BIOLOGY

Paper 0970/12
Multiple Choice (Core)

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

General comments

There was good understanding of: the characteristics of living things; the type of organisms that cause tooth decay; what a transmissible disease is, and the effects of deforestation.

There was some uncertainty about: the functions of phloem; the stages of human nutrition; where urea is produced in the body; the structure that receives the pollen nucleus during fertilisation; what are barrier methods of birth control, and the features of mitosis.

It is important for candidates to work methodically through information provided in questions, such as **Questions 8**, **10**, **12**, **22**, **37** and **40**.

Comments on specific questions

Question 6

Many candidates understood the correct method for working out the actual diameter of the cell. Candidates would benefit from being able to recall and apply the formula for calculating magnification.

Question 7

Most candidates knew that diffusion is involved and that a partially permeable membrane is required for osmosis to occur. Some candidates incorrectly thought that cell walls were required for osmosis to occur.

Question 8

This proved to be a very demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise.

Question 10

This proved to be a very demanding question. To select the correct option, candidates were required to work through the information on the graph and determine which statement was correct. A methodical approach allowed successful candidates to select option **D**.

Question 12

There was some uncertainty as to whether the answer was photosynthesis or respiration. Photosynthesis in the spiral-shaped chloroplasts releases oxygen and that oxygen attracts the bacteria.

Question 13

Many candidates appreciated that nitrates are required to make amino acids which can then be used to make proteins. Starch was a common incorrect response.

Question 14

Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell. The most common incorrect answer was **A**, absorption.

Question 15

This was a demanding question with successful candidates being able to identify absorption and digestion as the two processes represented by the experiment.

Question 17

Whilst most candidates understood that water first enters root hair cells, many candidates were uncertain whether water then progresses to the xylem or to the mesophyll. The correct route was root hair to xylem to mesophyll.

Question 18

Most candidates incorrectly believed that a function of phloem is to transport minerals to the roots.

Question 22

Many candidates correctly identified where the carbon dioxide concentration was the highest.

Question 24

Many candidates incorrectly thought that the amount of urea in the blood increases as it passes through the kidneys. The liver is responsible for producing urea from excess amino acids whereas the kidneys are responsible for removing urea from the blood.

Question 25

There was some uncertainty in the location of relay neurones. Few candidates could recall that relay neurones are located in the spinal cord.

Question 27

Many candidates successfully selected option **D**. Candidates were uncertain as to the effect of adrenaline on the size of the pupils and therefore option **C** was frequently selected. Adrenaline increases the size of the pupils.

Question 29

There was uncertainty by many candidates about the part of the flower that receives the pollen nucleus during fertilisation. The pollen nucleus is received by the ovule.

Question 31

Many candidates were unaware that the diaphragm is a barrier method of birth control.

Question 32

Many candidates were not aware of the features of mitosis. Perhaps some candidates confused mitosis with meiosis.

Question 36

Interpreting the food web proved to be demanding for some candidates. Successful candidates appreciated that organism L was a decomposer.

Question 37

To be successful, candidates needed to work through the diagram methodically, applying their knowledge of the carbon cycle to the diagram. Plants give out carbon dioxide during respiration and animals ingest plants when feeding.

BIOLOGY

Paper 0970/22
Multiple Choice (Extended)

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

General comments

There was good understanding of: the function of valves in the circulatory system; the product of anaerobic respiration in muscles; how the concentrations of glucose and urea in urine compare to their concentrations in blood plasma and the fact that a person's blood group is not affected by the environment.

There was some uncertainty about: which component of the blood produces antibodies; the distinction between active and passive immunity; the fact that the hormone progesterone is used in contraceptive pills, and the role of nitrifying bacteria.

It is important for candidates to work methodically through information provided, such as in **Questions 4**, **6**, **9**, **20**, **32**, **33** and **37**.

Comments on specific questions

Question 2

There was some uncertainty as to whether dicotyledons have broad leaves and parallel veins. Dicotyledons have broad leaves and branched veins, not parallel.

Question 4

Candidates would benefit from being able to recall and apply the formula for calculating magnification. Candidates need to work carefully when converting units.

