

T Level Technical Qualification in Health

Core knowledge and understanding

Paper B

Mark scheme

This mark scheme has been written by the assessment writer and refined, alongside the relevant questions, by a panel of subject experts through the external assessment writing process and at standardisation meetings.

The purpose of this mark scheme is to give you:

- examples and criteria of the types of response expected from a student
- information on how individual marks are to be awarded
- the allocated assessment objective(s) and total mark for each question.

Marking guidelines

General guidelines

You must apply the following marking guidelines to all marking undertaken throughout the marking period. This is to ensure fairness to all students, who must receive the same treatment. You must mark the first student in exactly the same way as you mark the last.

- The mark scheme must be referred to throughout the marking period and applied consistently; do not change your approach to marking once you have been standardised.
- Reward students positively giving credit for what they have shown, rather than what they might have omitted.
- Utilise the whole mark range and always award full marks when the response merits them.
- Be prepared to award zero marks if the student's response has no creditworthy material.
- Do not credit irrelevant material that does not answer the question, no matter how impressive the response might be.
- The marks awarded for each response should be clearly and legibly recorded in the grid on the front of the question paper.
- If you are in any doubt about the application of the mark scheme, you must consult with your team leader or the chief examiner.

Guidelines for using extended-response marking grids

Extended-response marking grids have been designed to assess students' work holistically. They consist of bands-based descriptors and indicative content.

Bands-based descriptors: each band is made up of several descriptors for across the AO range, AO1 to AO3, which, when combined, provide the quality of response that a student needs to demonstrate. Each band-based descriptor is worth varying marks.

The grids are broken down into bands, with each band having an associated descriptor indicating the performance at that band. You should determine the band before determining the mark.

Indicative content reflects content-related points that a student may make but is not an exhaustive list. Nor is it a model answer. Students may make all, some or none of the points included in the indicative content as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

Application of extended-response marking grids

When determining a band, you should use a bottom-up approach. If the response meets all the descriptors in the lowest band, you should move to the next one, and so on, until the response matches the band descriptor. Remember to look at the overall quality of the response and reward students positively, rather than focussing on small omissions. If the response covers aspects at different bands, you should use a best-fit approach at this stage and use the available marks within the band to credit the response appropriately.

When determining a mark, your decision should be based on the quality of the response in relation to the descriptors. You must also consider the relative weightings of the assessment objectives, so as not to over / under credit a response. Standardisation materials, marked by the chief examiner, will help you with determining a mark. You will be able to use exemplar student responses to compare to live responses, to decide if it is the same, better or worse.

You are reminded that the indicative content provided under the marking grid is there as a guide and therefore you must credit other suitable responses a student may produce. It is not a requirement either that students must cover all the indicative content to be awarded full marks.

Assessment objectives

This assessment requires students to:

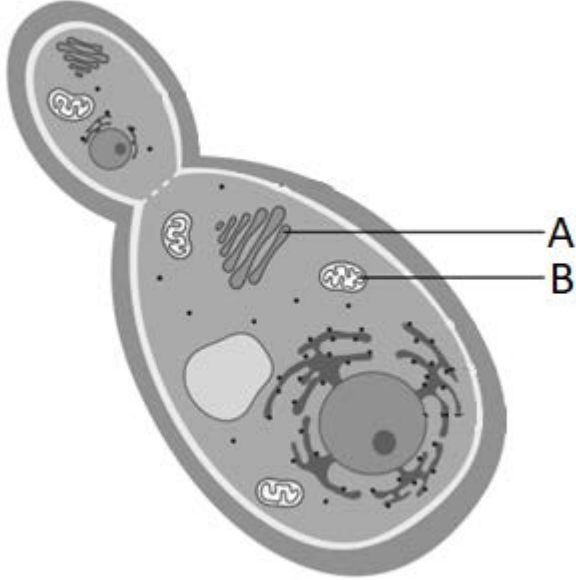
- AO1: Demonstrate knowledge and understanding of contexts, concepts, theories and principles in healthcare.
- AO2: Apply knowledge and understanding of contexts, concepts, theories and principles in healthcare to different situations and contexts.
- AO3: Analyse and evaluate information and issues related to contexts, concepts, theories and principles in healthcare to make informed judgements, draw conclusions and address individual needs.

The weightings of each assessment objective can be found in the qualification specification.

Section A: body systems 1

This section is worth 35 marks, plus 6 marks for the quality of written communication (QWC) and use of specialist terminology.

1



The diagram shows a cross-section of a eukaryotic cell. It contains a large nucleus with a nucleolus, surrounded by rough endoplasmic reticulum. Other organelles include mitochondria, lysosomes, and a Golgi apparatus. Label A points to the Golgi apparatus, and label B points to a mitochondrion. A large grey checkmark is visible on the right side of the diagram.

Figure 1 **Structure of the microorganism**

(a) Referring to Figure 1, name the organelle labelled A found within this eukaryotic cell.

[1 mark]

AO1 = 1 mark

Award **one** mark for correctly naming organelle A, up to a maximum of one mark:

A = Golgi body / apparatus

Qualification specification reference

B1.3

(b) Referring to Figure 1, what is the function of the organelle labelled B?

[1 mark]

AO1 = 1 mark

Award **one** mark for the following:

- respiration (1).

Qualification specification reference

B1.3

2 A baby has the following symptoms following a children's birthday party at a small indoor soft play area:

- white spots in the inner cheeks
- white coating on the tongue
- some difficulty feeding.

A total of 35 children were in attendance throughout the day, where children shared the same play area, toys and eating area.

