

BIOLOGY

Paper 0970/12
Multiple Choice (Core)

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

General comments

There was good understanding of: excretion; features of mammals; the role of antibiotics and the water cycle.

There was some uncertainty about: dichotomous keys; chemical digestion and the location of the xylem.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 3, 18 and 28**.

Comments on specific questions

Question 3

Many candidates selected an incorrect option. It is important that candidates work through each stage of the dichotomous key in order to identify a specimen.

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 7

Many candidates did not understand that diffusion involves the random movement of particles.

Question 8

Many candidates appreciated that since the plant root has a higher concentration of magnesium ions than the surrounding soil, the process moving magnesium ions into the root must be active transport.

Question 9

Many candidates understood that the outer, green region of the leaf turns blue-black. Some candidates incorrectly thought that the central white area would also turn blue-black.

Question 10

Many candidates appreciated that the rate of reaction should go on the *y*-axis and pH on the *x*-axis. Some candidates reversed the labelling of the axes.

Question 11

Many candidates correctly identified the best conditions for the digestion of starch. Some candidates incorrectly believed that boiled amylase should be used. Candidates should be aware that boiling an enzyme denatures it.

Question 13

Most candidates incorrectly selected option **B**, indicating that there are three guard cells in the diagram. There are in fact six; two guard cells around each stoma.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 16

Most candidates opted for an incorrect distractor, in particular the large intestine. Most water absorption takes place in the small intestine.

Question 17

Few candidates understood that there are xylem vessels in the roots, stem and leaves of a young plant.

Question 18

Some candidates correctly selected option **C**, appreciating that as humidity increases, the rate of transpiration decreases. Many candidates incorrectly selected option **A** as they thought that transpiration rate increases with an increase in humidity.

Question 19

This question highlights the necessity to read each question carefully. The question asked: Which part carries blood directly from the lungs? The word 'from' is key here and it gives the correct option as **D**.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 22

While many candidates selected the correct option, some candidates incorrectly believe that bronchioles come before bronchi.

Question 23

Many candidates understood that oxygen and glucose are needed to release energy in aerobic respiration. Carbon dioxide and glucose were the commonest incorrect response.

Question 24

Many candidates understood that yeast respire anaerobically to produce carbon dioxide and ethanol (biofuel). Some candidates incorrectly selected option **B**, missing the fact that yeast respiration must be anaerobic if it is to produce ethanol.

Question 25

This question was well-answered, although some candidates confused ureter with urethra.

Question 28

This was a demanding question. While some candidates understood that the rotating motion would cause the shoot to grow horizontally, many candidates incorrectly believed that the shoot would grow upwards.

Question 30

Many candidates understood that fertilisation is the fusion of nuclei to form a zygote. Some candidates incorrectly believed that fertilisation is the fusion of alleles to form a zygote.

Question 31

Many candidates appreciated that pollination occurs when pollen grains are transferred from the anther to the stigma. Some candidates incorrectly believed that pollination occurs when pollen grains are transferred from the anther to the ovary.

Question 34

This question was well-answered by many candidates, although some candidates incorrectly believed that new cells for growth are formed by meiosis.

Question 38

Few candidates appreciated that decomposition releases carbon dioxide into the atmosphere.

Question 39

Few candidates appreciated that carbon dioxide is the useful product of anaerobic respiration in the manufacture of bread.

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Paper 0970/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: excretion; DNA base sequences; asexual reproduction and natural selection.

There was some uncertainty about: the location of ciliated cells; the colour changes of hydrogencarbonate indicator; shunt vessels; negative feedback; the pupil reflex; application of genetic crosses and the meaning of diploid.

It is important for candidates to work carefully and methodically through information provided in the question, such as in **Questions 20** and **32**.

Comments on specific questions

Question 5

This proved to be a demanding question with some candidates incorrectly selecting option **D**, plant roots, confusing the cilia with root hairs, or option **A**, alimentary canal, confusing the cilia with villi or microvilli.

Question 6

While many candidates appreciated that the process of diffusion involves the random movement of particles, some candidates incorrectly believed that it is the net movement of particles up a concentration gradient.

Question 7

Many candidates correctly recognised molecule **X** as a protein. Some candidates incorrectly identified the molecule as glucose.

Question 12

Only a minority of candidates understood the colour changes of hydrogencarbonate indicator solution at different concentrations of carbon dioxide.

Question 13

Most candidates incorrectly selected option **B**, indicating that there are three guard cells in the diagram. There are in fact six; two guard cells around each stoma.

