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Examiners' report

BIOLOGY B (ADVANCING BIOLOGY)

H422

For first teaching in 2015

H422/01 Summer 2024 series

Version 1

ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 1 series overview

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• demonstrated knowledge of tissue fluid formation as a result of hydrostatic pressure in Question 7 • understood the roles of bacteria in the nitrogen cycle in Question 25 • evaluated the advantages and disadvantages of fossil and anatomical evidence in classifying species in Question 32 (c) • clearly compared the differences in transcription between eukaryotic cells and prokaryotic cells in Question 35 (a) • Could accurately draw and label the structure of HIV in Question 36 (a) • Could explain the mechanism of competitive inhibition and apply this knowledge to saquinavir in Question 36 (b) (ii).	• had difficulty recalling the process of blood clotting in Question 4 • used incorrect terminology to describe the stages of apoptosis in Question 9 • incorrectly described the stages of how a colorimeter is used in Question 31 (b) (iii) • had difficulty recalling how a biosensor is used to measure blood glucose concentration in Question 31 (c) (ii) • had difficulty comparing the gas exchange mechanism in a leaf to that used in the stem of a plant in Question 33 (a) (ii) • had difficulty calculating heart rate from the ECG trace draw in Question 37 (a) (i).

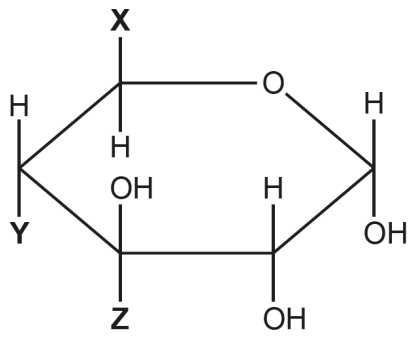
Section A overview

This section of the paper consisted of 30 multiple choice questions covering a range of topics across all modules of the Biology B specification. In general, candidates found all of the multiple choice questions accessible and performed well in this section.

As with previous series, there were a number of candidates that left some multiple choice items blank or gave multiple answers. Candidates are encouraged to state their preferred option clearly. If an alternative answer is given later in the exam the original answer should be crossed out and the new answer clearly written. An answer with two letters was not given credit.

Question 1

1 The diagram shows a molecule of α-glucose.



The table below shows chemical groups **X**, **Y** and **Z** labelled on the diagram.

	Chemical group		
	X	**Y**	**Z**
A	OH	CH_2OH	H
B	CH_2OH	OH	H
C	H	OH	CH_2OH
D	H	CH_2OH	OH

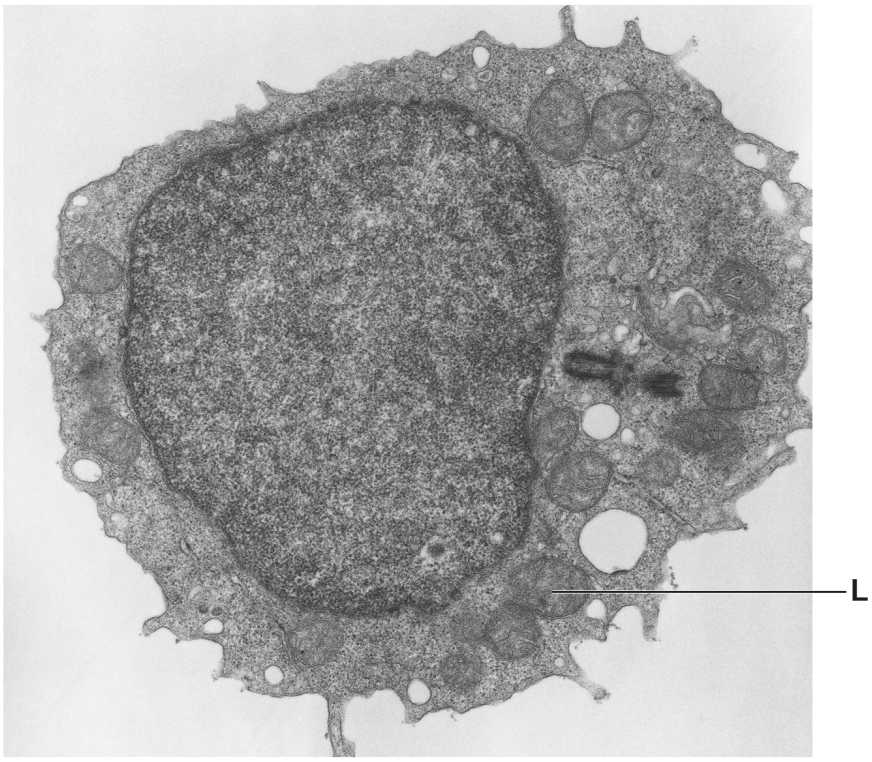
Which of the rows, **A** to **D**, is correct?

Your answer

[1]

Candidates answered this question well. This is likely due to the candidates correctly remembering that carbon-6 forms the CH_2OH group. Some candidates incorrectly stated option C. This mistake was probably caused by the candidates remembering that the CH_2OH group is on the outside of the glucose but mistaking X for Z, the correct answer is option B.

This is an electron micrograph of the ultrastructure of a leucocyte.



Use the electron micrograph to answer questions **2** and **3**.

Question 3

3 What is the role of the organelle labelled **L**?

A Aerobic respiration

B Lipid synthesis

C Protein synthesis

D Transport

Your answer

[1]

Candidates answered this question well. Some candidates incorrectly stated option D. This mistake was probably caused by the candidates thinking that the oval shape was a secretory vesicle. The correct answer is option A.

Assessment for learning

Some candidates could be better prepared for future exams by using electron micrographs more frequently in their revision.

Question 5

5 The following statement describes a feature of the genetic code:

The same codon codes for the same amino acid in almost all species.

Which feature of the genetic code is being described?

