

Principal examiner reports for teachers

Principal examiner reports for teachers summarise what candidates did well and what candidates needed to improve for this examination series only.

This report is to be used in conjunction with the question paper and mark scheme.

For guidance on teaching and learning we provide resources for many of our syllabuses.

Resource	Where to find it
Grade descriptions – Grade descriptions describe the level of performance typically demonstrated by candidates achieving the different grades awarded for a qualification.	School support hub Select: Subject > Resource finder > Syllabus and specimen materials
Schemes of work – Schemes of work are designed to support you in your teaching and lesson planning.	School support hub Select: Subject > Resource finder > Teaching and learning
Lesson planning – Guidance on how to plan a lesson.	Lesson planning
Resource plus – There may be additional resources such as teaching packs containing lesson plans, resources and worksheets and videos for aspects of your syllabus.	School support hub Select: Subject > Resource finder > Teaching and learning
Teaching tools	Teaching Tools
Exemplar candidate responses	School support hub Select: Subject > Resource finder > Teaching and learning
Learner guide – A guide for students to help them understand what the course involves.	School support hub Select: Subject > Resource finder > Teaching and learning
Community forums – Do you have a question or something to share? Our online forums are great way to keep up to date with your subject and the global Cambridge community.	Community forum on the school support hub
Access to scripts for this series.	Access to scripts service
Results analysis is available for some syllabuses.	Results analysis
Test maker is available for some subjects.	Test maker

Other services from Cambridge International Education

- [Digital mocks service](#)
- [Insight assessments](#)
- [Professional development](#)
 - [Focus on assessment](#)
 - [Online marking workshops](#)

BIOLOGY

Paper 0610/12 Multiple choice (Core)

Key messages

Candidates performed well on **Questions 1, 2, 3, 4, 8, 10, 11, 12, 14, 15, 19, 20, 22, 23, 26, 27, 28, 29, 30, 34, 35, 38, 39 and 40.**

Candidates performed less well on **Questions 5, 6, 7, 9, 13, 16, 17, 18, 21, 24, 25, 31, 32, 33, 36 and 37.**

Candidates should ensure to work through all the information in the question and options. Diagrams should be carefully considered.

Comments on specific questions

Question 5

- Option **A** was a common incorrect answer.
- Candidates needed to convert their answer from cm to mm to arrive at the correct answer.

Question 6

- Option **B** was a common incorrect answer.
- Candidates did not correctly interpret the experiment so chose the opposite expected change in the mass of the potato.

Question 7

- Option **D** was a common incorrect answer.
- This suggests candidates did not understand that transpiration is a passive process.

Question 9

- All options were popular.
- This suggests that candidates were unclear on the description of an enzyme. Most candidates did not know that enzymes are catalysts and many candidates thought that lipase is made of fat.

Question 13

- Option **C** was a common incorrect answer.
- Although the diagram shows the large intestine labelled as **L**, option **C** does not contain a correct function of the large intestine. Candidates should take care to read the options in full.

Question 16

- Option **C** was a common incorrect answer.
- It was common to mistake phloem for xylem.

Question 17

- Option **B** was a common incorrect answer.
- Candidates multiplied the length of one complete heartbeat by 60 seconds rather than divide 60 seconds by the length of one complete heartbeat. It is often helpful for candidates to look at a numerical

answer and see if it is reasonable. Here a heartrate of 24 beats per minute is not reasonable when the one complete heartbeat takes less than a second.

Question 18

- Option **C** was a common incorrect answer.
- A common error was to confuse the left and right sides of the heart.

Question 21

- Option **D** was a common incorrect answer.
- Candidates should ensure to read the question thoroughly. Carbon dioxide can be produced by respiration not moved from blood into alveoli.

Question 24

- Option **C** was a common incorrect answer.
- The identities of the neurones in the pupil reflex were well understood. A common error was to mistake the cornea as the effector.

Question 25

- Option **B** was a common incorrect answer.
- Candidates should take care to read the questions carefully. The young plant was growing in the dark and so there is no light stimulus for phototropism to occur.

Question 31

- All options were popular.
- The pathway taken by sperm in the female reproductive system before fertilisation was not well known.

Question 32

- All options were popular.
- The terms homozygous, heterozygous, dominant and recessive were not well recalled. It is often helpful to write out the genotypes suggested by the options.

Question 33

- Option **D** was a common incorrect answer.
- The shape of seeds is an example of discontinuous variation and so is caused by genes only.

Question 36

- Option **B** was a common incorrect answer.
- Candidates did not correctly interpret the population growth curve confusing lag and exponential (log) phases.

Question 37

- Option **A** was a common incorrect answer.
- The production of methane pollution by human activity was not well known.

BIOLOGY

Paper 0610/22 Multiple choice (Extended)

Key messages

Candidates performed well on **Questions 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 18, 22, 24, 25, 28, 31, 32, 33, 34, 35, 37, 38 and 39.**

Candidates performed less well on **Questions 9, 12, 17, 19, 20, 21, 23, 26, 27, 29, 30, 36 and 40.**

Candidates should carefully look at the graphs provided looking at all the details included. Candidates should read the whole question before answering. The full context of the question is important.