Question 6

This proved to be a demanding question. Osmosis would cause water to pass through the partially permeable membrane of both pieces of apparatus and so the liquid level in both tubes would rise. Some candidates incorrectly believed that the liquid level in tube 1 would fall.

Question 10

Many candidates correctly selected option **D**, the substrate is less likely to fit into the active site. A number incorrectly believed that the heat had killed the enzyme. Enzymes are not living things and therefore cannot be killed. Heat can denature enzymes but it cannot kill them.

Question 13

This proved to be a demanding question. Many candidates did not know that assimilation is the stage of nutrition taking place when food molecules become part of a body cell.

Question 16

There was some uncertainty about the function of the phloem, with some candidates incorrectly believing that it transports starch to the roots. Starch is insoluble and therefore is not transported.

Question 18

Many candidates were uncertain about which component of the blood produces antibodies. Most candidates incorrectly selected option **A**, the phagocyte. Successful candidates selected option **B**, the lymphocyte.

Question 19

The distinction between active and passive immunity was not well understood. Candidates would benefit from having a clear understanding of the two terms.

Question 23

Most candidates correctly identified the spinal cord as containing relay neurones, some candidates incorrectly opted for the synapse.

Question 28

There was uncertainty about which hormone is used in contraceptive pills. Candidates would benefit from being able to recall the roles of the hormones named in the syllabus.

Question 29

Many candidates appreciated that oestrogen causes the lining of the uterus to become thick and glandular before ovulation. Some candidates incorrectly opted for progesterone. Progesterone helps to maintain the lining of the uterus in preparation for implantation.

Question 30

Many candidates correctly identified the diagram that represents nuclear division of skin cells for growth and repair. Some candidates incorrectly selected option **A**, which shows a diploid cell dividing to produce haploid cells. Candidates would benefit from having a clear understanding of mitosis and meiosis.

Question 32

Many candidates appreciated that the expected result of the test cross, if the black guinea pig was heterozygous, would be 50% black and 50% white. Some candidates incorrectly believed that the expected result would be 100% black. Maybe they did not recall that in a test cross, one parent is always homozygous recessive.

Question 36

There was some uncertainty about the role of nitrifying bacteria. Nitrifying bacteria convert ammonia to nitrates.

Question 40

There was some uncertainty about the possible effect of female hormones as a pollutant of water courses. Some candidates incorrectly believed that the hormones decreased the amount of oxygen for fish.

BIOLOGY

Paper 0970/32
Theory (Core)

Key messages

Candidates would benefit from reading the questions carefully, as they often contain specific information that must be used in the answer. In addition, the question may give instructions, such as 'state **two**' or draw **three** lines', and these instructions must be followed if full marks are to be awarded.

The number of marks available often indicates the number of separate points that a candidate needs to make if they are to be awarded full marks.

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.

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 data should be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description. Candidates should be encouraged to practise the difference between 'explain' and 'describe'.

Comments on specific questions

Question 1

(a) Many candidates were awarded maximum marks with reproduction and respiration being the commonest answers. Some candidates did not carefully read the question and included movement and/or nutrition in their list. Another common error was to refer to breathing instead of respiration.

(b) Some candidates incorrectly named the group as gorilla or vertebrate, rather than the scientific group, mammals. A few candidates stated external ears as a correct feature but many named features that were not visible, such as warm blooded, give birth to live young and produce milk. Some candidates had used the figure to see a visible feature and stated that they walked on all four limbs but did not appreciate that this is not a characteristic feature of the group.

(c) Most candidates could state at least one other group of vertebrates with reptiles being the most frequently seen. Some candidates stated invertebrates, such as arthropods and crustaceans. Some candidates did not read the question properly and stated mammals.

Question 2

(a) The majority of the candidates were able to correctly label the structures. Some candidates confused the nucleus and the vacuole. Candidates should be reminded that label lines should finish exactly on the structure being labelled.

(b) (i) Most candidates were able to identify one way in which the cell had changed. Candidates would benefit from using precise explanations, such as the cytoplasm increasing in volume rather than size.

(ii) The majority of candidates clearly explained that water had entered the cell by osmosis. Few referred to the partially permeable membrane or were able to explain why osmosis had occurred in terms of concentrations inside and outside the cell.