A Degenerate

B Non-overlapping

C Triplet

D Universal

Your answer ☐

[1]

Candidates answered this question well. The most common incorrect answer was option A although few candidates made this mistake. The high number of correct answers indicates that candidates understand these key terms very well. The correct answer is option D.

Question 9

9 The sentences below are about the events in apoptosis.

Inside the cell the nucleus shrinks in a process called .....1..... . The cytoskeleton and the nucleus are then broken down and the .....2..... changes to form blebs. The cell fragments are packaged into .....3..... and engulfed by .....4..... .

Which of the rows, **A** to **D**, shows the correct words to complete the sentences?

	1	2	3	4
A	karyorrhexis	cell surface membrane	vesicles	macrophages
B	karyorrhexis	cytoplasm	vacuoles	neutrophils
C	pyknosis	cell surface membrane	vesicles	macrophages
D	pyknosis	cytoplasm	vesicles	neutrophils

Your answer ☐

[1]

Candidates had difficulties with this question. Apoptosis is often a topic that some candidates find easy to understand the concept but they find it difficult to expand on details due to the unfamiliarity of some of the terminology. The most common incorrect answer was option A suggesting that some candidates had a misunderstanding between the terms karyorrhexis and pyknosis. The correct answer is option C.

Misconception

Candidates had a misunderstanding between the terms karyorrhexis and pyknosis.

Question 10

10 Mitosis and meiosis occurs during gametogenesis.

Which of the cells produced during gametogenesis is diploid?

A Ovum

B Secondary oocyte

C Spermatid

D Spermatogonium

Your answer

[1]

Candidates found this question difficult. The most common incorrect answer was option B, secondary oocyte. This is likely to be that candidates have been taught the process well, but they have not fully understood what the terms haploid and diploid mean. The correct answer is option D.

Question 11

11 Hormone replacement therapy (HRT) is used to relieve the symptoms of menopause.

What is **not** an advantage of taking HRT during menopause?

A Preventing hot flushes

B Reduced risk of osteoporosis

C Reduced risk of stroke

D Reduction in mood swings

Your answer

[1]

This question was one of the more challenging multiple choice multiple choice questions on the paper with the whole range of answers being seen. The requirement to state which was **not** an advantage of taking HRT may have been the reason for candidates finding this question difficult. Correct answer C.

Question 14

14 Which of the statements about different respiratory pigments is correct?

A Adult haemoglobin has a higher affinity for oxygen than fetal haemoglobin.

B Myoglobin has a lower affinity for oxygen than adult haemoglobin.

C The dissociation curve of fetal haemoglobin is shifted to the left of the adult haemoglobin curve.

D The dissociation curve of myoglobin is shifted to the right of the adult haemoglobin curve.

Your answer ☐

[1]

Oxygen dissociation curves is often a challenging topic for candidates due to the unfamiliarity of the topic in general, the different pigments that are present (e.g. adult haemoglobin, foetal haemoglobin and myoglobin) and how the affinity for oxygen changes at different partial pressures and different concentrations of CO_2. Correct answer C.

OCR support

The topic exploration packs on 'Oxygen dissociation curves' can be used to support teaching of this topic.

Question 16

16 Which of the following statements about oxidative phosphorylation is/are correct?

1 Electrons passing down electron transport chains release energy for ATP production.

2 It occurs in both chloroplasts and mitochondria.

3 Protons are pumped through ATP synthase to provide energy to phosphorylate ADP.

A 1, 2 and 3 are correct

B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer ☐

[1]

A number of candidates gave the answer as option A. Only a very few candidates believed that option C was correct. Statement 3 is the strongest distractor as protons diffuse through ATP synthase passively meaning options A and C cannot be correct. Statement 2 is also not correct as oxidative phosphorylation does not occur in chloroplast. Option D is correct.

Question 28

28 Which of the options is **not** a method used by antibodies to destroy pathogens?

A Agglutination

B Coagulation

C Neutralisation

D Opsonisation

Your answer ☐

[1]

Candidates answered this question well. The use of terminology relating to immunity was well understood and so it allowed candidates to pick option B as the method not used by antibodies. The correct answer is option B.

Section B overview

This section included questions on a range of topics from across the syllabus. The questions had varying levels of demand and assessed a range of exam skills. Many of the questions were highly structured with varying levels of demand within a topic area.

Question 31 (a)

31 The kidney has a role in the excretion of urea.

(a) Complete the sentences about urea using the most appropriate word(s).

Ammonia is produced when excess amino acids are ..... in the liver. Ammonia is then combined with .... to form urea in a series of reactions called the ..... cycle. Urea is removed from the body in urine.

[3]

Many candidates successfully identified the process of deamination and obtained at least 1 mark on this question. Candidates that achieved 2 marks often were not confident with ornithine cycle. A few candidates were able to obtain all 3 marks.

Question 31 (b) (i)

(b) The composition of urine can be investigated using 'mock' urine samples.

Three 'mock' urine samples were provided to a group of students for analysis. The students were instructed how to test each sample using Combur^{7} Test ® strips.

The test strips were dipped in each urine sample for 3 seconds and then left for 60 seconds. After 60 seconds the resulting colours on each test strip were compared to a reference chart.

The reference chart and the results are shown in **Fig. 31**, **on the Insert**.

(i) Sample **X** was prepared to match the control colours.

Using **Fig. 31** outline how samples **Y** and **Z** were **prepared** to give the results shown by 'mock' urine samples.

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..... **[3]**

This question was well answered. Although, while many candidates referred to the 'addition' of glucose, proteins and erythrocytes, others incorrectly stated that blood was added, rather than erythrocytes.

Question 31 (b) (ii)

(ii) Suggest why it was important to store 'mock' urine sample **Z** at 4 °C.

.....

..... **[1]**

Most candidates correctly mentioned the presence of erythrocytes or the denaturation of proteins/enzymes. The most common incorrect answers focused around preventing the growth of microorganisms. Some incorrect answers mentioned the damage to blood.