Comments on specific questions

Question 9

- Option **A** was a common incorrect answer.
- This suggests that candidates did not understand that the plateau region of the graph is where light intensity is no longer a limiting factor. Candidates should carefully look at the graph in a question.

Question 12

- Option **D** was a common incorrect answer.
- Candidates were able to identify where pepsin and trypsin act. Some candidates did not know that maltase acts in the small intestine.

Question 17

- Options **B** and **D** were common incorrect answers.
- A common error was to think water left the small intestine.

Question 19

- Option **B** was a common incorrect answer.
- Many candidates did not know that carbon dioxide is not produced in anaerobic respiration in humans. Candidates should be encouraged to read the whole question carefully.

Question 20

- Options **C** and **D** were common incorrect answers.
- The action of maltase was not well recalled by some candidates.

Question 21

- Options **A** and **C** were common incorrect answers.
- This suggests that many candidates either did not know the site of urea production or excretion.

Question 23

- All answers were popular.
- A common error was to incorrectly identify the increased elongation was occurring on the upper side.

Question 26

- Option **A** was a common incorrect answer.
- Some candidates could not identify LH as hormone X. Candidates should carefully look at all the information provided in the graph before answering the question.

Question 27

- Option **C** was a common incorrect answer.
- There was a misconception that a pregnant woman's blood gains dissolved oxygen and loses urea as it passes through the placenta. Candidates should read the question carefully.

Question 29

- Option **D** was a common incorrect answer.
- It is often helpful in questions like this to draw out the rounds of cell division to see how many are required to reach the desired number of cells.

Question 30

- All answers were popular.
- Candidates should work through the pedigree diagram. It is often helpful to annotate a pedigree diagram with the known genotypes and then work the rest of the individuals.

Question 36

- Options **A** and **B** were common incorrect answers.
- Candidates were unsure about the consequences of untreated sewage pollution on aquatic ecosystems.

Question 40

- Option **D** was a common incorrect answer.
- Candidates should read the details of each option carefully.

BIOLOGY

Paper 0610/32 Theory (Core)
--

Key messages

What candidates did well

- Many candidates were good at answering short answer questions based on knowledge recall and where no explanation was required.

What candidates needed to improve

- Interpreting a graph and writing a description using data drawn from that graph.
- Identifying structures in familiar diagrams.
- Providing complete answers to the question that has been asked.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Dichotomous keys were well understood by many candidates.

Limited responses

- A minority of candidates would benefit from further practice in distinguishing the features used in keys.
- A few candidates answered by writing out the binomial names in full, which limited the time available for the rest of the paper.

(ii) Comprehensive responses

- Many candidates were able to state a visible feature from Figure 1.2 that is found only in birds.

Limited responses

- Some candidates suggested wings were a visible feature only found in birds.

(b) (i) Comprehensive responses

- Many candidates correctly gave the Plant Kingdom as their answer (or, occasionally, named Fungi or Protocista).

Limited responses

- Some candidates stated classes of arthropods or vertebrates.

(ii) Comprehensive responses

- The presence of an exoskeleton was the most commonly cited Arachnid feature.
- The presence of eight legs and the body being divided into two parts were features known by relatively few candidates.

Limited responses

- In general, candidates need to be more precise. For example: 'more legs' needs to be qualified as 'eight legs'.

(c) Comprehensive responses

- Many candidates were able to complete the sentences about organisms in an ecosystem.

Limited responses

- Many candidates would benefit from further study of the subject areas involved in the responses.

Question 2

(a) (i) Comprehensive responses

- There were some excellent, succinct responses from a minority of candidates.

Limited responses

- The majority of candidates would benefit from having more practice in answering this type of question.
- Often the temperatures quoted were inaccurately read from the graph.
- Rather than referring to the rate of photosynthesis increasing or decreasing, a significant number of candidates referred to 'the line' going up or down.
- Many candidates need to be more precise and avoid including irrelevant material such as enzymes becoming denatured.

(ii) Comprehensive responses

- Most candidates could determine the temperature required.

Limited responses

- None seen.

(b) (i) Comprehensive responses

- The majority of candidates knew the word equation for photosynthesis.

Limited responses

- None seen.

(ii) Comprehensive responses

- Some candidates were able to correctly name a cell that is adapted for photosynthesis.

Limited responses

- Many candidates needed to read this question more carefully. Instead of giving the name of a type of cell, as requested, many gave the answer 'chloroplast' or 'chlorophyll'.

(iii) Comprehensive responses

- Candidates generally correctly identified the role of chlorophyll in respect of light and stated that the energy from light was used to produce glucose/carbohydrate.

Limited responses

- Candidates need to appreciate that the photosynthetic process resulted in the production of carbohydrates/glucose.

(iv) Comprehensive responses

- Many candidates drew four lines correctly.

Limited responses

- A significant number of candidates drew three or five lines.
- The least known facts were that sucrose is transported in the phloem and that starch is an energy store.

(v) Comprehensive responses

- Some candidates stated aerobic respiration and mitochondrion.

Limited responses

- Many candidates need to be more precise as the process described was aerobic respiration as opposed to the frequently given answer of respiration (unqualified).
- The majority of candidates would benefit from knowing where aerobic respiration occurs within a cell.