Question 14

Many candidates appreciated that most water absorption takes place in the small intestine. Some candidates incorrectly opted for the large intestine.

Question 15

While many candidates understood that the process shown in the diagram is chemical digestion, a small number incorrectly opted for chewing. This shows that some candidates are unclear of the differences between chemical and physical digestion.

Question 19

Only a small proportion of candidates appreciated that shunt vessels connect arterioles to venules.

Question 20

This proved to be a very demanding question for most candidates. When breathing in, the pressure in the lungs decreases as the volume of the thorax increases, this causes air to be forced into the lungs and hence the pressure increases. Option **B**, correctly shows these pressure changes.

Question 21

Many candidates understood that skin, mucus and stomach acid prevent pathogens from entering body tissues.

Question 22

Many candidates correctly determined that the bubble moves more quickly towards the seeds at 40 °C than at 20 °C. A similar number of candidates incorrectly believed that the bubble moves more quickly away from the seeds at 40 °C than at 20 °C.

Question 26

Many candidates were unable to recognise that the synthesis of glycogen in response to an increase in blood glucose concentration is part of a negative feedback process.

Question 27

Many candidates understood the changes that occur during the pupil reflex. Some candidates were uncertain whether the circular and radial muscles should be relaxing or contracting to decrease the size of the pupil.

Question 31

Only a small proportion of candidates appreciated that a diploid human cell has 22 pairs of chromosomes and two sex chromosomes.

Question 32

Although it appears that most candidates understood how to complete the genetic cross, some opted incorrectly because they did not consider the probability of only males having haemophilia.

Question 37

Many candidates understood that a characteristic of bacteria that makes them useful in genetic engineering is that plasmids can be transferred between cells. Some candidates incorrectly selected option **B**, their nucleus contains DNA. Bacteria do not have nuclei.

Question 38

While many candidates understood that carbon dioxide is the useful product of anaerobic respiration in bread-making, some incorrectly opted for ethanol.

Question 40

This question was generally well-answered. Some candidates did not appreciate that an increase in decomposition has to precede a reduction in dissolved oxygen.

BIOLOGY

Paper 0970/32
Theory (Core)

Key messages

Candidates should ensure that they read each question carefully and answer the question being asked. Candidates sometimes see one or two key 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

There was evidence that candidates had used past papers when preparing for the exam. This is useful as some candidates have a good knowledge of biology but are unsure how to express themselves clearly.

Comments on specific questions

Question 1

- (a) (i) Many candidates were awarded full marks. Some candidates were confused about structures **A** and **B**, often reversing their functions.
- (ii) Very few candidates were able to correctly indicate the position of the blind spot. The fovea was often incorrectly indicated.
- (b) This question was generally well-answered, with most candidates linking the size of the pupil to the amount of light. Some candidates used the word dilate but were unsure if this meant getting larger or smaller.
- (c) Candidates sometimes gave the response rather than the stimulus itself. Heat and cold are the same stimulus as temperature.

Question 2

- (a) (i) and (ii) The majority of candidates correctly identified the camel, sheep and cat.
- (iii) Most candidates correctly identified the buffalo. The most common incorrect answers were goat, elephant and chicken.
- (b) Most candidates scored one mark for correctly identifying that the breathing rate increases. Very few candidates were awarded the second mark for stating that the depth of breathing also increases. Some incorrectly referred to this as breathing heavily or harder. Many candidates incorrectly talked about the effect of exercise on heart rate.
- (c) (i) Few candidates were awarded full marks for this question. In questions requiring a comparison, candidates should always ensure that they give comparative statements, such as; inspired air

contains more oxygen than expired air. Many candidates stated the exhaled air contained no oxygen, rather than less oxygen. Very few discussed the water content.

- (ii) Some candidates were unfamiliar with a chemical test for carbon dioxide. Limewater was the best known although any suitable indicator was accepted.
- (d) The most common correct answer was trachea. Intercostal muscle was the answer least likely to be correct and was most frequently mistaken for the ribs. The alveoli were occasionally confused with the bronchioles.

Question 3

- (a) (i) Candidates found this to be a demanding question as they had to distinguish between the terms dominant and recessive, and phenotype and genotype.
- (ii) Most candidates were able to complete the genetic diagram correctly and give the correct ratio.
- (b) (i) Most candidates successfully interpreted the pedigree diagram.
- (ii) Many identified a heterozygous individual, but some did not recognise that **U** and **V** could have been heterozygous or homozygous.
- (iii) This question was not well answered as candidates did not use the information given at the start of the question. 50% was a common incorrect answer.