Question 31 (b) (iii)

(iii) The students concluded that 'mock' urine sample **Y** represented the urine of a patient with untreated diabetes.

One of the students suggested that a colorimeter could be used to provide evidence to support their conclusion.

Outline how a colorimeter could be used to support the students' conclusion for 'mock' urine sample **Y**.

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..... **[3]**

This question was well answered. Candidates often mentioned the use of Benedict's solution, correctly described the absorbance of light and the production of a calibration curve but rarely considered the quantitative nature of the data. Not very successful answers included over simplified answers such as, 'zero the machine', 'use a filter' and 'plot a curve'.

OCR support

Candidates can use the practice PAG materials in order to help them develop their indirect assessment of practical skills.

Question 31 (c) (i)

(c) Once diagnosed, a patient with diabetes is treated and then monitored by a team of health care professionals.

(i) Explain **one** method of treating **Type 2** diabetes.

.....

.....

.....

.....

..... **[2]**

Most candidates correctly selected a healthy/low sugar diet as a method of treating type 2 diabetes with some also discussing the use of metformin. The most successful answers then linked this to the lowering of blood glucose levels.

Question 31 (c) (ii)

(ii) Explain how a biosensor is used to monitor the effectiveness of diabetes treatments.

.....

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..... **[2]**

Many candidates observed that blood was put in contact with the biosensor (strip). The enzyme, glucose oxidase, was often recalled. Some candidates recalled that gluconolactone was produced due to the action of the enzyme. Only a small number of candidates mentioned that a current produced and could be measured.

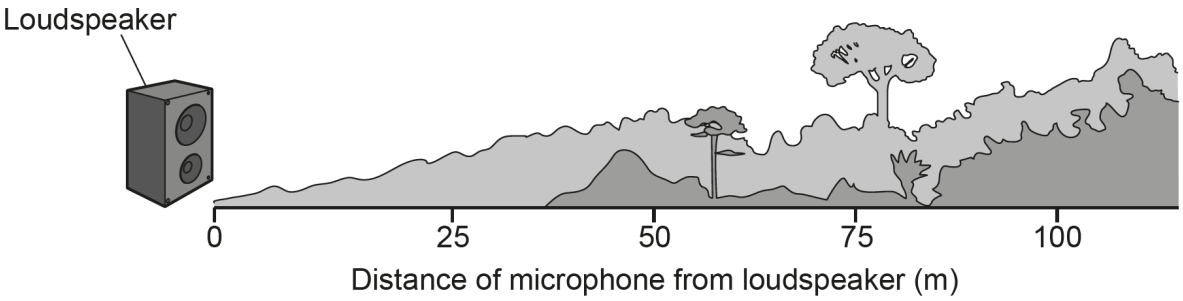
Question 32 (a) (i)

32 Researchers used orangutans to study human language development because they have a complex and developed language system and are the only ape-like species to use consonant and vowel-like sounds when communicating.

(a) In a recent *in vivo* study, calls with either consonant or vowel-like sounds were recorded from individuals from two different species of orangutan.

These recorded calls were then played back from a loudspeaker. A microphone was used to pick up the recordings and measure the loudness of the sounds at increasing distances from the loudspeaker. This is shown in **Fig. 32.1**.

Fig. 32.1



(i) The sound level at 25 m from the loudspeaker was measured at 80 decibels (dB).

The researchers estimated that for every doubling of the distance from the loudspeaker the sound level dropped by 6 dB.

Estimate the sound level recorded at 100 m from the loudspeaker.

Estimated level of sound = ... dB **[1]**

Almost all candidates successfully completed the calculation.

Calculation:

At 25m the sound level was 80dB

At 50m the sound level was 80dB - 6dB = 74dB

At 100m the sound level was 74dB - 6dB = 68 dB

Question 32 (a) (ii)

(ii) State **one** advantage and **one** disadvantage of completing this study *in vivo*.

Advantage .....

.....

Disadvantage .....

.....

[2]

Many candidates correctly referred to the advantage of the natural environment but few candidates included the impact of the forest on the transmission of sound. The most incorrect answer given was that the sounds of the forest would 'drown out' the sound produced by the speaker. The placing of equipment was rarely seen.