What is the likely cause of the illness in the baby?

[1 mark]

AO2 = 1 mark

Award **one** mark for one of the following:

- lack of social distancing in the children at the party (1)
- inadequate sanitation of equipment and play areas (1).

Accept any other suitable response.

Qualification specification reference

B1.17

3 Identify one of the two stages of the body's response to injury.

[1 mark]

AO1 = 1 mark

Award **one** mark for an identified stage, up to a maximum of **one** mark:

- involuntary inflammatory response (1) Note: Do not accept inflammation unqualified
- proliferation stage (1).

Accept any other suitable response.

Qualification specification reference

B1.23

4 A runner wants to run a marathon without stopping for drinks. A friend warns against it due to hot weather and advises them to drink water to replenish lost nutrients, prevent overheating and keep muscles working.

Evaluate the friend's advice.

[6 marks]

AO3 = 6 marks

Award **one** mark for each valid evaluative point, up to a **maximum** of six marks.

Answers should reflect the importance of following the advice and stopping for drinks because of increased fluid loss / heat production and can include:

- Sustained running can increase fluid loss through increased breathing rate, which can lead to dehydration if the runner does not drink enough (1). While drinking water can prevent dehydration, it does not replenish the nutrients lost through sweat, which is important for preventing muscle cramps and fatigue (1). The friend's advice is correct in preventing dehydration, but it is better to drink a combination of water and electrolyte drinks to maintain electrolyte balance (1). This will likely help the marathon runner to complete in a good time as there is less chance of cramps and fatigue (1). The marathon runner could also consume carbohydrates during the marathon, which may also provide the energy needed for muscle contraction as another option (1). Therefore, it is important to stay hydrated but also to maintain electrolyte balance during a marathon (1). The friend is right in advising the runner to drink enough water to prevent overheating during a marathon (1). Overheating can affect enzyme behaviour and alter electrolyte levels, which would have negative impacts on normal cellular behaviour such as that of neurons, cardiac cells and muscles (1). However, the runner should be careful not to drink too much water, as it could lead to bloating and stomach cramps, which could hinder their performance (1). It is important to strike a balance between drinking enough water to prevent overheating and not drinking too much that it leads to discomfort (1). Drinking water in small, regular sips

can prevent bloating and cramps (1). Therefore, the runner should drink water in moderation, paying attention to body signals during the marathon (1).

Accept any other suitable response.

Qualification specification reference

B2.21

5 Spirometry is a simple way to test how well air can be moved into and out of the lungs.

The total volume exhaled indicates the functional size of the lungs.

Figure 2 shows the volume–time curves for two patients in comparison to a normal curve.

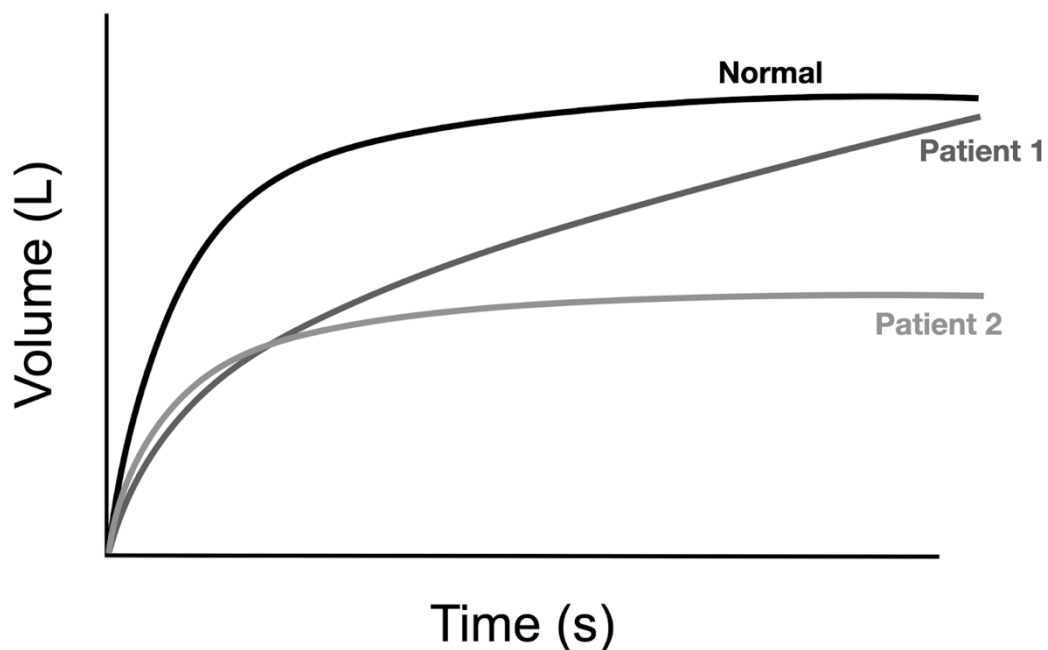


Figure 2 Volume-time curves for two pulmonology patients in comparison to a normal curve

One patient has chronic obstructive pulmonary disease (COPD). The other patient has pulmonary fibrosis, which is a restrictive disorder caused by scarring of the lungs that limits the volume the lungs can expand to.

Referring to Figure 2, identify which patient has COPD and explain one piece of evidence to support your decision.

[3 marks]

AO2 = 1 mark

Award **one** mark for a correct identification, up to a maximum of **one** mark:

- patient 1 has COPD (1).