Question 3

(a) There was some uncertainty in linking the components of the diet with their functions. A common error was to link vitamin D with insulation or growth of muscles. The function of calcium ions was the most well-known.

(b) (i) Most candidates identified meat as the type of food with the most fat.

(ii) Most candidates identified white fish as the type of food with no fibre.

(c) Most candidates were aware that fibre can help to prevent constipation. A few candidates mentioned movement through the alimentary canal but often answers were too vague to be credited. Several candidates referred to fibre being needed for muscle/bone development suggesting confusion between muscle fibre and dietary fibre.

(d) (i) Most candidates stated a suitable fruit or vegetable with citrus fruits being the most common. Some candidates incorrectly stated wholemeal bread.

(ii) Scurvy was the correct answer written by most candidates. The most common incorrect answers were kwashiorkor and rickets.

(e) (i) Most candidates successfully added up the energy used, although some omitted the energy used while sleeping.

(ii) Most candidates correctly calculated the percentage of energy used. A common error was to give 24% which suggests candidates divided the energy used while sleeping by 100.

(iii) Some candidates correctly stated respiration but some stated homeostasis, suggesting they did not appreciate the 'release energy' aspect of the question.

Question 4

(a) This question was well answered and candidates clearly understood about human influences on ecosystems. The commonest error was to pick livestock instead of monoculture.

(b) Many candidates successfully named carbon dioxide and methane. Nitrogen was a common incorrect choice.

Question 5

(a) (i) This was a demanding question and candidates found it difficult to work their way through the diagram and count up. Most candidates were able to gain a mark for the herbivores but the primary consumers and carnivores were less well answered. Some candidates just looked at the number of animals on the same printed level rather than at the same feeding level.

(ii) Most candidates correctly identified the bird or the snake. A few gave generic answers, such as primary consumer, and could not be awarded the mark.

(b) Most candidates understood how a change in the population of snakes could affect the populations of other species in the food web.

(c) Candidates found this question challenging. Energy and organic were the required terms.

(d) (i) Most candidates correctly calculated the width of the bar as 8 mm, realising that each organism is represented by a bar of 4 mm.

(ii) There was some uncertainty about how to draw a pyramid of numbers. Some candidates incorrectly added numerical axes or drew pyramids that were pyramid shaped rather than a series of horizontal bars. Some candidates did not label the organisms on the pyramid.

Question 6

(a) Many candidates were awarded a mark for stating that a drug modifies or changes something but few stated that drugs modify chemical reactions. Many answers focused on the negative effects of misused drugs or the positive effects of medicines, rather than providing a definition.

(b) Most candidates stated that antibiotics are used to treat bacterial infections. Some candidates named a disease, often viral in origin, rather than state bacterial infections.

(c) Candidates found this question demanding and were uncertain of the term bacterial resistance. Many candidates correctly manipulated the data to provide a relevant data quote and some realised that the time to develop resistance was different for each antibiotic. Very few compared the data further by actually describing the differences.

(d) The question asked candidates to name body defences that prevent pathogens from entering the body. Some answers stated the body's second line of defence, e.g. the role of lymphocytes, phagocytes and antibodies, and therefore could not be credited. Some candidates stated hair, but could not be awarded a mark as they did not qualify it by stating hair in the nose. Blood clotting was rarely seen.

Question 7

(a) The oviduct was well known and the cervix the least well known.

(b) Most candidates only drew three lines, indicating they had clearly read the instructions. Most knew that oestrogen is a hormone and that it is produced by the ovaries. Some candidates were not aware that oestrogen causes breasts to grow.

(c) (i) There was a great deal of uncertainty about the events in the menstrual cycle with many not being able to state the days of the events. The date of ovulation was best known. Candidates would benefit from a greater understanding of the menstrual cycle.

(ii) This question proved challenging with few candidates correctly describing the release of hormones. The majority stated changes that occur in the uterus rather than in the ovary.

Question 8

(a) The vast majority of candidates successfully named two products of photosynthesis. Oxygen was the most common correct answer with the most common incorrect answer being carbon dioxide. This suggests candidates focused on the gases involved in photosynthesis rather than the products.

(b) (i) Most candidates clearly explained that an increase in carbon dioxide concentration would increase the rate of photosynthesis. Some candidates were confused by the constant temperature statement in the question and they incorrectly stated that the rate would not increase further.