Question 3

(a) Comprehensive responses

- The structures most often labelled correctly were the diaphragm and an alveolus.

Limited responses

- The larynx was often identified as the trachea.
- Some candidates named fewer than four structures indicating that they would benefit from greater familiarity with the diagram.
- Most candidates would benefit from knowledge of the position of the intercostal muscles, as these were often identified as structures unrelated to the respiratory system.

(b) Comprehensive responses

- Most candidates arranged the structures in the correct order.

Limited responses

- None seen.

(c) Comprehensive responses

- A few candidates gave three correct characteristics of a respiratory surface.

Limited responses

- Some candidates gave no response to this question. They would benefit from further knowledge about respiratory surfaces.
- The majority of candidates were familiar only with the characteristic of respiratory surfaces having a large surface area (per volume).
- A significant number of candidates need more familiarity with the characteristics of respiratory surfaces as these candidates wrote about the diffusion of oxygen and carbon dioxide.

(d)(i) Comprehensive responses

- The majority of candidates knew where ciliated cells are located within the respiratory system.

Limited responses

- Some candidates gave no response to the question, indicating that they would benefit from further knowledge in this area.
- Most candidates need to be more familiar with the function of these cells, as commonly given incorrect answers were 'to trap pathogens', 'to increase the surface area of the respiratory surface' or 'to move oxygen into the alveoli'.

(ii) Comprehensive responses

- Some candidates knew the definition for a tissue.

Limited responses

- The majority of candidates would benefit from an understanding of the nature of a tissue. Many gave seemingly random names such as 'sperms', 'stomach' and 'leaf'.

Question 4

(a) Comprehensive responses

- Many candidates identified the growth response as gravitropism.

Limited responses

- None seen.

(b)(i) Comprehensive responses

- Most candidates were able to identify the two salient angles.

Limited responses

- A significant number of candidates would benefit from further practice in performing the appropriate calculation, as many of the calculations presented involved the procedure to achieve a percentage.
- A few candidates selected the angles (or two other angles) and did not use them in a calculation. These candidates would benefit from further practice in handling data.

(ii) Comprehensive responses

- Most candidates were able to select the two conclusions that were supported by evidence from the graph.

Limited responses

- None seen.

(c) Comprehensive responses

- A few candidates only completed the diagram. Of these, the majority drew both the root and the shoot as bent structures.
- It would be of benefit to candidates to recall the work done previously in a particular question as, having identified gravitropism in part **(a)**, the majority of candidates proceeded to give an explanation in part **(c)** which related to phototropism.

Limited responses

- Candidates need to follow instructions given as very few candidates attempted to complete the diagram.

(d) Comprehensive responses

- Most candidates could state at least one environmental condition needed for germination.

Limited responses

- Nearly all candidates would benefit by realising that light is not necessary for germination.

Question 5

(a)(i) Comprehensive responses

- The site of fertilisation was known by a majority of candidates.

Limited responses

- None seen.

(ii) Comprehensive responses

- Many candidates knew that fertilisation involves the fusion of an ovum and a sperm.

Limited responses

- Most candidates need to appreciate that fusion of the gamete nuclei is vital in fertilisation.

(b)(i) Comprehensive responses

- The functions of the placenta were known in general terms by most candidates.

Limited responses

- Most candidates would benefit from further practice in identifying structures (and their functions) found in a diagram of the female reproductive system during pregnancy.

- Many candidates would benefit from a more detailed knowledge of placental functions.

(ii) Comprehensive responses

- The amnion/amniotic sac was identified by a significant number of candidates.

Limited responses

- None seen.

(iii) Comprehensive responses

- Many candidates identified the amniotic fluid as a shock absorber and protection for the fetus.

Limited responses

- Commonly cited incorrect answers were the placenta, the amnion, and the abdominal wall.

Question 6

(a) (i) Comprehensive responses

- A significant number of candidates completed the Punnet square accurately and gave an acceptably expressed ratio for the phenotypes produced.

Limited responses

- A significant number of candidates made no attempt to answer the question, indicating that they would benefit from more practice at this skill.
- Some candidates completed a heterozygous cross.
- A number of candidates need further practice in using a Punnett square as, fairly frequently, the gametes were written as the full genotype: for example, Rr and rr.

(ii) Comprehensive responses

- Some candidates identified the term used to describe an individual with two different alleles for a gene.

Limited responses

- The majority of candidates would benefit from a more precise knowledge of the terminology associated with a study of genetics.

(b) Comprehensive responses

- A few candidates only explained why the farmer's prediction was incorrect.

Limited responses

- A large number of candidates made no attempt to answer this question.
- The majority of candidates would benefit by knowing the meaning of the term 'pure-breeding'.
- Commonly given incorrect answers referred to artificial selection, random pollination and vague comments about dominant and recessive alleles.

(c) (i) Comprehensive responses

- Most candidates appreciated that a gene was a section of DNA.

Limited responses

- Most candidates would benefit from the understanding that a gene codes for a specific protein.

(ii) Comprehensive responses

- A minority of candidates were able to give the name of the type of variation caused by genes only.