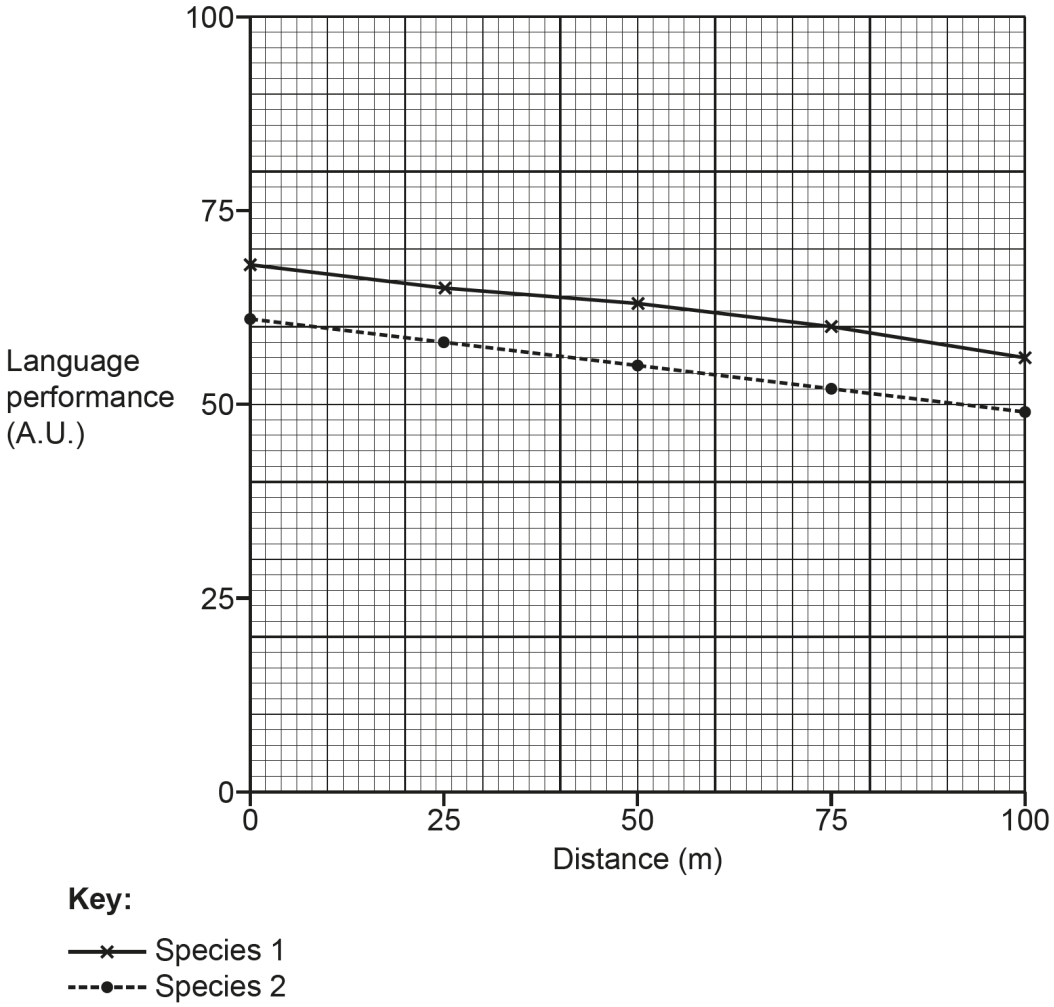
Question 32 (b) (i)

(b) Even though sound levels decrease with distance, the language may still be understood.

Language performance indicates how well the language is understood over distance.

Fig. 32.2 shows some of the data for language performance from the study.

Fig. 32.2



(i) Calculate the percentage loss in language performance for **Species 1** over 100 m.

Percentage loss = ... % **[2]**

Many candidates obtained the correct percentage loss. Some obtained 1 mark for incorrect rounding of the value. Candidates that scored 0 marks often used the wrong values from the graph.

Calculation:

Reading from graph at 0m for Species 1 = 68

Reading from graph at 100m for Species 1 = 56

percentage change = ((new quantity – original quantity)/ original quantity) × 100

percentage change = ((56-68)/68) x 100

percentage change = 17.6 % = 18% (recording answer to 2 sig figs by using the least number of significant figures used in the calculations)

OCR support

Maths for Biology resources offer support on all the maths skills required for A level Biology. These can be accessed on Teach Cambridge.

Question 32 (b) (ii)

(ii) From the data in **Fig. 32.2** the researchers concluded:

Orangutans are able to communicate with each other over long distances.

Discuss the validity of this conclusion.

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..... **[3]**

Many candidates correctly gave a statement in support of 'valid' with the idea that there was only a small percentage loss being the most common correct answer. Correct 'invalid' statements were seen less frequently. Only a small number of candidates mentioned the limitation of two species being used.

Question 32 (c)*

(c)* The orangutan species in the study and human species, *Homo sapiens*, are classified as belonging to the Hominidae family. They evolved from a common ancestor.

Evaluate the use of fossil and anatomical evidence for classifying members of the Hominidae family.

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..... **[6]**

This was a challenging extended response (LoR) question to achieve level 3. There was a tendency for candidates to focus on only positive or negative aspects meaning the answer was limited to level 2. A number of candidates that did give both positive and negative statements did so but only for fossils.

The best answers were structured using positive and negative subheadings for both fossils and anatomical evidence.

Exemplar 1

Fossil: this type of evidence can be traced back using carbon dating to indicate how old a species is and where the ~~common ancestor~~ different species evolved from the common ancestor. However, this evidence can be seen as unreliable because this is more indicative of brain size and intelligence and not common ancestors.

Anatomical: this evidence can show how a species used to look and similarities and differences in the anatomy/skeleton of species. The homo sapien skeleton can be compared with the orangutan skeleton to show their similarities which classify them in the Hominidae family. However this only considers physical similarities and differences and not anything to do with DNA or genetics. a species can look physically similar to another without being closely related. [6]

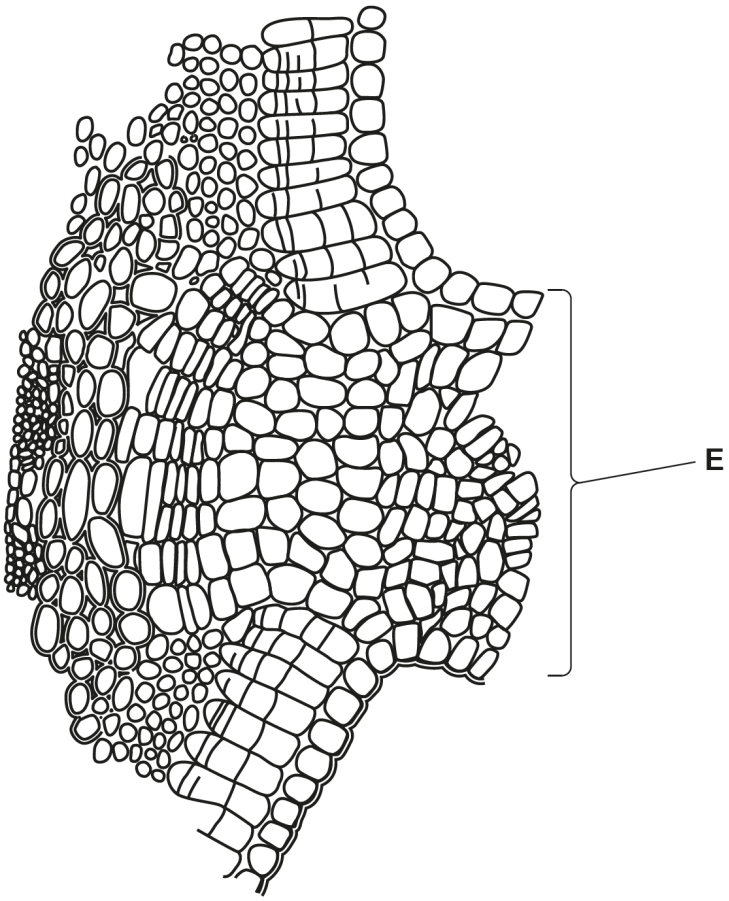
Extra answer space if required.