(ii) Many answers were too vague to be awarded the mark. Light intensity was required, rather than just Sun or light.

(c) Most candidates correctly identified where photosynthesis was occurring, showing their knowledge of chlorophyll and its requirement for photosynthesis. Very few candidates appreciated that respiration occurs in all areas of the leaf. Most incorrect answers thought respiration only occurred in the green area.

(d) Most candidates correctly stated epidermis and palisade with a few stating cuticle. Some candidates incorrectly stated cell structures, such as the cell membrane, chloroplasts and guard cells, rather than cell types or the cuticle. Candidates should take care with spelling, particularly in terms such as palisade and mesophyll. Spelling does not have to be perfect but it does have to be unambiguous.

(e) (i) Most candidates gained the mark for xylem. A number of incorrect answers included roots and root hair cells.

(ii) There was some confusion over which mineral ion is used to make chlorophyll. Many candidates incorrectly stated a molecule, such as nitrogen, and a few candidates stated chloroplast.

(iii) There was some confusion over which mineral ion is used to make amino acids with few correctly stating nitrate ions. Incorrect answers included protein, protease and nitrogen.

(f) This question was well answered and candidates displayed a good understanding of the carbon and water cycles. With questions requiring a longer answer, candidates should be encouraged to plan their response to ensure their answers are focused on the specific question being asked. Candidates sometimes provide detailed scientific answers which do not answer the question and therefore gain little credit. In this question, some candidates described the water cycle in terms of water run-off and prevention of soil erosion rather than describing plants taking in water via their roots and then losing water to the atmosphere through transpiration.

BIOLOGY

Paper 0970/42
Theory (Extended)

Key messages

Candidates should be reminded of the importance of carefully reading each question. Some questions were misread by candidates, who then gave responses that did not answer the question.

Candidates should be reminded to take note of the mark allocations as they indicate the number of specific points that need to be made in answers.

Candidates should be reminded of the differences between command words, particularly between 'describe' and 'explain'. Many answers to **Question 5(b)** were explanations instead of descriptions. Similarly, candidates should also know how to respond to questions that ask 'how' and 'why' certain processes occur.

Candidates should use appropriate specific terminology when phrasing their answers. Inappropriate use of terms hampered candidates in **Question 3(a)**, **Question 1(b)(iii)**, **Question 1(c)**, **Question 5(c)** and **Question 6(c)(iii)**.

General comments

There was evidence of misreading some questions. In **Question 6(b)** many candidates missed the importance of the word 'cell' in the question and wrote about roles of DNA in determining the features of organisms and in inheritance. In **Question 6(c)(i)** there were correct descriptions of the role of meiosis in response to a question about mitosis.

In some questions, candidates did not make links to particular topics from the syllabus. For example, in **Question 3(c)(i)** they often missed ideas about the effect of intensive livestock farming on the environment. They also rarely made any reference to the inefficiency of using crops to feed animals rather than humans from topic 19.2. The conservation of fossil fuels from topic 21.4 of the syllabus was very rarely mentioned in answer to **Question 4(b)(iii)**.

Many candidates gave good answers to **Question 5(c)**. However, some candidates did not plan or structure their answers and described the two processes separately without comparing them directly by identifying similarities and differences.

Comments on specific questions

Question 1

(a) (i) Very few candidates provided a complete definition of sensitivity. Many candidates gave a simple definition and did not include the term stimulus, or stimuli, in their answers. The majority of candidates gained one mark for stating that sensitivity involved a response or reaction by an organism.

(ii) There were good definitions of the term sense organ, although few referred to receptors or receptor cells in their answers, using instead the general definition that applies to all organs.

(b) (i) Many candidates correctly named the fovea or yellow spot. Incorrect answers included blind spot.

(ii) To be awarded full marks, candidates had to show the lens thicker than in Fig. 1.1, light rays refracted in the cornea and/or in the lens and light rays coming to a point on the fovea. Some

candidates completed the diagram very carefully and were awarded full marks. Common errors were to omit the lens, show the lens as thinner than in Fig. 1.1 and cross the light rays either outside the eye or in the vitreous humour. A few candidates completed the light rays freehand, rather than using a ruler, and so often gave irregular lines.