Limited responses

- Most candidates would benefit by reading the question with more care. Commonly, the responses given were genetic terms apparently selected at random such as 'dominant', 'genotype' and 'mutation'.

(iii) Comprehensive responses

- Most candidates knew that genes are found in the nucleus or are components of chromosomes.

Limited responses

- None seen.

Question 7

(a) Comprehensive responses

- Many candidates could identify an herbivore, a secondary consumer and an organism which operated at trophic levels three and four.

Limited responses

- Some candidates would benefit from more practice in selecting organism types from a food web and determining their trophic levels.

(b) Comprehensive responses

- The majority of candidates knew that the sun is the source of energy for the food web.

Limited responses

- Some candidates would benefit from realising that producers are not the ultimate source of energy in a food web.

(c) Comprehensive responses

- The majority of candidates drew an acceptable food chain.

Limited responses

- Some candidates need to follow instructions as some food chains given were not derived from the food web shown in the question.

(d) Comprehensive response

- A significant number of candidates drew an accurate pyramid of biomass on the grid.

Limited responses

- Many candidates would benefit from further study on the difference between a pyramid of numbers, a pyramid of biomass and a bar chart as inappropriate diagrams appeared on many scripts.
- Some candidates attempted to draw a line graph using the limited data available. These candidates would benefit from further guidance in appropriate use of information.

(e) (i) Comprehensive responses

- Many candidates explained the role of a decomposer succinctly.

Limited responses

- A significant number of candidates would benefit from a more thorough understanding of the process of decomposition.
- Fairly frequently, candidates wrote answers such as: 'decomposers carry out decomposition'. These candidates need to realise that this type of statement does not demonstrate that they understand the process.

(ii) Comprehensive responses

- The majority of candidates could name one of the gases produced by decomposers.

Limited responses

- None seen.

BIOLOGY

Paper 0610/42 Theory (Extended)
--

Key messages

What candidates did well

- Most candidates demonstrated scientific knowledge and could competently apply their knowledge to scenarios given in the questions.
- Candidates displayed mathematical skills, reading from graphs accurately, completing calculations and showing their working.
- Candidates were able to analyse data, food webs, photomicrographs and graphical information.

What candidates needed to improve

- Some candidates needed to be clear about the requirements of different command words. For example, many candidates simply gave a description when an explanation was required.
- Some candidates muddled keywords including antigen and antibiotic; lymphocytes and phagocytes; homogenous and homozygous.
- Sometimes labelling skills were inaccurate. Labels should be completed with a label name, label line drawn with a ruler, no arrowhead and the end of the line touching the structure that it is meant to label.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Most candidates were able to state the names of two kingdoms in addition to the animal kingdom.

Limited responses

- Some candidates stated bacteria as the name of a kingdom instead of the kingdom prokaryote.

(ii) Comprehensive responses

- Many candidates identified the statements that described all organisms.

Limited responses

- Some candidates identified additional statements, including that all animals have lungs and are vertebrates.

(b) (i) Comprehensive responses

- Most candidates identified one of the bases in the diagram.

Limited responses

- Some candidates identified the bonds between the bases or part of the sugar-phosphate backbone.

(ii) Comprehensive responses

- Most candidates were able to identify the four bases of DNA and describe which bases pair together.

Limited responses

- A few candidates could not give the letters of all four bases.
- A few candidates could not state which bases paired together.

(c) (i) Comprehensive responses

- Most candidates identified the clouded leopard as the species with the closest base sequence to the common ancestor.

Limited responses

- A very small number of candidates named a species other than the clouded leopard.

(ii) Comprehensive responses

- Many candidates were able to identify the two species most closely related as the lion and the leopard.
- Some candidates could describe that they shared the most recent common ancestor.

Limited responses

- Some candidates identified the clouded leopard and snow leopard as the most closely related.
- Many candidates described the lion and leopard as sharing a common ancestor and not identifying that this ancestor was the most recent common ancestor.
- Some candidates identified the jaguar as the common ancestor.
- Many candidates stated that the lion and leopard were the most closely related because they had the most similar DNA base sequences, which was not information that could be derived from the diagram given.

(d) (i) Comprehensive responses

- The majority of candidates were able to identify the cell membrane and nucleus from the photomicrograph.

Limited responses

- Very few candidates identified parts other than the nucleus and cell membrane on the photomicrograph.

(ii) Comprehensive responses

- Most candidates identified the mitochondria in the photomicrograph and were able to state the functions of release of energy through aerobic respiration.

Limited responses

- Some candidates stated that anaerobic respiration rather than aerobic respiration occurred in the mitochondria.
- Some candidates described the mitochondria as producing energy rather than releasing energy.
- Some candidates stated that they provided energy for aerobic respiration.

(iii) Comprehensive responses

- Most candidates stated that ribosomes were responsible for protein synthesis.

Limited responses

- Some candidates gave examples of the production of specific proteins.

(iv) Comprehensive responses

- Most candidates identified image size or image length as the other measurement required.

Limited responses

- A few candidates identified the size or length of the cell rather than the image of the cell.