Many candidates answered this question well by splitting their answer into 2 sections, 'Fossil' and 'anatomical' evidence, like in this exemplar. Some candidates went further and split 'fossil' and 'anatomical' into two further sections giving pros and cons of each. Candidates that included both fossil and anatomical evidence with pros and cons could access level 3 marks. In this exemplar, there is no incorrect science and so the candidate scored 6 marks.

Question 33 (a) (i)

33 A student observes a microscope slide of a section through the woody stem of a plant.

(a) A diagram drawn by the student from their observations is shown below. The structure where gas exchange takes place in the stem is labelled **E**.



(i) Name the structure labelled **E**.

..... **[1]**

Relatively few candidates selected lenticels. Other features of plant tissues and cells were given as answer, e.g. mesophyll cells, guard cells and pits. Lenticel was often spelled incorrectly but phonetic spelling was allowed.

OCR support

A common mistake was that candidates could not identify lenticels in the question and some found it difficult to compare them to stomata. Support is available for this at Teach Cambridge:

Delivery guide (2.2.3) Gas exchange in mammals and plants.pdf

Question 33 (a) (ii)

(ii) Compare gas exchange in this part of the stem with gas exchange in the underside of a leaf.

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..... **[3]**

Many candidates achieved all 3 marks by stating the presence of stomata, with the use of guard cells to open/close. Some candidates also noted that the rate of gaseous exchange was greater on the underside of the leaf. Low scoring answers often gained credit for a correct point about stomata and then gave the converse answer about lenticels, e.g. stomata can open/close but lenticels do not open/close.

Question 33 (b)

(b) The structures labelled **E** can also be found on the surface of fruit such as apples.

The mean number of these structures found on a variety of apple was calculated at 1.2 per cm^2 of surface.

The variety of apple has a mean diameter of 9 cm.

Calculate the mean number of these structures found on one apple.

Assume the apples are spherical and use the equation:

Surface area of a sphere = $4\pi r^2$

Mean = ... **[2]**

A number of candidates successfully completed the calculation. Some were limited to 1 mark for providing the correct value of surface area ($254.5cm^3$), but not the correct final answer.

Calculation:

Radius of the apple = 9/2 = 4.5 cm

Surface area of the apple = $4\pi r^2 = 4\pi(4.5)^2$

Surface area of the apple= $254.5cm^2$

Number of lenticels per $1cm^2$ = 1.2

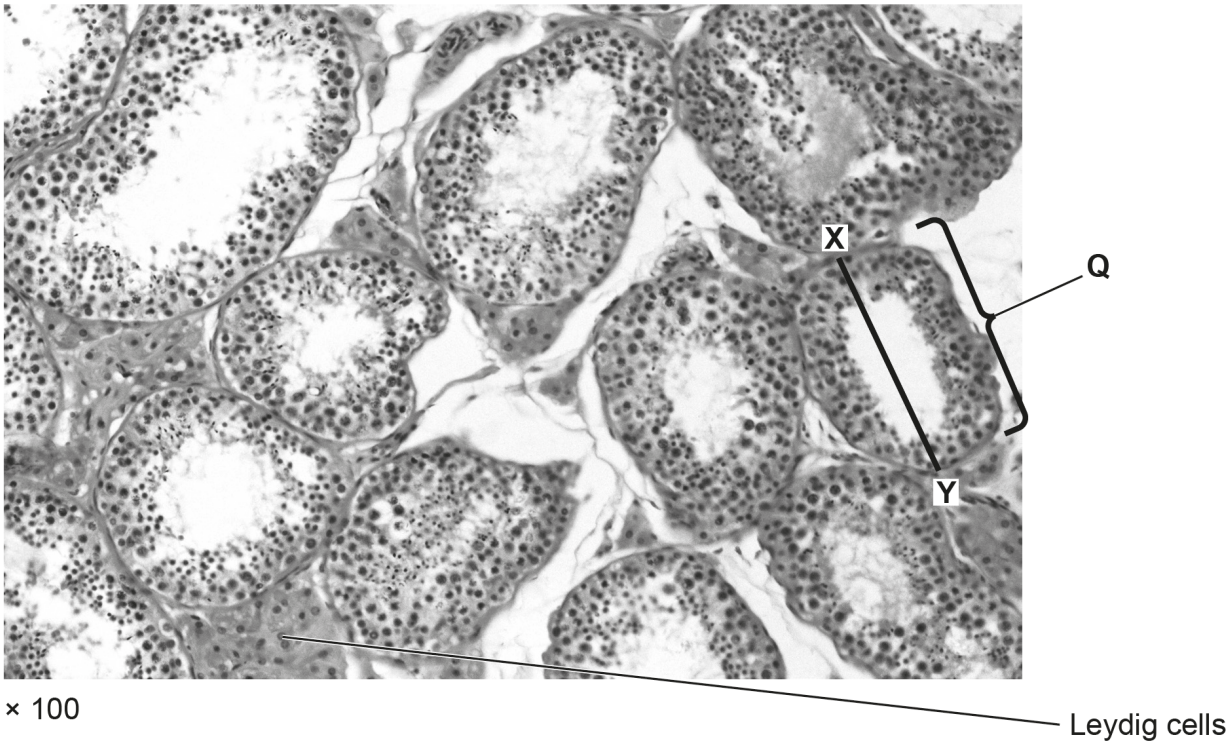
Number of lenticels on the apple = 254.5 x 1.2 = 305.4024… = 305

Question 34 (a) (i)

34

(a) **Fig. 34.1** is a photomicrograph of tissues in a human testis.