Question 4

- (a) This was generally well-known though answers were often vague and could not receive full credit. A diet containing all the nutrients was the most common correct answer. The idea of the correct proportions was infrequently given, or incorrectly stated as equal proportions. Very few answers referred to the energy content of the food.
- (b) The most common combination was milk, rice, tuna fish and grapefruit. Water was often stated as the main source of calcium and olive oil was often written as the main source of carbohydrate or protein.
- (c) This was well-known with many correct answers, although the spelling of fibre varied. Some correctly stated roughage or water. Common errors were vitamins and carbohydrates.
- (d) Many candidates gave a correct response of obesity. Many also related the fat to the heart and various heart conditions. Some answers just referred to heart disease without stating coronary or the consequences of a heart problem e.g. heart attack. A few candidates interpreted the 'too much energy' aspect of the question as people being malnourished, fatigued and not having enough energy to function. Candidates interpreted this aspect as people using too much energy rather than consuming too many calories.
- (e) Many candidates who knew the answer were not awarded the mark because of the way in which they expressed themselves. Most answers referred to food or nutrients for the baby. Most answers referred to a baby rather than the correct term of fetus. Answers such as the mother eats for two or the baby eats the mother's food were too vague to be credited.
- (f) The most common characteristics were respiration, reproduction and growth.

Question 5

- (a) Very few candidates were awarded full marks. Evaporation and stomata were the most frequently given correct responses. Very few candidates knew water diffuses through the stoma or stomata.
- (b) Most candidates gained one mark for either identifying species **B** losing more water than species **A** or for a data comparison. Many candidates went on to score two marks by explaining that both species lost more water in hot temperatures. Some candidates were confused by the experiment and stated that the plants were given hot or cold water. Candidates did not always make their statements comparative.

- (c) This question proved to be demanding for candidates. The most frequent incorrect response was to plot the bar at 6.8 cm^3 rather than less than 4.8 cm^3 .
- (d) Most candidates correctly named the xylem.

Question 6

- (a) A few answers gave a range or referred to a 28 day cycle. This shows that candidates did not recognise the importance of the question stating 'use Fig. 6.1'.
- (b) Candidates had a good understanding of the changes that occur during puberty. Some candidates did not state that girls would have pubic hair.
- (c) Many correctly named oestrogen. Errors included naming testosterone or progesterone or an amalgamation of oestrogen and testosterone e.g. oestrosterone.
- (d) Many candidates stated testosterone, showing candidates were either still thinking of the previous question or just focused on the word hormone in the question.

Question 7

- (a) (i) The majority of candidates were awarded this mark with most of the correct answers being within a 6.0 cm^3 to 6.9 cm^3 range.
- (ii) Many candidates correctly selected 4.4 cm^3 and 5.4 cm^3 but then did not know how to calculate the percentage increase. There were a significant number that incorrectly included 5.0 cm^3 in their selection of values.
- (b) Human involvement was generally correctly selected but '...over many generations.' was less well-known. '...caused by the environment.' was a popular incorrect answer.
- (c) The most common error was to answer 2 and 5, rather than 1 and 5. There were a significant number that answered 3 and 4 as they had missed the need to select incorrect statements.
- (d) Adaptive feature was not well-known. The most common incorrect answers included inheritance, natural selection, genetic engineering, gene and DNA.

Question 8

- (a) Most candidates correctly stated species and time. A few of the answers stated area or place, many answers stating environment or habitat instead of area.
- (b) (i) Most candidates stated 88 with a few 89 and 90 answers. Some candidates incorrectly stated 88 000, 000 as they missed the million stated on the answer line. Few candidates showed their calculations.
- (ii) This question was very well-answered with most correctly stating 1970.
- (c) Most correct answers referred to an increase in birth rate, although this was answered in different ways, including no use of contraception, polygamy and teenage pregnancies. These were often given as separate answers but candidates should appreciate that they would be the same mark point. Many answers referred to migration without making it clear that it is into a country/area. Some answers were incomplete, for example, birth rate stated but no reference to an increase.
- (d) Many candidates missed the fact that the question asked about the impact of increasing human population on the environment, with many just focussing on the effects of an increasing human population. Most candidates stated pollution followed by lack of resources and deforestation. Some answers focused on the increase in humans in terms of their lifestyle, for example, fewer jobs available, and did not refer to the effect on the environment.