Question 2

(a) (i) Comprehensive responses

- Many candidates identified the percentage and then completed the calculation, showing their working.

Limited responses

- Some candidates identified a percentage value outside the acceptable range.
- Some candidates did not use the correct formula.

(ii) Comprehensive responses

- Most candidates identified the two correct conclusions.

Limited responses

- Some candidates incorrectly identified that species 2 had a greater rate of photosynthesis than species 1.
- The correct conclusion 'Species 1 has a rate of at least 50 per cent of the maximum over a temperature range of 23 °C.' was not identified by some of the candidates.

(iii) Comprehensive responses

- Most candidates described the effect of temperature on the rate of photosynthesis of species 1 in detail and with reference to values and using correct units.
- Many candidates explained the effect, including reference to kinetic energy of particles and an explanation of denaturation.

Limited responses

- Some candidates described the effect of temperature on the rate of photosynthesis without providing an explanation in their response.
- Common misconceptions included that kinetic energy decreased past the optimum temperature and that enzymes denatured at low temperatures.
- Some candidates needed to refer to denaturation including detail on how the active site changes shape and the effect on formation of enzyme-substrate complexes.
- Some candidates only described the effect of temperature on the rate of photosynthesis above the optimum temperature.

(b)(i) Comprehensive responses

- Many candidates stated the balanced chemical equation for photosynthesis.

Limited responses

- Some candidates gave the equation for respiration rather than photosynthesis.
- Some candidates included carbon dioxide in the products.
- Some candidates did not balance the equation.

(ii) Comprehensive responses

- Most candidates described the role of magnesium in the synthesis of chlorophyll.

Limited responses

- Many candidates did not include the role of chlorophyll in the transfer of light energy to chemical energy.
- Some candidates described the production of chloroplasts instead of chlorophyll.
- Some candidates stated that the leaves without chlorophyll would be yellow and did not describe further why chlorophyll was needed by the plant.

(c) Comprehensive responses

- The role of cellulose and the carbohydrate translocated in the phloem were commonly stated by candidates.

Limited responses

- Some candidates stated amino acids as the carbohydrate translocated in the phloem instead of sucrose.
- Many candidates gave inaccurate functions of starch, sometimes referring to starch as a store of food rather than energy.

Question 3

(a) (i) Comprehensive responses

- Most candidates were able to identify the types of blood vessels in the diagram.

Limited responses

- A few candidates reversed vein and artery.
- A few candidates gave named examples of arteries and veins.

(ii) Comprehensive responses

- Many candidates identified the artery with a label line and the letter P.

Limited responses

- A few candidates did not use a label line, leading to ambiguity in the part they were labelling.
- A few candidates labelled the vein or capillaries.

(iii) Comprehensive responses

- Many candidates were able to explain several structural adaptations of capillaries and how this was related to the exchange of substances in the body.

Limited responses

- Many candidates described the diffusion of blood across the walls of the capillaries rather than nutrients or gases.
- Some candidates referred to capillaries as thin rather than having a thin wall.
- Some candidates referred to a large area rather than a large surface area.
- Some candidates referred to capillaries reaching each part of the body rather than each cell or tissue in the body.
- A few candidates described the lumen of capillaries as being wide rather than narrow.

(b) (i) Comprehensive responses

- Most candidates identified two components of blood in addition to white blood cells.

Limited responses

- A few candidates named examples of white blood cells instead of giving additional components.

(ii) Comprehensive responses

- Many candidates were able to describe the role of lymphocytes and relate this to the production of antibodies and the role of antibodies in protection from infection.

Limited responses

- Some candidates confused the terms antigen and antibodies.
- Some candidates confused the role of the lymphocytes and phagocytes.
- Some candidates attributed the role of antibodies to lymphocytes.

Question 4

(a) (i) Comprehensive responses

- Most candidates were able to identify the cornea.

Limited responses

- Some candidates identified the cornea as the lens or conjunctiva.
- Some candidates identified the iris as the pupil, lens, ciliary muscle or suspensory ligament.

(ii) Comprehensive responses

- Most candidates were able to accurately draw a label line and identify the fovea.

Limited responses

- Some candidates did not use a label line and instead drew an F on the structure, which lead to ambiguity in which structure they were labelling.
- Some candidates labelled the choroid, other parts of the retina or the optic nerve.

(iii) Comprehensive responses

- Many candidates were able to describe the presence of cone cells and their role in colour vision.
- A few candidates were able to describe the number of different types of cone cells and their role in the absorption of different colours of light.

Limited responses

- Many candidates incorrectly stated the presence of rod cells in the fovea.
- A few candidates described the role of cone cells in black and white vision rather than colour vision.

(b)(i) Comprehensive responses

- Many candidates gave detailed descriptions of the changes to the ciliary muscles, suspensory ligaments and lens to cause less refraction of light and enable a distant object to be viewed.
- A few candidates described the focusing of light on the retina.

Limited responses

- Some candidates incorrectly suggested that suspensory ligaments are antagonistic muscles, referring to them as contracting.
- A few candidates described the ciliary muscles as contracting rather than relaxing and the lens as getting thicker rather than thinner.
- A few candidates referred to less light refracted rather than less refraction of light.
- Some candidates described the image, rather than the light, focusing on the retina.