(iii) The most common correct answers stated that the ciliary muscles relax, the suspensory ligaments become taut or tighten and the lens becomes thinner. Some candidates explained that ciliary muscles and suspensory ligaments have roles in changing the shape of the lens, but did not describe how this happens when light comes from a distant object. Some candidates did not read the question carefully and described what happens when light comes from an object near to the lens. Common errors included stating that the ligaments stretched or that they acted as a muscle antagonistic to the ciliary muscles. Many thought the ciliary muscles control the amount of light entering the eye. Many wrote about contraction of suspensory ligaments.

(c) Most candidates stated that the pupil reduces in size in bright light. Many gave good descriptions of the functions of the muscles in the iris in reducing the size of the pupil, although only the strongest candidates went on to mention or describe the antagonistic action of the muscles. Again, some candidates misread the question and described the role of these muscles in dilating the pupil in dim light. There were very few correct comments about the iris in changing the size of the pupil. Some candidates confused the iris with the pupil in their answers stating that the iris decreases in size in bright light. The most common errors included reversing the roles of the circular and radial muscles or referring to ciliary muscles and suspensory ligaments as having a role in controlling the diameter of the pupil. There were many answers that referred to 'circulatory' and 'radical' muscles. Many stated that the pupils contract in bright light.

(d) Almost all candidates gave reflex action or involuntary action as their answers.

Question 2

(a) Many candidates named the parts of the tooth correctly. Spellings of enamel and dentine were not always correct, but credit was given for phonetic spellings. Common errors were to confuse enamel (**A**) and dentine (**B**) and give cement for gum (**D**). The term crown was not accepted for enamel. In a diagram of a tooth, the crown would be shown by a bracket.

(b) A common error was to explain how molar teeth are adapted for chewing rather than describing their role in mechanical digestion in the mouth. Good answers often included the idea that molars crush or grind food to increase the surface area for the action of enzymes. Amylase was often mentioned. Many candidates became confused with chemical digestion as they stated that molars break down pieces of food into smaller molecules or into soluble substances.

(c) There were many good descriptions of the process of tooth decay outlining the role of bacteria in producing acid that erodes enamel, exposing dentine and maybe reaching the nerves in the pulp and causing pain. There were few correct references to dentine in the answers. Weaker answers often stated that bacteria consume the teeth or described the circumstances that might lead to tooth decay.

Question 3

(a) This question was based on a food web for an ecosystem in a forested area in Central America. Most candidates gave correct answers for the first, second and fourth rows of the table. Many were unsure what to call the trophic level described in the third row. Few called it the quaternary consumer, but many knew that it was the fourth consumer level often using words like 'fourthtiary'. Not all candidates identified the great horned owl as the example from Fig. 3.1.

(b) (i) Candidates were often unsuccessful at identifying the group of organisms as decomposers. Many gave omnivores or the fifth trophic level. Acceptable alternatives included detritivores and named groups, such as bacteria, fungi and microorganisms.

(ii) Most answers to this question identified the loss of energy from one trophic level to another as the reason for the limited number of trophic levels. Respiration and inedible material were given as common reasons for the energy loss at each trophic level. Most ended their answers by stating that there is very little energy available to top predators and certainly not enough for another trophic level. A few candidates began at the base of the food web and explained that plants make use of

only a small proportion of the light energy available, so accounting for the limited energy available to support an extra trophic level.

(c) (i) Many candidates misinterpreted this question and wrote about the effect of intensive livestock systems on the welfare and health of the animals concerned. They wrote about the limited variation in flocks of chickens and the likelihood that disease will spread easily from chicken to chicken. Good answers referred instead to the effects of faeces and urine on waterways, the effect of clearing land on the local wildlife and its biodiversity, and the release of greenhouse gases, especially methane. A minority discussed the spread of disease from livestock to wild animals or dealt with the wasteful use of energy in livestock production compared with providing food from crops. There were some good answers that explained that livestock systems need large supplies of food and the effect that monocultures of feed crops, such as maize, can have on ecosystems.