BIOLOGY

Paper 0970/42
Theory (Extended)

Key messages

Candidates should always look carefully at the command word in each question, and should understand the different requirements for each command word. In particular, some candidates did not understand the difference between 'describe' and 'explain'.

Data quotes to support observations should be given as a value with a unit. When data quotes are used to support a descriptive comment about a difference, they should be comparative.

Candidates must use the correct scientific terminology when describing or explaining phenomena. Careful use of key terminology is required, especially where there may be confusion with similar words. Examples on this paper were lipase and ligase, ovum and ovule, mitosis and meiosis and nitrification and nitrogen fixation. Care should be taken when writing about genes and alleles. Many candidates stated in **Question 2** that the plants inherited 'different genes' when what they meant was 'different alleles'. All organisms of the same species have the same genes.

General comments

There were some excellent answers to the questions on this paper. Particularly good were the responses to **Question 1(b)(i)** on active transport, **Question 4(b)** on synaptic transmission and **Question 2(b)(i)** that required candidates to work out the genotypes of a cross involving codominance.

Candidates did not often check their answers. In **Question 1(b)(i)** some candidates wrote that diffusion is the 'movement from a higher concentration to a higher concentration'. In some cases, candidates described the direction correctly, then stated that active transport occurs down a concentration gradient or described the same directional movement in diffusion.

Some candidates did not take care when transcribing information from the paper. In **Question 1(f)(i)** some candidates wrote about proteins and not pectins. There were also a number of candidates that recognised that the fungal extract contained amylase but also stated that it contained pectin rather than pectinase.

Candidate should take care over their choice of words. Produce is a word that is often misused. Throughout **Questions 3(b)** and **(d)** candidates wrote about the production of follicles and eggs during the menstrual cycle rather than their development or maturation.

Comments on specific questions

Question 1

- (a) Many candidates gave the duodenum as the other region of the small intestine. A few candidates did not read the question carefully enough and gave the ileum. Colon, stomach, lacteal, capillaries and goblet cells were some of the incorrect answers seen.
- (b)(i) There were many good answers to this question on active transport that referred to the energy required, often stating that it was provided by respiration. Some answers stated that active transport occurs through proteins in membranes; rarely did candidates add that diffusion does not require the presence of a membrane.

- (ii) Most candidates stated that microvilli increase the surface area or microvilli provide a large surface area. Stronger responses stated that this increases the rate at which nutrients can be absorbed by diffusion across the cell membrane. Many stated incorrectly that microvilli protect the epithelial cells or that they are a barrier to harmful substances. Some said that the increased surface area is for more absorption rather than for faster absorption.
- (c) (i) Many candidates correctly gave mucus as the protective substance produced by goblet cells.
- (ii) Most candidates gave one reason why a protective substance is needed in the intestines. Some correctly described the effect of stomach acid and others the protection against the damage enzymes might do to the intestinal epithelium. Some answered in terms of the gas exchange system rather than the digestive system. Lubrication and the easy movement of food through the intestines were seen quite often and did not gain credit. However, candidates who stated that the mucus provides protection against the physical damage or friction of food on the walls of the intestine did gain a mark.
- (d) Few candidates knew the functions of lacteals. Common incorrect answers were to absorb all nutrients and to increase the surface area for absorption. Few candidates gave the absorption of fat (or fatty acids and glycerol) and the transport of fat into the lymphatic system. Quite a few thought that the lacteals provide support to the villi or stored the digested food. A significant number thought that lacteals are involved in the digestion of lactose.
- (e) Few candidates gained all four marks for completing Table 1.1 correctly. Common errors were to identify endoplasmic reticulum as a cell or a tissue; intestinal epithelium as a cell and the ileum as a tissue.
- (f) (i) Some candidates gave excellent answers to this question, giving at least three conclusions with supporting evidence. However, some candidates did not read the information carefully and simply described what could be seen in the diagrams with no attempt at interpretation. Some candidates thought that the fungal extract was the source of the starch and the pectin. Some described pectin and starch as enzymes rather than substrates. Very few candidates referred to the enzymes diffusing through the agar.
- (ii) The question asked for a prediction about the results. Most gave explanations in terms of enzymes working slowly, or not at all, at 5 °C or the enzymes being denatured at that temperature. The expected prediction was smaller or no clear zones.