(ii) Comprehensive responses

- Most candidates were able to state the correct term of accommodation.

Limited responses

- A few candidates omitted this question.
- A few candidates incorrectly stated myopia, short-sightedness or long-sightedness.

Question 5

(a)(i) Comprehensive responses

- Most candidates identified the correct male and female eye colour.

Limited responses

- A few candidates needed to be clear about the colours. They identified the male eye colour as white and the female eye colour as red.

(ii) Comprehensive responses

- Most candidates gave the correct term 'homozygous'.

Limited responses

- A few candidates gave the term 'homogenous'.

(iii) Comprehensive responses

- Many candidates were able to give the male and female genotypes and predict the offspring genotypes.

Limited responses

- Most candidates omitted the sex when giving the phenotypic ratio.
- A small number of candidates omitted the sex chromosomes in the Punnett square.

(iv) Comprehensive responses

- Many candidates gave the type of inheritance as 'sex-linked'.

Limited responses

- Common incorrect responses included codominance and monohybrid inheritance.
- A small number of candidates omitted this question.

(b) Comprehensive responses

- Many candidates were able to identify the number of pairs of chromosomes in the fruit fly cells and state the name of the type of cells.
- Many candidates could also describe mitotic cell division.

Limited responses

- Some candidate identified two pairs of chromosomes in the fruit fly cells rather than four.
- Some candidates stated the cell type as daughter, haploid or somatic rather than diploid.
- Some candidates identified the type of cell division as meiosis instead of mitosis.
- Many candidates described the chromosomes as dividing, separating or multiplying instead of doubling or replicating.

Question 6

(a) (i) Comprehensive responses

- Many candidates were able to identify producers from the food web.
- Some candidates were able to identify an organism that only feeds as a secondary consumer.
- Some candidates were able to identify an organism that consumes at three different trophic levels.

Limited responses

- Some candidates identified loach, rainbow trout or daphnia instead of shrimp as the organism that only feeds as a secondary consumer.
- Some candidates identified the bald eagles instead of the rainbow trout as the organism that consumes at three different trophic levels.

(ii) Comprehensive responses

- Many candidates were able to construct a correct food chain from the food web.

Limited responses

- Some candidates included fewer than the required six organisms.
- Some candidates constructed a food web instead of a food chain.
- Some candidates included the incorrect feeding relationships by drawing arrows in the wrong direction.
- Some candidates constructed a pyramid rather than a food chain.
- Some candidates constructed a food chain that included organisms not present in the food web provided.

(iii) Comprehensive responses

- Many candidates gave a feature that was unique only to amphibians.

Limited responses

- Many candidates gave features that although possessed by amphibians, were also seen in other vertebrates including metamorphosis, webbed feet, breathing through lungs and gills, ability to live on land and in water and shell-less eggs.

(iv) Comprehensive responses

- Most candidates were able to explain the effect of harvesting the rainbow trout on the population of bald eagles.

Limited responses

- One misconception was that harvesting the rainbow trout increased their population, so bald eagles would have more to eat and their population would increase.

(v) Comprehensive responses

- Some candidates were able to explain that crop plants were producers and that a shorter food chain would result in less proportion of energy lost through a variety of means including movement and heat.

Limited responses

- Some candidates stated that crop plants contained more energy than rainbow trout without explaining in terms of energy losses along the food chain.
- Some candidates needed to explain how the energy was lost after identifying that energy is lost between the trophic levels.

BIOLOGY

Paper 0610/52 Practical Test

Key messages

What candidates did well:

- Most candidates were able to draw a clear and continuous outline in their diagram of the chilli pepper fruit.
- Most candidates were able to label suitable axes with units when drawing their graph.

What candidates needed to improve:

- Candidates need to ensure that the proportions of the image given in the question paper are represented in their diagram.
- Candidates should ensure that the scale chosen for their graph is appropriate and equidistant.
- Candidates should only consider safety precautions that are relevant to specific hazards, rather than general references such as standing up or wearing lab coats.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Most candidates demonstrated a good understanding of how to calculate the surface area of a cube.

Limited responses

- Some candidates did not multiply the area by the number of faces of the cube.

(ii) Comprehensive responses

- A large number of candidates were able to draw a suitable table of results for the data they collected, including headings for the independent and dependent variables.
- Many candidates were able to record three values for both the independent variable and the dependent variable, with many demonstrating a suitable trend according to their centre data.

Limited responses

- Some candidates put units in the body of the table, not just in the heading.

(iii) Comprehensive responses

- Most candidates were able to provide a suitable conclusion based on their results, with reference to the initial investigation of how the surface area of potato tissue affects the activity of catalase.

Limited responses

- Some candidates simply restated their results without giving a general conclusion for the investigation about how the surface area of potato tissue affects the activity of catalase.

(iv) Comprehensive responses

- Many candidates were able to identify two suitable control variables for the experiment.

Limited responses

- Some candidates did not qualify the control variables.

(v) Comprehensive responses

- The vast majority of candidates wrote a suitable answer for safety. The most common response was the use of a scalpel in cutting the potatoes.