(ii) Candidates tended to concentrate on one aspect of the impact of soil erosion. For example, some concentrated on the effects on the physical environment, mentioning flooding, landslides and desertification. Others dealt with the loss of mineral ions leading to a decrease in soil fertility and reductions in plant growth. A smaller number dealt with the effects on the water cycle. Most candidates could gain credit by explaining that soil erosion leads to a loss of habitat. Some candidates developed this idea by referring to all the organisms that make up the community in soils. Many extended their answer too far, linking soil erosion to deforestation leading to climate change.

Question 4

(a) (i) Many candidates identified both parts of the yeast cell correctly. Ribosome(s), endoplasmic reticulum, rough endoplasmic reticulum and the abbreviations ER and RER were accepted for **A**. Vacuole was the expected answer for **D**, but vesicle was also accepted.

(ii) Most candidates correctly identified the function of the nucleus (**B**) and the mitochondrion (**C**). Common incorrect answers for the mitochondrion included produce energy for the cell, anaerobic respiration and provides energy for respiration. A few misread the question and named the organelles.

(iii) Almost all candidates identified the chloroplast as the structure found in plant cells, but absent in yeast cells. Some gave cell wall even though it was labelled in the diagram of the yeast cell.

(b) (i) The two enzymes given in Fig. 4.2 are amylase (**S**) and maltase (**T**). Some candidates gave maltase as **S** and amylase as **T**. Other candidates struggled with their spelling, but unambiguous spellings were accepted.

(ii) The majority of correct answers to this question gave the formula for glucose, inserted a 2 before the formula for ethanol and added $2CO_2$ to complete the equation. Some candidates put a 3 before glucose and balanced their equation correctly so were given credit. Incorrect answers were not balanced correctly, often by omitting the 2 before CO_2.

(iii) Most candidates realised that this question was asking them to contrast renewable fuels with non-renewable fuels. A few candidates expressed the misconception that renewable was the ability to reuse the biofuels. Many candidates incorrectly thought that biofuels have less of an environmental impact than fossil fuels because when burnt they do not emit carbon dioxide or that they do not need to be burnt or that they are biodegradable. There were many references to biofuels being 'eco-friendly' without any explanation of what this much-used term actually means. The very best answers explained that the carbon dioxide emitted by using biofuels is offset by the uptake of carbon dioxide by the plants, such as maize, grown for the production of biofuels. Few candidates stated that the use of biofuels will help to conserve fossil fuels as they are a finite resource. Many wrote that biofuels are cheaper and easier to produce than fossil fuels that have to be mined. These answers did not gain any credit. Also, many wrote about biofuels being natural and fossil fuels being artificial or similar.

(iv) Carbon dioxide uptake for use in photosynthesis was the first point made by good answers to this question. Many candidates stated that carbon dioxide is a requirement of the process so adding it to the atmosphere in glasshouses increases the rate of photosynthesis, assuming other factors are not limiting. Some correctly used the term limiting factor in their answers. Some candidates thought that this question was about the greenhouse effect, explaining that the carbon dioxide will help to

keep heat in the glasshouse. This could not be credited. Many suggested that plants carried out photosynthesis in order to produce oxygen as if this was an advantage to the plant or to the owner of the glasshouse. Few stated that carbon dioxide enrichment increases yields of glasshouse crops. Fewer still linked the increase in photosynthesis to an increase in biomass by referring to the production of sugars, starch or protein.

Question 5

(a) Many candidates completed the table showing the sites of production of the hormones and their roles correctly. However, others found it more of a challenge. Common errors were:

- FSH causes the production of eggs and/or follicles, rather than stimulating their development
- FSH causes ovulation.

(b) The points that were credited were descriptions of the change in the thickness of the lining of the uterus. Many candidates gave explanations for the changing thickness in terms of shedding of the lining and its subsequent growth accompanied, occasionally, by the ways in which these changes are controlled by hormones or the reasons for the changes in terms of implantation. The question asked for a description so simple statements that the thickness decreases between days 0 and 7 and increases between days 7 and 28, with some detail for one or both of the phases, was all that was required.

(c) Many candidates used the information given in Fig. 5.2 to good effect when comparing the two methods of assisted reproduction. Many answers were carefully structured so that similarities and differences were separated and described clearly. Some correct points that were seen infrequently were:

- intercourse does not occur
- fertility drugs are used
- implantation of the embryo occurs so that the lining of the uterus must thicken in preparation
- embryo selection and embryo biopsy is possible with IVF but not with AI.