Fig. 34.1



Spermatogenesis takes place in the part of the testis labelled **Q**.

(i) Identify the part of the testis labelled **Q**.

..... **[1]**

Many candidates correctly named the structure as the seminiferous tubule. The most common incorrect answer was spermatid and sperm duct.

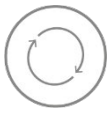
Question 34 (a) (ii)

(ii) Calculate the actual length of **Q** between points **X** and **Y**.

Actual length = ... μm **[2]**

A number of candidates successfully completed the calculation. Some included the incorrect power in their calculation and so, were limited to 1 mark (e.g. 30μm).

Assessment for learning



It can be good to allow the candidates to practice magnification calculations on a regular basis and develop an understanding of powers. This can be used to help meet the maths skill M0.5 and M1.8.

Question 34 (a) (iii)

(iii) State the role of Leydig cells labelled on **Fig. 34.1**.

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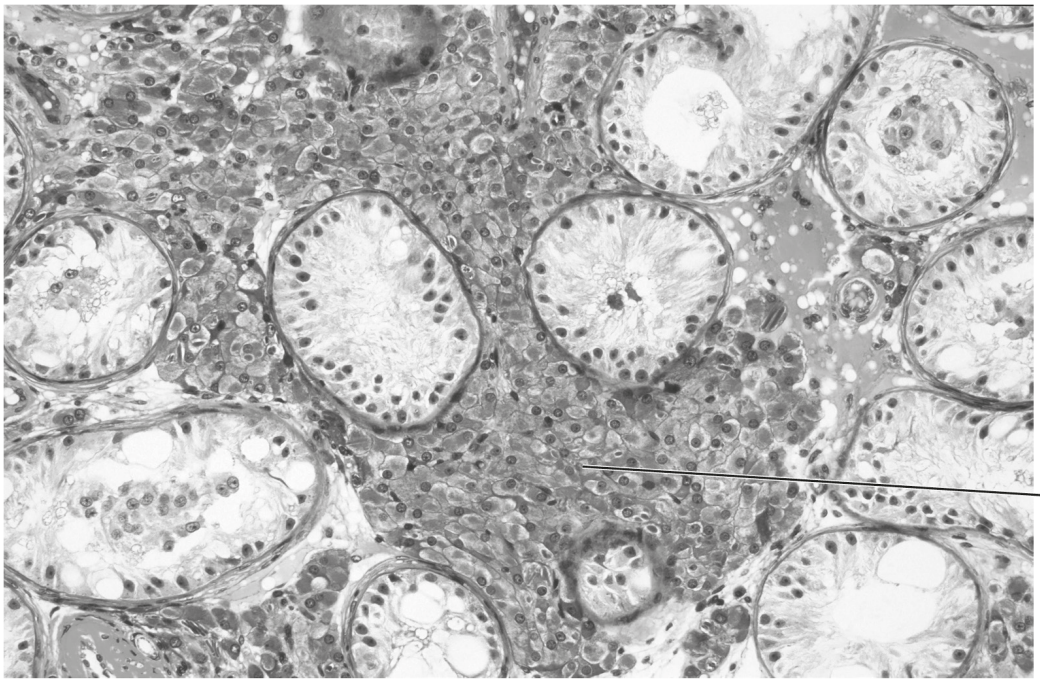
..... **[1]**

Many candidates stated the secretion/production of testosterone. Some incorrectly suggested that the Leydig cells were the site of sperm production/maturation. Some candidates gave no answer or gave the role of Leydig cells as the production of luteinizing hormone.

Question 34 (b)

(b) **Fig. 34.2** is a photomicrograph of the same tissues in a testis from a patient with infertility.

Fig. 34.2



× 100

Use **Fig. 34.1** and **Fig. 34.2** to explain reasons for the patient's infertility.

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..... **[3]**

This question was often answered well, with many candidates referring to more Leydig cells, low sperm numbers and fewer Sertoli cells in order to gain all 3 marks.

Question 34 (c)

(c) Most forms of infertility can be treated.

Describe the most appropriate treatment method that could be used for couples in each of the following cases:

The man produces sperm, but his sperm ducts are blocked

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Sperm and oocytes are produced but fertilisation does not occur

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[4]

Candidate responses were often well developed with many obtaining 3 or more marks. The retrieval of sperm, ICSI and the fertilisation in the lab were the most frequent answers. Common mistakes included the retrieval of sperm directly from the testis and the retrieval of semen.

Question 34 (d)

(d) Explain the importance of spermatogenesis to the process of fertilisation.