Limited responses

- Some candidates focused on the use of a lab coat, which is not an acceptable safety measure.

(vi) Comprehensive responses

- Many candidates were able to identify possible sources of error with suggested improvements. The most common response was that temperature was not controlled and that they could use a thermostatically controlled water bath.
- A large number of candidates recognised that the foam was uneven and could not be accurately measured, with fewer candidates suggesting a suitable improvement such as measuring the volume of gas collected.

Limited responses

- Some candidates focused on human error in measurement, which is not what the question required.

(b) Comprehensive responses

- It was clear that many of the candidates were familiar with the test for starch.

Limited responses

- Some candidates confused the test for starch with other biochemical tests.

(c) (i) Comprehensive responses

- Many candidates were able to identify the independent and dependent variable.

Limited responses

- The most common error was simply stating time (unqualified) for the dependent variable, rather than qualifying this by stating the time taken for the potato disc to rise.

(ii) Comprehensive responses

- Very few students were able to suggest a suitable control experiment for the investigation, such as boiling the potato discs to denature the enzyme before following the rest of the method.

Limited responses

- The most common responses were identification of the control variables, rather than experimental control.
- Candidates are reminded that a control experiment is used to compare data against to ensure the independent variable was the factor that caused the change in the dependent variable.

(iii) Comprehensive responses

- Many candidates did well with the graphing exercise.

Limited responses

- The most common errors were either in not choosing a scale that allowed the points to take up at least 50% of the available space or for lines that were extrapolated beyond the plotted points.

(iv) Comprehensive responses

- This question required candidates to identify the concentration value from their drawn line of best fit at 80s.

Limited responses

- Candidates should note that they need to clearly show on the graph how they determined the value.

Question 2

(a) (i) Comprehensive responses

- Most candidates made a large drawing of the chilli pepper fruit that was of a suitable size. Candidates mostly used sharp pencils and continuous lines without shading.

Limited responses

- On the picture of the chilli pepper fruit provided, there were five seeds with the 2nd and 3rd seed touching with a pair of seeds touching the septum. It was important that candidates spotted these finer details and drew them with accuracy. The most common error was not providing enough detail on the drawing.

(ii) Comprehensive responses

- Candidates did well with the magnification calculations.

Limited responses

- The most common errors were measuring incorrectly in cm or not providing their answers to three significant figures. This highlights the importance of reading the questions carefully.

(b)(i) Comprehensive responses

- Many candidates were able to recognise the colour change in Benedict's solution.

Limited responses

- A small number of candidates confused this with the biuret test.

(ii) Comprehensive responses

- Many candidates were able to calculate the percentage increase in the sugar content of the ripe chilli pepper fruits.

Limited responses

- Some candidates needed to express their answers to the stated number of decimal places.

Question 3

Comprehensive responses

- Many candidates were able to correctly identify a method for changing windspeed by using a fan on different settings.
- Many candidates were able to accurately describe the use of a potometer to measure the rate of transpiration. The most commonly identified control variables were temperature, surface area of the leaves and the species of plant.

Limited responses

- Candidates and centres should note that simply stating repeat the data is not enough, it needs to be repeated at least two more times to give a total of three measurements. This allows anomalies in the data to be identified.

BIOLOGY

Paper 0610/62 Alternative to Practical

Key messages

What candidates did well

- Most candidates knew the positive results to identify starch and reducing sugars.
- Most candidates could construct a table to present results and take measurements from the experimental data.
- Most candidates could identify appropriate constant variables in investigations.

What candidates needed to improve

- Candidates need to understand the difference between control variables and a control experiment.
- Candidates need to make careful observations of the biological material that they are asked to draw.
- Candidates need to use axes in the correct orientation and use linear scales based on sensible ratios, for example, 2 cm on the graph grid representing 1, 2 or 5 units of the variable.
- Candidates should only consider safety precautions that are relevant to specific hazards, rather than general references such as standing up or wearing lab coats.

Comments on specific questions

Question 1

(a) (i) Comprehensive responses

- Most candidates correctly calculated the total surface area of the eight cubes of potato.

Limited responses

- Common errors included not multiplying the area of one side by six to calculate the surface area of the whole cube or not multiplying by eight to calculate the surface area of all eight cubes.

(ii) Comprehensive responses

- Almost all candidates drew a table with a header and columns that could present the results. Most candidates also recorded measurements of the height of the foam in their tables.

Limited responses

- Many candidates did not give sufficiently detailed titles to their column headings. Other candidates omitted to include units in their headings or gave the wrong units. The most common wrongly recorded unit was to report surface area as cubic centimetres, rather than square centimetres.
- Some candidates included the units in the data cells, rather than the column headings only.
- A small number of candidates were inconsistent in their use of millimetres or centimetres in their measurements of foam height.

(iii) Comprehensive responses

- Many candidates stated an appropriate conclusion for the investigation.

Limited responses

- Some candidates described the relationship between surface area of the potato cubes and the height of the foam, rather than linking this to enzyme activity.

(iv) Comprehensive responses

- Very few candidates gave two correct variables that were kept constant.

Limited responses

- Common incorrect answers included temperature, time that the blocks were put in hydrogen peroxide and the concentration of hydrogen peroxide.