Note: Award converse that identifies that patient 2 could not have an obstructive lung condition

AO2 = 2 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- at the start of the exhale, patient 1's volume is much lower than normal, which suggests it is more difficult to get the air out of their lungs (1) / which is seen in obstructive lung conditions (1) / which is seen in COPD
- at the end of the exhale, patient 1's volume is close to normal, which suggests their lung volume is not much reduced (1) / which is seen in obstructive lung conditions (1) / which is seen in COPD (1) / and COPD patients exhibit increases in lung volume (1).

Note: Award converse that explains why patient 2 could not have an obstructive lung condition

Accept any other suitable response.

Qualification specification reference

B2.8, B2.10

6	<p>A patient has been a heavy smoker for a long time. They have been diagnosed with COPD, which causes shortness of breath and coughing especially when active. They use an inhaler but struggle with the build-up of mucus making it difficult to breathe. The doctor decides to prescribe them with some mucus-thinning medication.</p> <p>Explain one reason why mucus-thinning medication may be prescribed.</p> <p style="text-align: right;">[2 marks]</p>
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AO2 = 2 marks

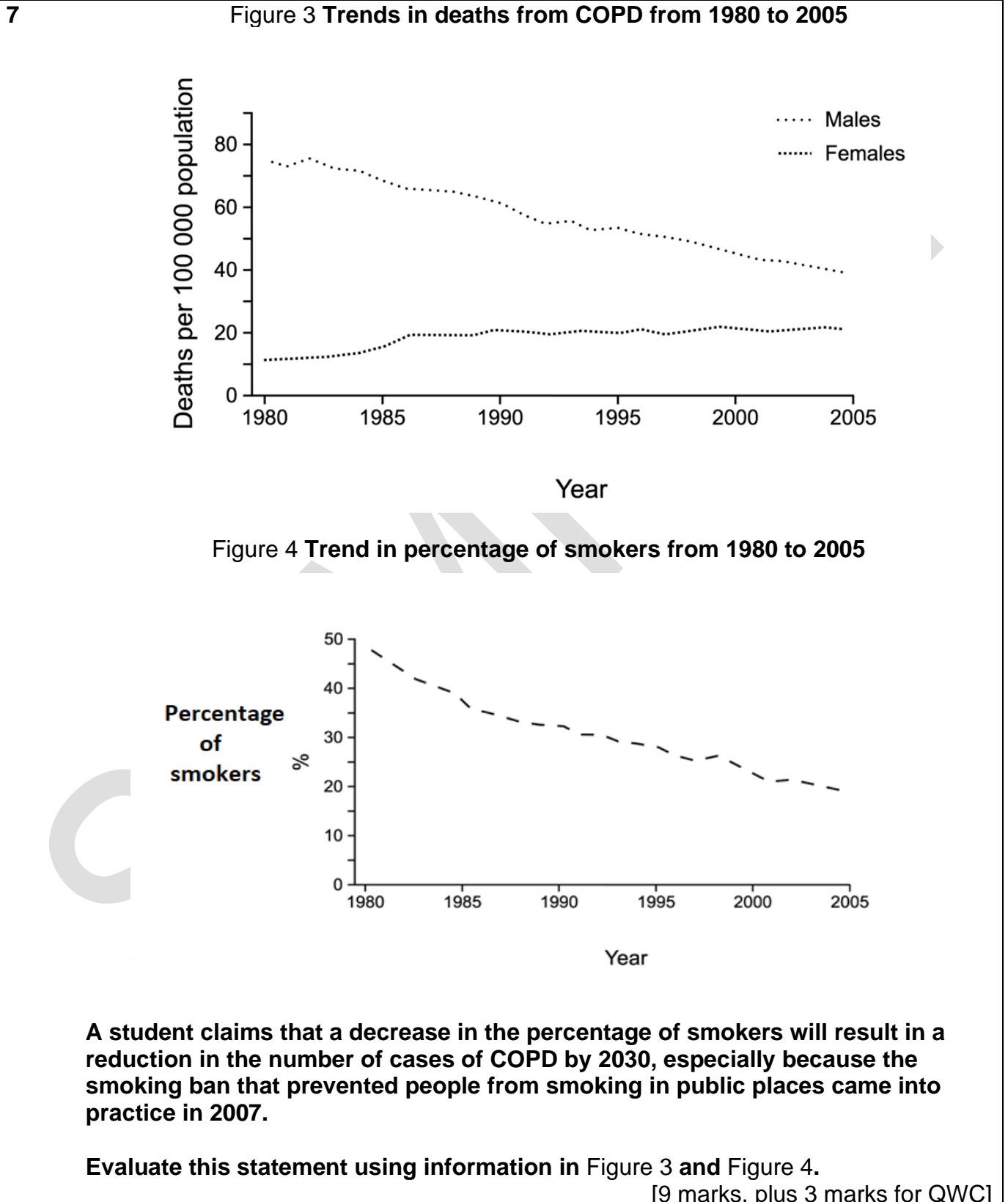
Award **one** mark for each explanation, up to a maximum of **two** marks:

- mucus-thinning medication will break down mucus so that it is thinner / more runny; this would improve the transport of mucus (1) and facilitate its removal from the lungs (1)
- improved clearance of mucus from the lungs can prevent mucus plugging of small airways and may improve gas exchange (1), which would allow more oxygen into the blood (1)
- mucus-thinning medication may break up the mucus making it easier to cough up and clear from the airways (1), which would help the patient to breathe more easily / reduce symptoms such as shortness of breath (1).