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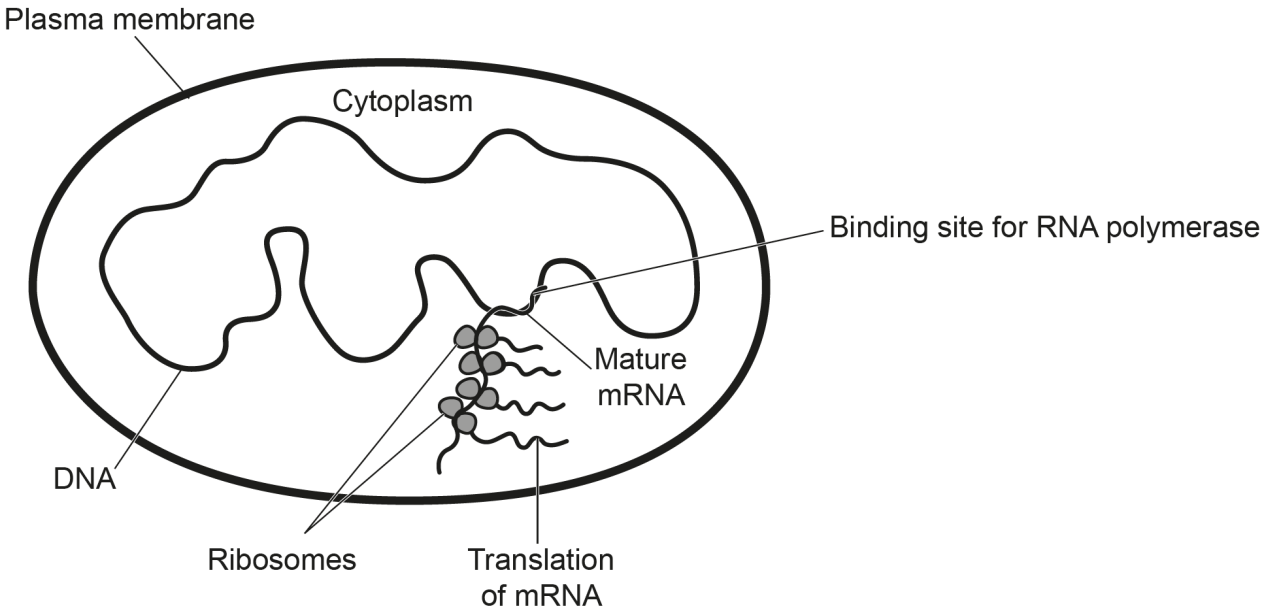
..... **[3]**

Many candidates were confident with this topic. Knowledge of spermatogenesis and the production of haploid sperm was often seen. The idea that the diploid number is restored was accurately discussed. Relatively few candidates considered the prevention of chromosome number doubling.

Question 35 (a)*

35 Transcription is the process of producing mRNA using a strand of DNA as a template.

The diagram shows a prokaryotic cell producing mature mRNA.



(a)* Compare transcription in the prokaryotic cell with transcription in a human cell.

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..... **[6]**

Many candidates had good understanding of the terminology involved. There was a tendency by some candidates to refer mostly to one of the cell types and mention the other to a lesser extent. However, many obtained marks at Level 2 or above.

Exemplar 2

~~Transcription in a human cell involves unwinding the double stranded DNA using DNA helicase to break H-Bonds. But in the prokaryotic cell the DNA remains~~

DNA in transcription of prokaryote is cyclical whereas in human cells it has a 5' caps and 3' poly-a tails.

Both cells use RNA polymerase to form phosphodiester bonds between nucleotides, in transcription.

In human cells mRNA leave the nucleus via the nuclear pore after transcription (to the rough endoplasmic reticulum for translation) however, in prokaryotic cells the mRNA ~~remains at the~~ is translated at the same time as being transcribed.

RNA polymerase forms Hydrogen bonds with complementary base in both cells.

~~Both~~ Transcription ~~does~~ occurs in the nucleus ~~of~~ in human cells but just occurs in cytoplasm in prokaryotes.

In both prokaryotic cells and human cells splicing occurs to remove introns and form mature mRNA.

This question posed some candidates difficulty as they only described transcription in either eukaryotes or prokaryotes. In this exemplary it can be seen that the candidate gave statements showing similarities and differences between transcription in eukaryotes and prokaryotes allowing the candidate to access Level 3 marks. However, incorrect science at the start of the answer limited this candidate to five marks.

Question 35 (b)

(b) RNA interference (RNAi) is used by many organisms to control genes.

Two forms of RNA, microRNA (miRNA) and small interfering RNA (siRNA), are involved in the different mechanisms of RNAi.

The table shows statements about the different mechanisms of RNAi.

Complete the table to show whether each statement is **True (T)** or **False (F)**.

Statement	**True (T) or False (F)**
Argonaute proteins allow miRNA to bind to many different mRNA molecules.	
miRNA and siRNA are both derived from double-stranded RNA molecules.	
siRNA binds to a specific sequence of complementary DNA nucleotides which allows the Argonaute protein to bind.	

[3]

A number of candidates found this question challenging. Some candidates provided the incorrect response for all three rows but others were more confident and, at least, recognised that the second statement was true.

Misconception

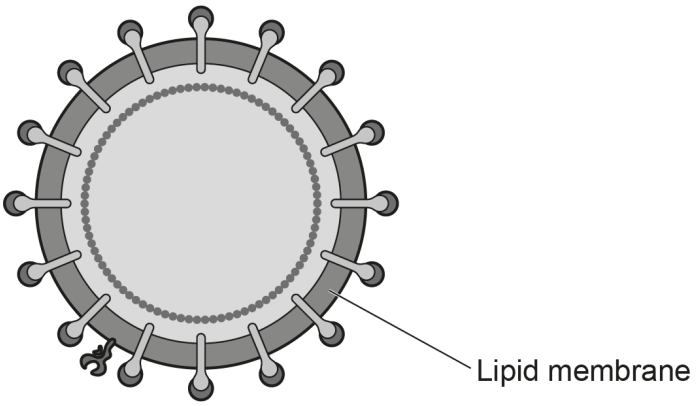
The most common misconception was around the roles of argonaute proteins and siRNA.

Support on this topic is available in the Delivery Guide on Genes technologies.

Question 36 (a)

36 A student was making revision notes about the human immunodeficiency virus (HIV).

This is the labelled diagram they started to draw to show the structure of HIV.



(a) Complete the student's diagram including labels to show the main components in the structure of HIV. **[3]**

Candidates struggled to draw the inner core correctly. The RNA molecule was often drawn in a circular format and the capsid was often missed off. Commonly seen correct labels included RNA and reverse transcriptase plus 'outer' structures such as glycoprotein or antigen.

