say that water should also be added. Fewer candidates stated that the mixture should be shaken to obtain the result. Some candidates referred to adding an emulsion solution. This question asked candidates to describe the method. Candidates were not expected to give the results of the test, although a large number did.

Question 3

(a) (i) High quality drawings were seen, with clear outlines, seven bladders and a midrib drawn with a double line. Very few lost marks for shading or stippling or making their drawing too small or so large that it covered text on the page. Occasionally, only a single bladder was drawn. This was usually too small and gained no marks. The most common reason for a mark not being awarded was for errors in the outline.

(ii) Generally, this question was answered well. Line **PQ** was nearly always measured accurately. The most common error was to round to the wrong number of decimal places. Some incorrectly included units in the magnification.

(iii) Candidates were not expected to know anything about seaweed to answer this question. They simply had to look for differences between the two photographs. Various descriptions of the bladders were accepted, such as eggs, lumps, or balls. There were many valid answers. The most common answer given was that the bladder wrack has more bladders, but that they are smaller than the bladders on the egg wrack. This gained both marks.

Those that missed marks often confused the bladder wrack with the bladders. For example, they said that there were more bladder wracks, rather than more bladders. Some referred to the wracks as being wet or dry, but this cannot be seen from the photographs.

(b) (i) The method of an investigation was described. Candidates had to suggest two constant variables in the investigation. As previously mentioned, candidates should give detail to the variables described. So, time or seaweed unqualified would be insufficient, but age of seaweed and sampling times would be awarded marks. Many candidates realised this was an investigation about transpiration and gave variables that affect the rate of transpiration: temperature, humidity and windspeed.

As the students recorded the initial and final mass of the seaweed, it was not important that the initial mass was constant. Amount of bladder wrack was not accepted, but length or size of bladder wrack was accepted. The length of the string was not important.

(ii) Many candidates were able to describe what was meant by an anomalous result: a result that does not fit the pattern or trend. However, many gave answers that were too vague to gain credit. For example, a result that is different, a wrong result, an abnormal result, or an inaccurate result.

(iii) Many candidates did not take the anomalous result into consideration when describing how to calculate the mean. Many simply described adding all the results and dividing by three. Some identified the wrong anomalous result (usually result three) and so did not get the mark.

(iv) Many candidates displayed good mathematical skills although some confused significant figures with decimal places. Others divided by 76, rather than 176, so could only get the second mark if they had given their answer as 130. Some divided 76 by 176 but could get one mark if they gave their answer as 43 (two significant figures).

(c) Most candidates labelled the axes correctly giving suitable labels including units. Some omitted all the labels or gave incorrect units for time such as ‘m’ for minutes or missed out part of the label for decrease in mass.

More practise needs to be given to drawing even scales when the data is not even. The mass of the egg wrack was measured every 30 minutes for the first two hours and then every hour for a further three hours. The most common mistake was to have even spacing between the sampling times, not considering the different time intervals. 150 minutes was commonly missed out.

Almost all candidates avoided the error of plotting a bar graph instead of a line graph. Most plotted the seven points correctly. The most common plotting error was at 0,0 rather than 30,0. Most candidates joined their plots point-to-point with a ruler. A straight line of best fit was not suitable here as the pattern shows a curve. Extrapolation was not accepted.

(d) The tests for protein and vitamin C were well known. Candidates should be encouraged to learn the correct spelling of biuret reagent and DCPIP.