Question 2

- (a) (i) Many candidates gave the definition of the term chromosome that is given in the syllabus. The vast majority of candidates knew that chromosomes were made of DNA.
- (ii) Many answers stated correctly that the bag over the flowers prevents pollen from other flowers landing on the stigma. This idea was expressed in a variety of ways, often including references to pollinators. There were many incorrect answers that suggested the bag would prevent the loss of pollen and even pollen falling out from the anthers, even though the anthers had been removed. A number of candidates referred to the use of the bag in terms of transpiration or controlling conditions, such as humidity, in order to facilitate pollination or germination of pollen.
- (iii) Most candidates were very unsure about the cause of the variation in the offspring. The strongest responses explained that variation is caused by meiosis in gamete production and in the random fertilisation of gametes with different genotypes. Many thought that variation was introduced by meiosis or mitosis occurring after fertilisation and the formation of a zygote. Some candidates referred to cross-pollination as being sexual and self-pollination as being asexual. Many candidates stated that variation was a result of mixing characteristics from both parents or the inheritance of different genes rather than different alleles.
- (iv) A large proportion of candidates used the terms haploid and diploid in the correct context. Gametes are the products of meiosis, they do not divide by meiosis. Almost all candidates assumed that the species in the question, in fact all species, have a diploid number of 46. If candidates are going to do this, they need to preface their answer by stating that this is the case in humans.

- (b) (i) Successful candidates gave the genotypes as $P^R P^R$, $P^R P^W$ and $P^W P^W$. Some candidates incorrectly gave P^R for $P^R P^R$ and P^W for $P^W P^W$ and P^{RW} for $P^R P^W$. Many candidates wrote out the phenotypes instead of the genotypes.
- (ii) Many identified the type of inheritance as codominance. Common alternatives that were not accepted included genetic, heterozygous and monohybrid.

Question 3

- (a) (i) Most candidates correctly named the ovary as the target organ for FSH. Common errors were uterus, follicle and ovule.
- (ii) Many stated correctly that FSH reaches its target organ in the blood. Some gave diffusion which was not accepted. Others stated that FSH is secreted by the pituitary gland, but not how it reaches the ovary.
- (iii) There were several ways of approaching this question about the relationship between FSH and LH during the menstrual cycle. Many correctly stated that the concentrations of the two hormones follow a similar pattern, increasing to a peak at day 14 and then decreasing. Others stated that the pattern was the same, but described the differences between the relative concentrations at the beginning of the cycle, at the peak and after the peak. Few quoted data to illustrate their description, but when they did, they often omitted the units, arbitrary units or a.u.. Many misread the scale on the horizontal axis of Fig. 3.1, identifying the day of the highest concentrations of FSH and LH as day 13 not day 14. Vague references to time such as 'in the beginning' and 'later' were insufficient to allow credit to be awarded.
- (b) Many candidates were unsure about the roles of FSH and LH in the menstrual cycle using terms like ovary, follicle, egg, corpus luteum, oestrogen and progesterone indiscriminately. Many who knew that the hormones act on the ovary, rather than the uterus, stated that FSH stimulates the production of eggs rather than their development or maturation. Candidates should know that potential eggs are produced by mitosis before birth and only begin to develop after puberty. Many stated that LH stimulates ovulation and many thought that FSH and LH have a direct role on the changes that occur to the uterus lining.
- (c) Descriptions of the changes that occur to the lining of the uterus during one menstrual cycle generally lacked detail. Strong responses began by stating that thinning of the lining occurs over the first five days of the cycle and that this is followed by regrowth over the next seven days. Many also stated incorrectly that the thinning of the uterus begins immediately after ovulation. Many candidates misinterpreted the question and wrote about what happens to the uterus and ovary if the egg is fertilised. Others wrote about the roles of oestrogen and progesterone in controlling the thickness of the uterine lining.
- (d) Strong responses described the role of progesterone in contraceptive pills in preventing the release of FSH so that eggs do not develop within follicles. Many correctly stated that ovulation does not occur, although some thought that ovulation is delayed rather than inhibited. Some thought that the pills contain FSH and LH, which would have the opposite effect of that intended. Many thought that the contraceptive pill kills sperm or a developing fetus.

Question 4

- (a) The parts of the reflex arc shown in Fig. 4.1 were named and identified correctly by many. Common errors were to confuse the three neurones and state that the receptor and effector conduct impulses.
- (b) There were some excellent accounts of impulse transmission across synapses, with many using the appropriate terminology for synaptic transmission. Weaker responses did not make it clear how neurotransmitters are released from the pre-synaptic neurone and did not state clearly that they diffuse across the synaptic cleft.
- (c) Almost all candidates named a suitable reflex that occurs in the eye or gave a description. The most common answer was the pupil reflex. Fewer candidates stated accommodation as a reflex and even fewer attempted to describe it.