Question 36 (b) (i)

(b) Saquinavir is used in the treatment of HIV infections.

Saquinavir is a competitive inhibitor of an HIV protease enzyme that breaks down large proteins into smaller polypeptides.

Treatment with saquinavir leads to the formation of non-functional, immature and non-infectious HIV viruses.

(i) Explain how HIV protease enzymes are produced when the virus infects a host cell.

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..... **[2]**

Many candidates were familiar with this series of events and obtained full marks. The only frequent mistake included referring to RNA and DNA as 'genetic material' throughout.

Question 36 (b) (ii)

(ii) Explain the mechanism of inhibition by which saquinavir affects the activity of HIV protease enzymes.

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..... **[3]**

The action of a competitive inhibitor was well understood by many candidates, with particular reference to saquinavir binding to the active site, blocking of the substrate and inability of the enzyme and substrate to then form the enzyme-substrate complex. A number of candidates explained the action of non-competitive inhibitors and as a result often limited themselves to only 1 mark.

Question 36 (b) (iii)

(iii) Suggest how treatment with saquinavir leads to non-functional, immature and non-infectious HIV viruses.

.....

.....

.....

.....

..... **[2]**

The first two marking points were generally included in the response (for 2 marks) but very few candidates noted that the small polypeptides are needed to form the protein coat.

Question 36 (c) (i)

(c) HIV causes acquired immunodeficiency syndrome (AIDS).

The World Health Organization is involved in attempts to control and prevent AIDS.

(i) Explain what the term **syndrome** means, using AIDS as an example.

.....

.....

.....

.....

..... **[2]**

The concept of a syndrome was often well-explained, in relation to a collection of symptoms. Some candidates repeated part of the stem of the question in their response and struggled to provide extra, creditworthy statements. Many candidates did not refer to AIDS as an example.

Question 36 (c) (ii)

(ii) State **two** ways the spread of AIDS can be controlled.

1 .....

2 .....

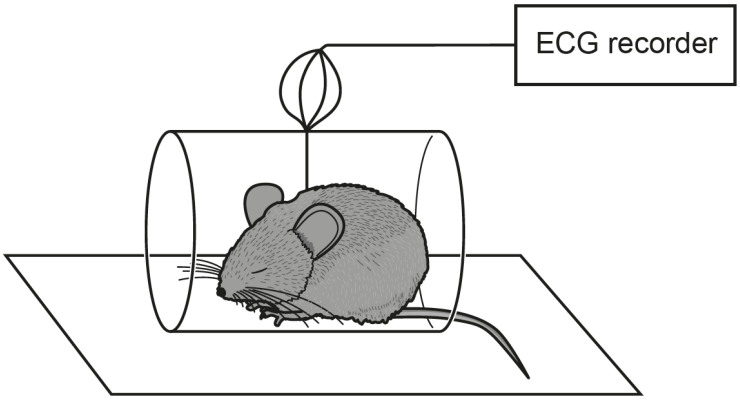
[2]

This question was very accessible for most candidates. Many correctly mentioned the use of condoms and clean needles.

Question 37 (a) (i)

37 Researchers often use mice to study the circulatory system.

(a) One group of researchers studied the effect of different anaesthetics on the heart rate of mice. They measured the heart rate of the mice using the electrocardiography (ECG) method below.



1. Gently place a conscious mouse (no anaesthetic) inside a tunnel mounted on a platform connected to an ECG recorder.
2. Ensure the paws are in contact with the electrodes on the platform.
3. Turn on the system and record the ECG for 5 minutes.
4. Use the ECG trace to calculate heart rate.
5. Repeat the procedure using mice sedated with different anaesthetics.

The table shows analysis of the data.

	Anaesthetic used to sedate mouse			
	None	**Ketamine**	**Isoflurane**	**Pentobarbital**
Heart rate (bpm)	590	148	440	

(i) The ECG trace for the mouse sedated with pentobarbital is shown below.

Calculate the heart rate of the mouse sedated with pentobarbital.

Heart rate = ... bpm **[2]**

Many candidates were confident with the calculation, but some struggled to accurately extract data from the graph. Others were limited to 1 mark because they did not give their answer as a whole number.

Question 37 (a) (ii)

(ii) Explain **one** modification to the method that would reduce the effect of random error on the results.

.....

.....

.....

.....

..... **[2]**

This question was accessible to many candidates. The most common answers described repeating the experiment three or more times and obtaining a mean value. Many also continued their answer and referred to the recognition of anomalies.

Question 37 (a) (iii)

(iii) The researchers concluded:

When using mice for cardiology studies it would be better to sedate them with isoflurane rather than them being conscious.

Suggest **one** supporting argument and **one** non-supporting argument for this conclusion.

Supporting .....

.....

Non-supporting .....

.....

[2]

Many candidates obtained both marks. Most of the candidates observed that the heart rate is not reduced as much with isoflurane as it is with other anaesthetics. The most common correct answer given by candidates for non-supporting was reference to ethical concerns.

Question 37 (b)

(b) In humans, the circulatory system is affected by aerobic exercise.

Outline the effects of long-term aerobic exercise on the circulatory system.

.....

.....

.....

.....

.....

..... **[3]**

This topic was well answered by many candidates. Candidates had a good appreciation of features such as increased VO_2 max., enlarged heart, decreased resting heart rate, increased stroke volume and an increase in the erythrocyte number. Some candidates used only basic terminology in their descriptions such as stronger heart while others did not refer to 'resting' heart rates.

Exemplar 3

- Increased heart size
- Increased stroke volume
- Increased number of red blood cells in the body
- Decreased resting heart rate

The best candidate answers to this question clearly listed or bullet pointed the effects of long-term exercise. In this example it is very clear that the candidate gave 3 correct answers, and the final bullet point is also a correct answer.

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