Accept any other suitable response

Qualification specification reference

B2.10



AO1 = 3 marks
AO2 = 3 marks
AO3 = 3 marks
QWC = 3 marks

Qualification specification reference

B2.8, B2.10

Band	Mark	Descriptor
3	7–9	<p>AO3 – Evaluation of the graph and statement is comprehensive, effective and relevant, showing logical and coherent chains of reasoning throughout.</p> <p>Fully accurate conclusions that are fully supported with rational and balanced judgements, with a full range of the relevant arguments.</p> <p>AO2 – Applied relevant data and knowledge of COPD.</p> <p>AO1 – A wide range of relevant knowledge and understanding that is accurate and detailed.</p>
2	4–6	<p>AO3 – Evaluation of the graph and statement is in most parts effective and in most parts relevant, showing in most parts logical and coherent chains of reasoning.</p> <p>Mostly accurate conclusions supported by mostly relevant judgements that consider a range of the relevant arguments.</p> <p>AO2 – Applied mostly relevant data and knowledge of COPD.</p> <p>AO1 – Knowledge and understanding is in most parts clear and in most parts accurate, although on occasion may lose focus.</p>
1	1–3	<p>AO3 – Evaluation of the graph and statement is in some parts effective and has some limited relevance, with some reasoning taking the form of generic statements that include some development.</p> <p>Brief conclusions supported by some relevant judgements that consider only basic arguments and show little relevance to the question aims.</p> <p>AO2 – Applied limited data and knowledge of COPD.</p> <p>AO1 – Knowledge and understanding of epidemiology and health promotion show some but limited accuracy, focus and relevance.</p>
	0	No creditworthy material

Indicative content

Examiners are reminded that indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or

none of the points included in the indicative content as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** may be implicit through the level of analysis and reasoned judgements and conclusions that the student provides.

AO1 Knowledge and understanding of COPD may include:

- smoking is the main cause of COPD
- exposure to air pollution over a long period can increase the risk of COPD
- genetics is also a risk factor for developing COPD
- certain types of chemicals and dust can also increase the risk of developing COPD
- COPD is more prevalent in older people
- COPD is a progressive disease that impacts the respiratory system leading to shortness of breath, coughing and wheezing.

AO2 Application of knowledge and understanding of COPD in relation to the data in the graph may include:

- as the graph shows trends over 25 years, it is likely to show impact of smoking / lifestyle habits over several decades
- downward trend in the incidence of COPD in males follows the downward trend in percentage of smokers
- upward trend in the incidence of COPD in females does not follow the downward trend in percentage of smokers
- exposure to air pollution and occupational hazards can contribute to the development of COPD rather than just smoking
- certain genetic variations are more susceptible to developing COPD after exposure to environmental factors such as smoking and air pollution.

AO3 Evaluation of future trends in incidence of COPD based on the observed trends of smoking and COPD may include:

- changes in behaviours by the population are multiple and difficult to have any confidence that reduced smoking incidence alone has reduced the incidence in males
- statement predicts a decrease in the next 10 years, which is not supported by the data that tracks % of smokers between 1980 to 2005
- based on current graph trends, there is likely to be an increase in the incidence in female COPD and a reduction in the incidence of male COPD, but this assumes that there are no changes in trends and no other effects
- number of cases might go up in the next 10 years as the population continues to increase and people live for longer
- the data does not include any other risk factors, meaning no valid conclusion can be made about the trend of COPD case in coming years:
 - the time between a change in smoking and observing changes in COPD incidence will be many years, making it difficult to understand if stopping smoking is successful
 - if people live longer, this may increase incidence of COPD due to age related factors

- there is no information of other risk factors, such as air pollution, or exposure to certain chemicals.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

8 The graph in Figure 5 shows the arterial blood pressure changing during a 55-year-old man's cardiac cycle.

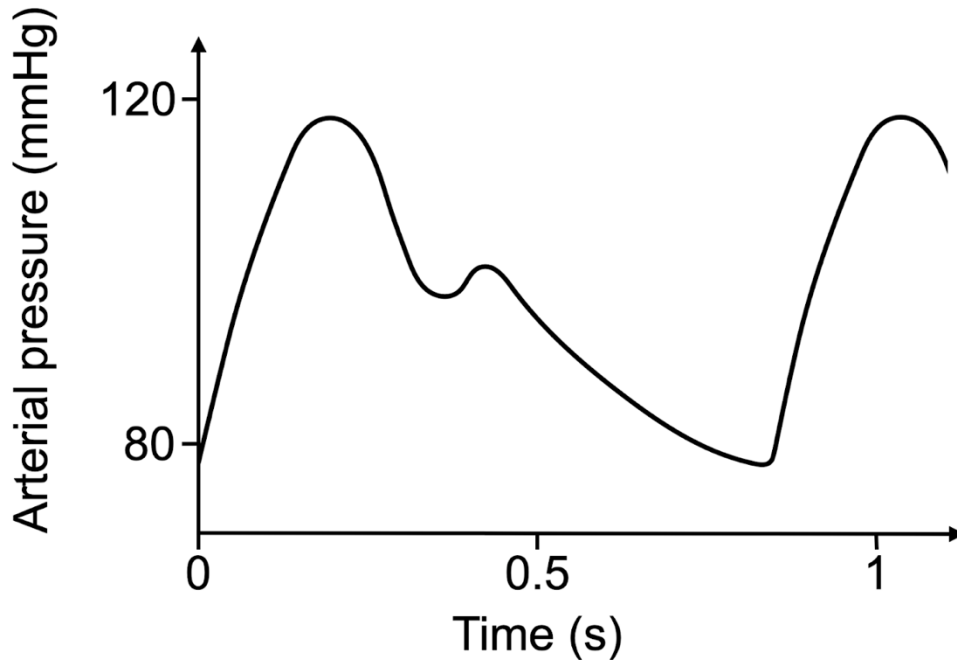


Figure 5 Arterial pressure during the cardiac cycle

Explain one way the information from the graph shows that his blood pressure is not a cause for concern.