Question 5

- (a) There were many good ideas given in answer to this question. The most common factors that affect the volume of urine produced in the human body included the volume of fluid ingested, the temperature, exercise, sweating and the concentration of solutes in the blood. Some candidates also identified drugs that influence urine production and some gave medical conditions, such as diabetes.
- (b) There were many very confused accounts of the relevant part of the nitrogen cycle. Candidates often knew something about the roles of bacteria in decomposition and nitrification, but the sequence of events was rarely described correctly. Many candidates incorrectly referred to nitrogen throughout their answer, for example nitrogen is denitrified to nitrate. Many candidates referred to nitrification, then described the process of nitrogen fixation, which was not relevant in this question. Strong responses started with protein in the animal waste and described its break down to amino acids. Ammonification, where amino acids are broken down to release ammonia or ammonium ions, was often missing from even the strongest responses. Many candidates gained marks by describing nitrification and the change from ammonia to nitrite and then to nitrate. Almost all candidates who attempted this question stated that plants absorb nitrate ions.
- (c) Candidates recognised that this was a question about eutrophication and many wrote a good account of the sequence of events following the pollution of a water course. Some began with organic waste and others with fertilisers, but both groups described the growth of algae and plants, competition for light, death and decomposition of producers, population increase in decomposers and reduction in oxygen concentration of the water leading to suffocation of fish and/or death of other aquatic animals. Some candidates misread the question and wrote about plastic pollution. Some thought that the biodiversity would be reduced because the livestock would drink the water, get sick and die. Some wrote about the effect of the pollution on the human population living near a water supply and stated that their deaths would reduce biodiversity. There was some confusion over the reason for the decrease in the oxygen concentration of water. Some thought that the lack of plants is the cause of the lack of oxygen and others that algal blooms prevent oxygen getting into the water.

Question 6

- (a) (i) Most candidates gained full marks by defining the term catalyst successfully. Many defined the term enzyme instead but these answers often gained full marks. A common error was to state that the catalyst does not take part in the reaction, instead of stating that it remains unchanged or is not used up in the reaction.
- (b) (i) Almost all correctly stated substrate **T**, although a few chose **Q**, **U** or **R**.
- (ii) Explanations for choosing substrate **T** were variable. The strongest responses explained that **T** was the only substrate that could fit into (or bind with) enzyme 1 because its shape was complementary to the shape of the enzyme's active site. Some candidates wrote about the lock and key mechanism without clearly stating these two points in their answers. Many could not be awarded the mark because they stated that the enzyme and substrate were complementary, rather than the enzyme's active site and the substrate.
- (c) Many candidates gained full credit for completing Table 6.1. Common errors included sucrose, fructose and simple sugars in row one, fatty acids and glycogen in row three, lipase in row five and omitting to name ligase in the penultimate row. Many did not make it clear in the last row that restriction enzymes cut DNA. Some candidates thought that restriction enzymes stick ends of DNA together.

BIOLOGY

<p>Paper 0970/52 Practical Test</p>

Key messages

Candidates must ensure that they read questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed. Variables that will be kept constant must also be considered and included in a plan.

Candidates should match the answers they give with the number of marks available for each part of a question. A three-mark question will require three separate marking points if full credit is to be awarded.

General comments

Most candidates performed very well on the planning exercise, producing a logical investigation. Identification of variables, safety and a workable method are key aspects of this task and were all covered in suitable detail by most candidates.

The data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included.

Comments on specific questions

Question 1

- (a) (i) Most candidates were able to construct a table that was suitable for the data collected. Generally, the table headings and table structure were good, although some candidates put units in the body of the table. The results collected indicated that the practical procedure was carried out with a good degree of confidence and ability.
- (ii) This question asked for a conclusion based on the results of the investigation recorded in 1(a)(i). Although this was done well by most candidates, a significant number simply described the results of the investigation rather than giving a conclusion. Answers that simply stated that one balloon had a larger diameter than the other could not be credited.
- (iii) Candidates were asked why the yeast suspension was stirred before using it. Many candidates did not give sufficient detail when answering the question. The idea of an even distribution of the yeast cells between the two test-tubes was well communicated by a few candidates.
- (iv) Most candidates were able to identify at least one variable that was kept constant during the investigation, but a lack of detail in the answers often prevented a second mark being awarded. Simply referring to temperature being kept constant was insufficient, as temperature was the independent variable. Instead, candidates needed to refer to the maintenance of temperature in each individual water-bath.
- (b) (i) Many candidates were able to suggest a piece of apparatus suitable for collecting and measuring the volume of gas produced. Those who did not choose a gas syringe often found it difficult to describe the collection of gas by a displacement method.
- (ii) Most candidates were able to identify a correct indicator for carbon dioxide and give the correct result of a positive test.