A common omission was to say that fertilisation occurs in both methods. Many candidates incorrectly stated that in AI, fertilisation occurs in the vagina or the uterus. Candidates often wrote that sperm and eggs are mixed in IVF without stating that this allows fertilisation to occur. Some candidates did not read the question carefully as they wrote about the reasons for infertility.

Question 6

(a) (i) Most candidates gave **T** as the base that pairs with **A**. The letters **B** and **D** were seen in some responses.

(ii) Most gave **C** and **G** as the other two bases in DNA.

(b) Many candidates stated that the genetic material in cells is in the form of DNA. Better responses stated that DNA codes for proteins. Fewer candidates explained that the sequence of bases in DNA determines the sequence of amino acids in proteins. Many candidates misread the question and wrote about the role of DNA in determining people's characteristics and its role in inheritance.

(c) (i) There were some good answers here explaining that chromosomes are copied or duplicated before mitosis occurs so that the daughter cells have the same number of chromosomes and are genetically identical. Candidates often stated that chromosomes thickened or split in two instead of saying that they are copied, duplicated or replicated. Some candidates wrote about meiosis and halving the chromosome number even though the question was about mitosis. Some candidates referred to identical or similar offspring rather than to daughter cells.

(ii) Many candidates gave cell membrane and cell wall as the structures that form between the two nuclei in a cell that divides into two. Incorrect answers included nuclear membrane and cytoplasm.

(iii) Candidates were often imprecise with their definitions of diploid. 'A full set of chromosomes' was a common answer that could not be awarded credit whereas 'A full set of paired chromosomes' was accepted. A diploid cell has two copies of each type of chromosome.

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

When planning investigations, candidates should use the same principles each time. They should describe the independent variable, the dependent variable and the variables that are kept constant. Then they should describe the method, including general procedures such as repeating the investigation more than two times and naming suitable safety procedures.

Sufficient practise is needed with choosing suitable scales for graphs, accurately plotting data points and drawing an appropriate line.

It would be helpful to candidates if they used a pencil when constructing a table, drawing a diagram and when drawing a graph. This means that mistakes can easily be erased and clearly corrected.

General comments

Many candidates displayed good skills in drawing cells from the photomicrograph.

In mathematical questions, it is important that candidates show their working so credit can be awarded for their method even if the final answer is incorrect.

Comments on specific questions

Question 1

Candidates were given the outline of an investigation involving the preparation of bread dough.

Approximately half the dough was kept at a cool temperature for ten minutes and the other portion kept at a higher temperature for the same period of time. Diagrams of the dough samples at the start and end of the ten minutes were provided for the candidates. Their first task was to measure the maximum height of all four samples and to mark the points on the diagrams at which the heights were measured. Most candidates marked the maximum heights, a few omitted to do so, and some marked points other than the maxima.

(a) (i) A table had to be constructed in which to record the results of the investigation. The majority of candidates constructed a suitable table and recorded the four required heights, most of the heights having been measured accurately.

Some candidates did not state the units in the heading of the table, or repeated them in the body of the table. Frequently, the heading for the different dough samples was left blank. It is important that every column has an appropriate heading, and where appropriate, a unit.

Some candidates mixed up the initial and final heights and recorded their measurements in the incorrect data cells. Measurements should ideally be in millimetres, rather than centimetres. If converting between units, candidates should take care to ensure that the conversion is accurate and the correct unit has been stated.

(ii) Nearly all candidates correctly calculated the change in height of both dough samples. Candidates that measured inaccurately, or recorded incorrectly, received credit if their calculation was correct using their recorded data.

(iii) Many candidates re-stated the results rather than reaching a conclusion about them. Suitable conclusions stated that at the higher temperature, the height of the dough increased more than in the lower temperature.

(iv) (v) The majority of candidates were able to identify the independent and the dependent variables in the investigation.