Use approximate readings to support your answer.

[2 marks]

AO2 = 2 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- the graph shows that diastolic blood pressure is (approximately) 80 mm Hg (1); this falls into the normal diastolic pressure, which is 80 mm Hg or below, and as a result is not cause for concern (1)
- the graph shows that systolic blood pressure is (approximately) 120 mm Hg (1); this falls into the normal systolic pressure, which is 120 mm Hg or below, and as a result is not cause for concern (1).

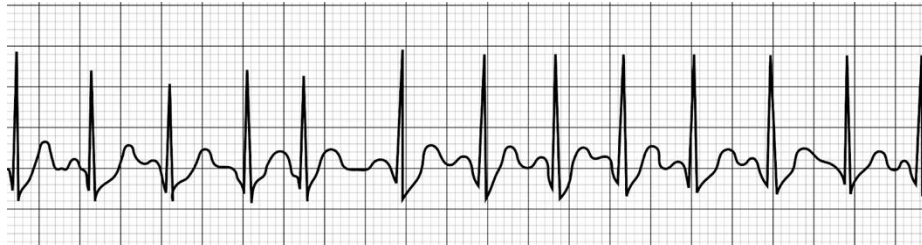
Accept any other suitable response.

Qualification specification reference

B1.29

9 Over one evening, three patients presented to accident and emergency with the same symptoms – chest pain, difficulty breathing and nausea. Their electrocardiograms (ECGs) are shown below.

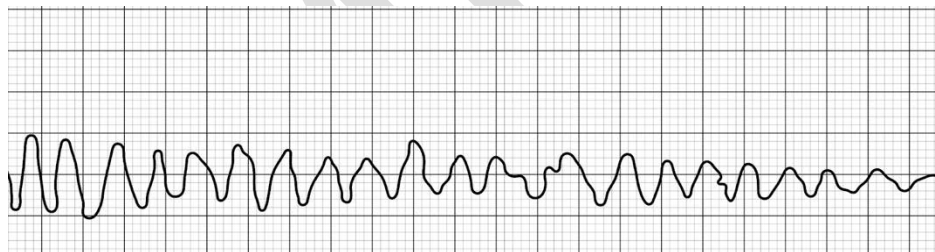
Patient 1: **Male, 21. Non-smoker. Final year university student revising at onset of symptoms.**



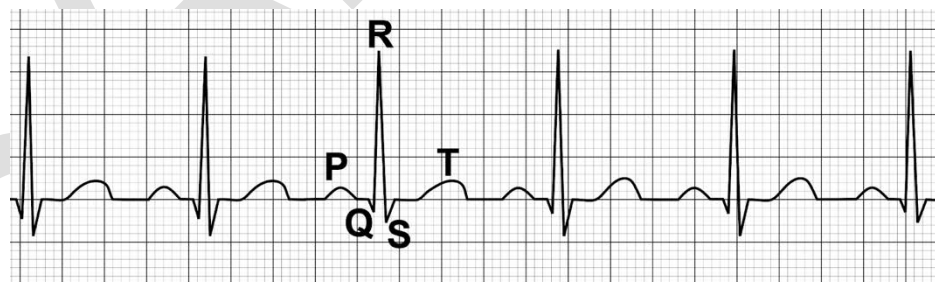
Patient 2: **Female, 38. Smoker. Solicitor. In a bar for leaving drinks at onset of symptoms.**



Patient 3: **Male, 44. Non-smoker. A sudden collapse while supermarket shopping.**



Normal: the waves of a normal ECG.



The triage team decides that patient 3 is the most seriously ill patient. Analyse their decision to prioritise patient 3's treatment.

Your response should demonstrate:

- understanding of the heart and the PQRST complex
- interpretation of the ECGs in terms of cardiac electrical activity
- consideration of the mechanical cardiac function in the different patients.

[9 marks, plus 3 marks for QWC]

AO1 = 3 marks
AO2 = 3 marks
AO3 = 3 marks
QWC = 3 marks

Qualification specification reference

B2.5, B2.6

Band	Mark	Descriptor
3	7–9	<p>AO3 – Analyses of the ECGs are comprehensive, effective and relevant, showing detailed, logical and coherent chains of reasoning throughout. Conclusions are fully supported with rational and balanced judgements that fully relate to how the ECG can be interpreted.</p> <p>AO2 – Applied all relevant knowledge of the cellular level of ECG mechanics.</p> <p>AO1 – Knowledge and understanding of the anatomy, physiology, biochemistry and electrocardiogram is clear and fully accurate with sustained focus.</p>
2	4–6	<p>AO3 – Analyses of the ECGs are in most parts comprehensive and effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Conclusions are mostly supported by judgements that consider most of the relevant arguments related to how the ECG can be interpreted.</p> <p>AO2 – Applied mostly relevant knowledge of the cellular level of ECG mechanics to the given context. Application is in most parts appropriate.</p> <p>AO1 – Knowledge and understanding of the anatomy, physiology, biochemistry and electrocardiogram is mostly clear and mostly accurate, although on occasion may lose focus.</p>
1	1–3	<p>AO3 – Analyses of the ECGs are in some parts effective and of some relevance, with some reasoning taking the form of generic statements with some development.</p> <p>Brief conclusions are supported by judgements that consider only basic arguments and show limited relevance to the question aims.</p> <p>AO2 – Applied limited knowledge of the cellular level of ECG mechanics to the given context.</p> <p>AO1 – Knowledge and understanding of the anatomy, physiology, biochemistry and electrocardiogram shows some but limited accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the

relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** may be implicit through the level of analysis and reasoned judgements and conclusions that the student provides.