(v) Comprehensive responses

- Most candidates identified a safety precaution for the investigation.

Limited responses

- Some candidates misread the question and described methods to control the variables, rather than a safety hazard.
- Other candidates described how to reduce the risk of a hazard, rather than stating the hazard.

(vi) Comprehensive responses

- Many candidates identified at least one source of error, with the method for measurement of the foam being the most common.
- The second most common correct error was to realise that the potato pieces were left in the hydrogen peroxide for different length of time, although sometimes this error was not described in sufficient detail.

Limited responses

- Fewer candidates gave a suitable improvement to measure the foam. Many candidates suggested an improvement was to avoid the error of parallax whilst taking the measurement, even though the error of parallax is not relevant to a two-dimensional diagram with the meniscus clearly marked.
- The few candidates who realised that temperature and pH were not controlled did well.
- Many candidates suggested improvements that could have been suitable suggestions if the investigation had been carried out in person (for example, cutting cubes of exact dimensions), however the method provided to candidates already described a high level of precision in those steps. This indicated that, while these candidates were familiar with the investigation, they had not carefully read the method provided.

(b) Comprehensive responses

- Almost all candidates knew that the blue-black is the result of a positive test for starch.

(c) (i) Comprehensive responses

- Most candidates correctly identified the independent and dependent variables for this investigation.

Limited responses

- A few candidates stated the independent variable as the dependent variable and vice versa.
- References to the release of gas bubbles or enzyme activity were confused with dependent variable.

(ii) Comprehensive responses

- Only very few candidates realised that denaturing the enzyme by boiling the potato prior to the investigation would be the most appropriate control.

Limited responses

- Many candidates confused controlled variables with a control experiment and listed many of the same points that they had suggested in **Question 1(a)(iv)**.
- Other candidates thought that soaking discs in water, rather than copper sulfate solution would be a control investigation, even though this was the first data point given in Table 1.1.

- Very few candidates realised distilled water could be used as a replacement for hydrogen peroxide as an alternative control experiment. Some candidates wrote vague statements about the use of water, without clearly explaining how it would be used.

(iii) Comprehensive responses

- Most candidates labelled the axes correctly and gave a linear scale that allowed for the plotted points to occupy at least half of the grid.

Limited responses

- Some candidates omitted to include units on their axes' labels.
- A few non-linear scales were seen, with equal spacing between 0 and 0.003, and 0.003 and 0.005 mol per dm³ being the most common error. Another reason for non-linear scales was the incorrect number of zeros after the decimal point on the y-axis.
- Those candidates who used awkward scales often made plotting errors, with (0.003; 45) and (0.025; 190) being the two data points that were plotted inaccurately most often.
- Some candidates used very large dots, rather than crosses or dots in circles for their plots. These large markers often meant that the plotting was inaccurate.
- The most common error was to extrapolate the line.

(iv) Comprehensive responses

- Many candidates determined the concentration of copper sulfate when the discs took 80 s to rise.

Limited responses

- A few candidates did not indicate on their graphs how they made their estimations.
- A small number of candidates made an indication on the graph, with inaccurate interpolation to the axis.

Question 2

(a) (i) Comprehensive responses

- Most candidates drew the chili pepper fruit that was sufficiently large and had a clear, unbroken outline.

Limited responses

- A few candidates shaded their drawings or used sketched lines.
- Other candidates did not make careful observations of structures such as the number and position of the seeds, or the wall of the fruit.

(ii) Comprehensive responses

- Most candidates measured the length of the chili pepper fruit accurately. These candidates often also used their measurement correctly to determine the actual length of the fruit.

Limited responses

- Some candidates did not give their answer to three significant figures.

(b) (i) Comprehensive responses

- Almost all candidates stated the correct positive result for the reducing sugar test.

(ii) Comprehensive responses

- Most candidates calculated the percentage increase in the sugar content of ripe chili pepper fruits.

Limited responses

- Some candidates used the wrong denominator in the calculation.
- Other candidates did not round the answers correct to two decimal places.

Question 3

Comprehensive responses

- Most candidates described suitable variables that they would keep the same during their investigation.
- Candidates also described appropriate methods to change wind speed, with the use of a fan being the most common. Some candidates described using the fan set at different speeds while others described placing the fan at different distances from the plant. Both were suitable methods.

Limited responses

- Some candidates identified windspeed as the independent variable, without outlining a plan that involved using at least two different wind speeds.
- Many candidates identified the need to measure the rate of transpiration, with no explanation of how this would be carried out. Amongst a wide range of different methods, some candidates described strategies that were either incomplete or would not work. For example, where some knew to make a measurement at the end of the investigation, they had not mentioned making a measurement at the start. Others described an investigation that did not include a plant at all.
- Some candidates knew that repeat measurements were necessary, although they did not state how many times to repeat, or they described repeating at different wind speeds. Whilst this is important to the investigation, it would be necessary to also describe repeats at each wind speed.
- It was very common for candidates to describe the need for gloves, goggles and a laboratory coat, even though their methods would not require any of these safety precautions.
- A few candidates included references to conclusions or graph plotting within their plans even though this was not required.