(b) (i) Most candidates realised that the dough would not be split exactly into two equal halves if separated by hand. Strong responses stated that the dough should be weighed to ensure equal masses. A few recommended dividing the dough by volume. This was credited, even though it would be difficult to do in practice. Some candidates thought that using a ruler to measure length and a sharp knife for the cutting would be sufficiently accurate. However, this could not be credited as simply measuring length does not imply an equal volume.

(ii) Many candidates clearly understood that the variation in initial dough heights was the key point. Using change in height eliminates the fact that the initial heights were different. Many candidates gave answers that were too vague, often citing greater accuracy or errors being minimised.

(c) The majority of candidates knew that iodine solution was used to test for the presence of starch and stated the positive colour as blue-black or dark blue. It needs to be noted that 'blue' on its own is not an acceptable description of the colour for a positive iodine solution test – the best description is blue-black.

(d) (i) The majority of candidates knew that limewater turns cloudy, or milky, in the presence of carbon dioxide. The use of hydrogencarbonate indicator as a test for the presence of carbon dioxide was not well known. The use of pH indicators which give a colour change in acidic conditions were also accepted. A small number of candidates incorrectly referred to limestone instead of limewater.

(ii) Many candidates described investigations using bread dough rather than a yeast suspension, as instructed in the question. This highlights the importance of reading the question carefully and following instructions closely.

Candidates should be familiar with designing investigations and should be able to describe the dependent variable, independent variable and variables that were kept constant. Few were able to accurately describe how to keep variables constant. For example, stating that temperature can be controlled using a water-bath is not specific enough unless it is qualified with a description of how the temperature of the water-bath is maintained, e.g. using a thermostatically-controlled water-bath or adding hot and/or cold water to the water-bath and checking the temperature with a thermometer.

The use of a gas syringe to collect the gas was frequently seen. Other methods, such as the displacement of water from an inverted measuring cylinder, were equally acceptable. Candidates also needed to state that the volume of gas would be recorded in a set time period, not just that the volume of gas would be recorded.

Candidates should be reminded that an investigation should be carried out at least three times (or repeated twice). The reason for this is that if an investigation is only performed twice and the results are different it is impossible to identify which result is anomalous.

A few candidates sketched and labelled the apparatus they would use. This is a helpful practice which limits the need for complex descriptions of apparatus.

Question 2

(a) (i) A large number of candidates were awarded full marks for their diagram of the plant cell. Nearly all diagrams were sufficiently large and were drawn with smooth, clear and unbroken outlines. Lines should be drawn free-hand and not produced with the help of a ruler.

Some candidates omitted details, such as the two main clusters of chloroplasts or the points where cells join.

A small number of candidates drew a stylised plant cell instead of the cell in the photomicrograph.

(ii) Most candidates successfully measured the length of the magnified cell and then calculated its actual length. A small number of candidates performed the original measurement inaccurately but carried out the calculation correctly and therefore received some credit.

Common errors were to give the first cell measurements in centimetres, to omit the units in the final answer, to carry out an incorrect conversion into micrometres, or to incorrectly use standard notation.

(b) (i) Most candidates successfully calculated the average number of bubbles per minute. A few who gave an incorrect answer seemed to have worked out the midpoint between the number of bubbles produced per minute at 100 and 140 cm, rather than using the number of bubbles produced in three minutes and dividing by three.

(ii) There were some excellent graphs and many were awarded full marks. Candidates should ensure that all data is plotted to within ± half of the smallest square on the graph grid. The most common errors were the absence of units on the axes or the use of non-linear scales. Axes do not need to start at zero, but when a zero is included and there is then a 'jump' in the values, a discontinuity mark must be included. The lines drawn were usually appropriate, but candidates should remember not to extrapolate the line beyond the data points.

(iii) Most candidates could use their graph to read off the correct rate of bubble production per minute.

(iv) Candidates were asked to describe the trends shown on the graph they had drawn. This proved to be challenging for many candidates. The majority of candidates described the relationship between the distance from the light and the rate of bubble production, but neglected the portion of the graph where the rate remained constant.

(v) Stronger responses stated that it was necessary to allow the plant time to equilibrate and reach the new temperature before proceeding with the investigation. Some candidates had difficulty in expressing their ideas clearly.

(vi) Many candidates performed the calculation correctly and were awarded full marks. Candidates should be reminded to show their working so credit can be awarded for their method even if the final answer is incorrect.