AO1 Knowledge and understanding of the human heart and its functions may include:

- triage determines the urgency of patient need for treatment
- adequate circulation is needed to keep all the cells in the body alive
- electrical impulses in the heart are controlled by nodes
- cardiac muscle / myocardial cells beat by themselves
- electrical activity / action potentials in the heart are caused by the movement of ions across the membranes of the cells
- heart beats are synchronised / regulated / co-ordinated by electrical impulses from nodes
- blood enters the atria
- sinoatrial (SA) node is located at the top of the right atrium
- SA node generates an electrical impulse that causes the atria to contract
- atria contract from the top down
- blood moves from the atria to the ventricles
- SA is the pacemaker of the heart
- atrioventricular (AV) node is located at the base of the right atrium
- (electrical) impulse then passes through the AV node where it is slightly delayed / there is a refractory period
- (electrical) impulse then passes through AV bundles/ Purkinje fibres
- the ventricles contract from the bottom up

Note: Also accept a correctly labelled diagram showing the structures and pathway of the electrical impulses

- P wave is triggered by the SA node
- P wave shows depolarisation of the atria
- P wave is associated with atrial contraction
- atrial repolarisation is not shown
- QRS complex is triggered by the AV node
- QRS complex shows depolarisation of the ventricles
- T wave shows repolarisation of the ventricles
- QRS complex associated with ventricular contraction
- T wave associated with ventricular resting
- between the periods of electrical activity blood flows
- normal ECG, for example but not limited to:
 - heart will beat in a regular, steady rhythm
 - each P wave is followed by a QRS complex.

AO2 Application of knowledge and understanding of the cardiovascular system and heart rhythm may include:

- adequate circulation is needed to ensure a consistent supply of glucose and oxygen to cells for respiration
- adequate circulation is needed to ensure toxic waste products are promptly removed
- triage determines the urgency of patient need for treatment to make sure limited resources are rationed / provide care to those in immediate need and those who will benefit the most from it
- signs of a normal ECG, for example but not limited to:
- heart beating in a regular, steady rhythm ensures blood is supplied to the body and heart consistently
- delay at the atrioventricular (AV) node allows the atria to fully empty into the ventricles.

Patient 3:

- rate / rhythm is present, which means that there is electrical activity
- the rate / rhythm is chaotic / disordered / cannot be determined / the waves are absent, which means that the heart is not beating / is just quivering / is fibrillating / the chambers are contracting in an unco-ordinated way
- the heart not beating / just quivering / fibrillating / the chambers contracting in an uncoordinated way means that blood is not being pumped to the body or to the heart itself
- the waves have irregular height / amplitude / are poorly formed because the action potentials are varied
- the chaotic / indeterminate rhythm means that the heart is not producing any meaningful contractions / is not contracting properly / the ventricles are depolarising randomly and with no sequence
- height / amplitude is decreasing because the heart cell's energy stores are running out
- heart cell's energy stores will be running out because the heart muscle is not being properly supplied with blood
- height / amplitude is decreasing, which means they are approaching asystole / flatlining / death / no electrical activity.

Note: Accept accurate comparisons to normal ECG involving number of squares or measurements of distance or size if this is linked to effort on the heart or circulation

AO3 Analysis of the electrical activity of the heart may include:

- Patient 1's ECG shows co-ordinated ventricular contraction, meaning that there is a cardiac output to supply all their cells with the glucose and oxygen needed for respiration and remove toxic waste products, suggesting that they are the most well of the three patients.
- Patient 1's ECG is (closest to) normal, meaning their heart is working correctly and that, while they will feel unwell and need treatment, they are not at immediate risk of death due to heart malfunction and therefore the triage team is right not to consider this patient the most unwell.
- Patient 1 is likely to be more effectively treated outside of A & E, where specialist staff are able to work with them to find a cause and create a treatment plan and therefore the decision of the triage team is supported.
- As patient 1 is not at immediate risk of death, care of patients 2 and 3 will be prioritised.

- Patient 2 shows co-ordinated ventricular contraction, meaning that there is a cardiac output to supply all their cells with the glucose and oxygen needed for respiration and remove toxic waste products suggesting they are somewhat unwell.
- Patient 2's atria are not effectively contracting but most (around 70%) blood will pass straight through the atria into the ventricles meaning that while cardiac output is reduced, it is not immediately life threatening.
- While patient 2 does have a serious medical condition and will require treatment to prevent complications and to help them feel better, they are not at immediate risk of death.
- As patient 2 is not at immediate risk of death but has a heart condition they will be prioritised over patient 1 but patient 3 will be prioritised over them.
- Patient 3 shows random / chaotic electrical activity across the ventricles / unco-ordinated ventricular contraction so there is no meaningful cardiac output and their cells are not being supplied with the glucose and oxygen needed for respiration and toxic waste products are not being removed, supporting the claim that patient 3 is the most seriously ill patient.
- Patient 3's disorganised / unco-ordinated ventricular contraction will significantly reduce pressure in the ventricles meaning blood will not be able to circulate as the blood pressure in the arteries is too high, supporting the idea that patient 3 is the most seriously ill.
- Patient 3's loss of cardiac output will not support life and they are in immediate danger of death / cardiac arrest / requiring resuscitation, and their care should be prioritised supporting the decision of the triage team.