- (c) (i) Most candidates were able to record the temperatures of the two water-baths, but a small number then went on to incorrectly calculate the change in temperature.
- (ii) In this question candidates were asked how the temperature of the water-baths could be maintained. Although some good answers were seen, with insulation being the most common, many candidates gave insufficient detail of monitoring the temperature as the water-baths were heated.

Question 2

- (a) (i) The quality of the drawing was generally very high. Lines were clear and distinct and the drawings were of a suitable size. Some candidates drew sketchy lines and included shading. A few candidates did not draw all of the visible structures and so could not be awarded the marks for detail.
- (ii) The measurement of the image was done well, but care needs to be taken not to confuse mm with cm. Nearly all candidates went on to correctly divide by the magnification, but the most common error was not giving an answer to two decimal places. Candidates must ensure that they read the question fully and understand the difference between significant figures and decimal places.
- (b) (i) The percentage decrease in the average distance travelled was generally done well with nearly all candidates able to select the correct values from the table. Fewer were able to manipulate the values correctly and some candidates appeared to miss the fact that the answer needed to be expressed to two significant figures. An understanding of how to calculate a percentage change is an important skill for all candidates.
- (ii) Most candidates scored very well on this question. It is important that a suitable scale is chosen. A scale that allows easy plotting of all points helps prevent candidates from making errors when determining where plotted points should be placed. A few candidates chose to plot the dependent variable on the x -axis, which made plotting of the points quite challenging.
- (iii) In this question, candidates were asked to determine a distance using the line drawn on their graph in **2(b)(ii)**. Many were able to do this with a good level of precision, but a significant number chose the wrong line or did not show on their graph how they had obtained their estimate.
- (iv) Most candidates were able to state the positive test for proteins. A very small number incorrectly stated Benedict's solution.
- (c) (i) The planning exercise was generally done well. The use of potometers was rarely seen, as was suspending leaves and measuring their change in mass over a period of time. Many candidates gained marks for identifying the variables, but far fewer gained marks for the actual method.
- (ii) Although some very good descriptions were seen, many candidates could not suggest how the humidity of the air surrounding a sample of leaves could have been changed. A bowl of hot water will increase the humidity whereas a dehumidifier will reduce the humidity.

BIOLOGY

Paper 0970/62
Alternative to Practical

Key messages

Candidates must ensure that they read questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed. Variables that will be kept constant must also be considered and included in a plan. When describing repeats, it is important that two repeats are specified. This means that three sets of data are collected so that any anomalous results can be identified and discarded.

Candidates should match the answers they give with the number of marks available for each part of a question. A three-mark question will require three separate marking points if full credit is to be awarded.

It should be noted that an electronic balance is a piece of apparatus used to find the mass of an object. A small number of candidates use the word 'balance' incorrectly: i.e. 'balance the leaves before and after the investigation' when they mean 'find the mass of the leaves before and after the investigation'.

General comments

The data table and the graph were drawn well by most candidates. The drawing skills of most candidates was seen to be good, with suitable detail included.

Comments on specific questions

Question 1

(a) (i) Candidates were asked to construct a table and to record the results of the investigation. The table needed to contain time, the circumference of the balloon and the condition in which the suspension had been kept (hot or cold). Many candidates found this demanding as they seemed unfamiliar with the concept of sub-headings. Most candidates gained the mark for table construction and the majority of tables were neatly drawn with ruled lines and were easy to interpret.

The second marking point was awarded for table headings with appropriate units. Many candidates were not awarded this mark as they either omitted a heading, left out the units or put the units in the body of the table. It should be noted that there is no abbreviation for minutes and while we frequently accept 'min', 'm' cannot be accepted as it is the abbreviation for metre.

The final mark was for correctly recording the results. There were very few instances where a mistake was made. The most common error was for candidates to transpose the results for hot and cold.

(ii) This question asked for a conclusion based on the results of the investigation recorded in 1(a)(i). Although this was done well by most candidates, a significant number simply described the results of the investigation rather than giving a conclusion. Responses that simply stated that one balloon had a larger diameter than the other could not be credited.