Note: It is not expected that students would know ECG changes associated with exercise, but they may identify that patient 1's ECG is consistent with normal changes during exercise

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

Section B: body systems 2

This section is worth 35 marks, plus 6 marks for the quality of written communication (QWC) and use of specialist terminology.

10 Identify the product of the chemical digestion of proteins by protease?

[1 mark]

AO1 = 1 mark

Award **one** mark for the following:

- amino acids (1).

Qualification specification reference

B2.11

11

Figure 6 shows the organs of the digestive system.

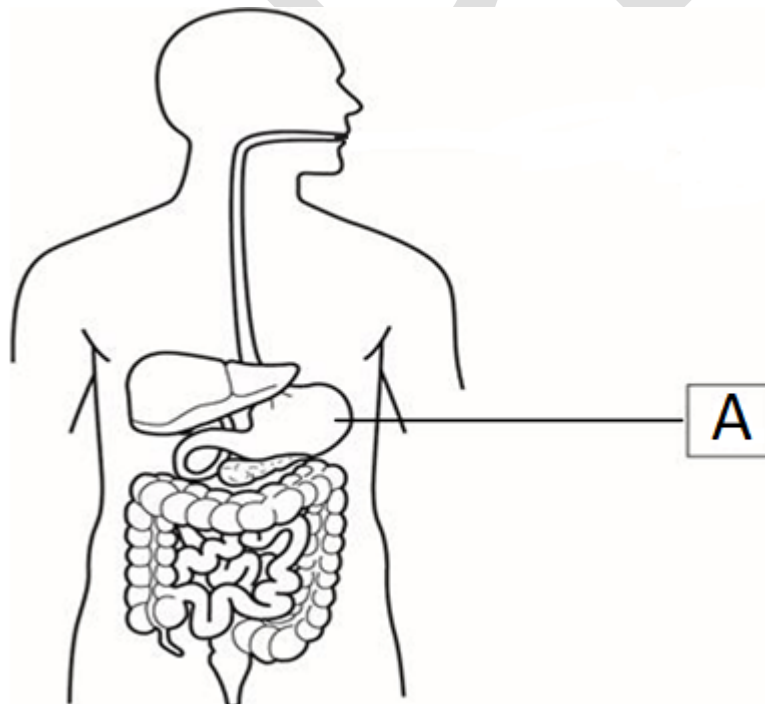


Figure 6 Human digestive system

Referring to Figure 6, explain one way in which physical digestion breaks down food at the point labelled A.

[2 marks]

AO2 = 2 marks

Award one mark for each explanation point, up to a maximum of two marks. Only award marks for the explanation of the correctly identified organ.

- stomach muscles contract to churn / mix the food (1), breaking the food into smaller molecules so it can be utilised by the body (1).

Accept any other suitable response.

Qualification specification reference

B2.11

12	Two patients decide to have a snack. Patient 1 ate a banana containing glucose and patient 2 ate a sandwich made with wholegrain bread that contained starch. After a few minutes, patient 1's blood sugar spiked quickly while patient 2's blood sugar increased more slowly. Explain one reason why patient 2's blood sugar increased more slowly.
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[2 marks]

AO2 = 2 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- patient 2's blood sugar increased more slowly because the starch in the wholegrain bread was too large to pass through the gut lining / wall / cell membrane / epithelium without being broken down first (1). However, patient 1's banana contained glucose that was small enough to pass through the gut lining without needing to be broken down first, leading to a more rapid increase in blood sugar levels (1).

Accept any other suitable response.

Qualification specification reference

B2.11

13	A patient has experienced symptoms of chronic abdominal pain, nausea and digestive problems. The doctor has diagnosed them with gallstones, which have caused a blockage in the pancreatic duct. Explain one reason why starch digestion is affected in patients with a blocked pancreatic duct.
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[2 marks]

AO2 = 2 marks

Award **one** mark for each explanation point, up to a maximum of **two** marks:

- secretion of pancreatic amylase / maltase is reduced or stopped by the blockage (1) so there are less enzymes available to breakdown / hydrolyse starch (1)
- starch cannot be fully broken down into glucose / monosaccharides in the gut as starch is too large to pass through cell membranes (1) so there are less glucose / monosaccharides available to be absorbed by the small intestine (1).

Accept cell membranes / cell / epithelium for ‘gut wall’.

Accept any other suitable response.

Qualification specification reference

B2.11

14 Crohn’s disease is a medical condition that causes swelling of the lining of the intestines. Approximately 15% of people with Crohn’s disease have a close relative who also has this disease. If one identical twin has Crohn’s disease, there is a 70% probability that the other twin will also have this disease.

A patient has been diagnosed with Crohn’s disease and is waiting to see the practice nurse for information and advice.

They say:

- **Crohn’s disease is caused by genetic factors.**
- **There is no treatment for Crohn’s disease.**

Evaluate to what extent patient 1’s claims are correct.