(iii) Candidates were asked why the yeast suspension was stirred before using it. Many candidates did not give sufficient detail when answering the question. The idea of an even distribution of the yeast cells between the two test-tubes was well communicated by a few candidates. It was clear that many candidates did not understand the term suspension.

- (iv) Most candidates were able to identify at least one variable that was kept constant during the investigation, but a lack of detail in the responses often prevented a second mark being awarded. Simply referring to temperature being kept constant was insufficient, as temperature was the independent variable. Instead, candidates needed to refer to the maintenance of temperature in each individual water-bath.
- (b) (i) In this question, candidates were asked to suggest another method of collecting and measuring the gas produced in the investigation. The most commonly given answer was to use a gas syringe. Another acceptable method, though infrequently stated, was to collect the gas using a displacement method. A significant number of candidates suggested counting the number of bubbles produced. This was not acceptable as the gas would not be collected.
- (ii) Most candidates were able to identify a correct indicator for carbon dioxide and give the correct result of a positive test. The test using limewater was well-known as was its positive result. The use of hydrogencarbonate indicator and its resultant yellow colour was less well-known. Many candidates used a pH indicator (e.g. universal indicator) and were awarded a mark for the correct colour change but not for the name of the indicator as it is not specific to carbon dioxide.
- (c) (i) In this question, candidates had to read and record the temperatures shown on two thermometer diagrams and calculate the changes in temperature over the duration of the investigation. This was answered correctly by nearly all candidates.
- (ii) Candidates were asked to suggest a modification to the investigative method that would prevent the temperature of the water-bath changing. The simplest answer was to use thermostatically controlled water-baths, and many candidates answered in this way. Using lagging, insulation or adding lids to the water-baths were also acceptable modifications. Some candidates said that they would heat the water (with a Bunsen burner or by adding hotter water etc.). This was not acceptable on its own, but was accepted if the idea was qualified by using a thermometer to check the temperature was not changing.

Question 2

- (a) (i) The quality of the drawing was generally very high. Lines were clear and distinct and the drawings were of a suitable size. Some candidates drew sketchy lines and included shading. A few candidates did not draw all of the visible structures and so could not be awarded the marks for detail. Candidates should draw in pencil rather than ink as ink cannot be erased if a mistake is made.
- (ii) The measurement of the image was done well, but care needs to be taken not to confuse mm with cm. A significant number of candidates measured the pollen grain length (62 mm) but wrote the length as either 6.2 mm or 0.062 mm. Nearly all candidates went on to correctly divide by the magnification. The most common error was not giving an answer to two decimal places. Candidates must ensure that they read the question fully and understand the difference between significant figures and decimal places.
- (b) (i) The percentage decrease in the average distance travelled was generally done well, with nearly all candidates able to select the correct values from the table. Fewer were able to manipulate the values correctly and some candidates appeared to miss the fact that the answer needed to be expressed to two significant figures. An understanding of how to calculate a percentage change is an important skill for all candidates. As in **2(a)(ii)**, candidates should show their working as partial credit can often be given even if the final answer is incorrect.
- (ii) Using both sets of data, candidates were instructed to draw a line graph and to provide a key. The majority of candidates labelled the axes correctly, had even scales and plotted data on more than half the grid. The plotting posed a problem for some as, in order to distinguish between the two lines, different symbols were used for the plot points. Where a large circular dot had been selected, this was frequently so large that it became inaccurate in terms of plotting. Most candidates drew the two lines as dot-to-dot which was appropriate. There were few instances of extrapolation. A few candidates drew bar charts rather than a line graph as instructed.
- (iii) In this question, candidates were asked to determine a distance using the line drawn on their graph in **2(b)(ii)**. Many were able to do this with a good level of precision, but a significant number chose the wrong line or did not show on their graph how they had obtained their estimate.

- (iv) The Benedict's test for the presence of reducing sugars was well-known. The need to heat the mixture was the most frequently omitted point.
- (c) (i) The planning exercise proved demanding for some candidates. The use of potometers was rarely seen, as was suspending leaves and measuring their change in mass over a period of time. Many candidates gained marks for identifying the variables, but far fewer gained marks for the actual method. Having stated that the investigation would be carried out at different temperatures, many candidates were unable to describe how these different conditions could be achieved. Some candidates did not attempt to plan an investigation, but listed generic points applicable to any investigation.
- (ii) Although some very good descriptions were seen, many candidates could not suggest how the humidity of the air surrounding a sample of leaves could have been changed. A bowl of hot water will increase the humidity whereas a dehumidifier will reduce the humidity.