[9 marks, plus 3 marks for QWC]

AO1 = 3 marks
AO2 = 3 marks
AO3 = 3 marks
QWC = 3 marks

Qualification specification reference

B1.20, B2.13

Band	Mark	Descriptor
3	7–9	<p>AO3 – Evaluation of the information is comprehensive, effective and relevant, showing logical and coherent chains of reasoning throughout.</p> <p>AO2 – Applied relevant knowledge of Crohn’s disease and inflammatory response.</p>

		AO1 – A wide range of relevant knowledge and understanding that is accurate and detailed .
2	4–6	AO3 – Evaluation of the information is in most parts effective and in most parts relevant , showing in most parts logical and coherent chains of reasoning. AO2 – Applied mostly relevant knowledge of Crohn’s disease and inflammatory response. AO1 – Knowledge and understanding is in most parts clear and in most parts accurate , although on occasion may lose focus.
1	1–3	AO3 – Evaluation of information is in some parts effective and has some limited relevance with some reasoning taking the form of generic statements that include some development. AO2 – Applied limited knowledge of Crohn’s disease. AO1 – Knowledge and understanding has limited accuracy, focus and relevance.
	0	No creditworthy material

Indicative content

Examiners are reminded that indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** may be implicit through the level of analysis and reasoned judgements and conclusions that the student provides.

AO1 Knowledge and understanding of Crohn’s disease may include:

- Crohn’s disease is an inflammatory bowel disease (IBD) that affects the gastrointestinal tract (GI)
- researchers have identified over 200 genetic variations that affect the risk of a person developing Crohn’s disease
- a range of factors in the environment may increase risk of Crohn’s disease, for example bacteria, diet, smoking, non-steroidal anti-inflammatory drugs (NSAIDs) / aspirin / ibuprofen, stress, and viruses (though they do not directly cause the disease)
- Crohn’s disease causes painful ulcers and inflammation anywhere in the gut (for example, bowel, colon, mouth)
- common physical symptoms of Crohn’s disease include diarrhoea, fatigue, weight loss, stomach cramps, blood in stool, high temperature, and joint pain
- there is a direct link between mental and physical health in Crohn’s disease (for example, brain–gut axis).

AO2 Application of knowledge and understanding of how Crohn's disease affects the digestive tract and treatment may include:

- during an immune response in a person without Crohn's disease, harmless bacteria in the GI tract are protected from immune system attack
- the nurse could discuss ways to relieve the patient's symptoms such as using steroid medications / surgery / immunosuppressants
- the nurse could help the patient understand what happens in people with Crohn's disease:
 - the immune system responds to harmless bacteria causing inflammation
 - the immune system recognises the presence of pathogenic bacteria through the activation of antigen presenting cells, for example macrophages
 - the presence of pathogenic bacteria is detected, which causes an increased amount of T cells to be released, activating an immune response
 - specific types of T cells produce pro-inflammatory cytokines
 - T cells can cause the increase in permeability of intestinal lining, allowing bacteria and other harmful substances into the tissue, which would cause further inflammation
- the patient could be informed about different treatment options such as:
 - immunosuppressants suppress the immune response in a person with Crohn's disease, in order to reduce inflammation caused by pathogenic bacteria and reduce the likelihood of recurrence
 - steroids suppress the immune system by blocking the production of cytokines, which can reduce the symptoms of Crohn's disease, but should not be used long term due to their side effects
 - enteral nutrition can help to reduce inflammation in the digestive tract by eliminating foods that can trigger an immune response and alter the composition of gut microbiota.

AO3 may include evaluation of causes and treatment options in Crohn's disease:

- multiple genes have been associated with an increased risk of Crohn's disease, supporting their initial thoughts as this emphasises genetic links
- psychological factors such as depression or stress have been linked to the development and exacerbation of Crohn's disease; stress can impact inflammation and the immune response in the body. Mental health disorders such as depression and anxiety have been linked to both genetic and environmental factors
- the fact that / in the question it states that Crohn's disease is triggered by pathogenic bacteria in the intestines of people with a genetic tendency to Crohn's disease suggests / proves that it is caused by genetic as well as environmental factors.
- severity of the symptoms in a person with Crohn's disease increases if they have certain genes in addition to environmental risk factors
- genetics is only one part of the picture in understanding causes of Crohn's disease and Anna will need support / information to understand how environmental factors have also influenced the development of the disease
- if Crohn's disease was only genetic, the percentage of people with Crohn's disease who have a close relative with the disease would be higher than 15%, disputing the patient's claims
- if Crohn's disease was only genetic, an identical twin would have 100% probability of having Crohn's disease if their twin had it, rather than 70%
- in 30% of cases, the twin of an identical twin with Crohn's disease does not have it
- in 85% of Crohn's disease cases, people do not have a relative with the disease

- the patient could be considered accurate in the claim regarding no treatment as there is no cure for Crohn's at the present time. However, there are a number of common treatments that relieve symptoms, which does not support the claim the patient makes
- though treatments are available to alleviate symptoms, some of those treatment options may have negative side effects
- overall, the patients claims that Crohn's disease is solely caused by genetic factors and that there is no treatment for it are not entirely correct
- in conclusion, it is probable that though genetics is a major factor of them developing Crohn's disease, additional environmental risk factors will likely have played a factor too, so the claims are only partially true.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.
0	There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.

15 (a) Some rare adrenal gland tumours often secrete testosterone and oestrogen.

High levels of sex hormones produce symptoms such as growth of body hair, breast growth and effects on the menstrual cycle.

Explain why adrenal tumours may be detected earlier in children under 10 than in adults.

[2 marks]

AO2 = 2 marks

Award **one** mark for each part of an explanation, up to a maximum of **two** marks:

- the symptoms from high levels of sex hormones will be less noticeable in adults (1) because they have already gone through puberty (1)
- the symptoms from high levels of sex hormones will be more noticeable in children under 10 because they may start puberty very early (1) and develop breasts / enlarged genitals / adult body hair / male pattern baldness / facial hair / reproductive characteristics (1).

Accept any other suitable response.

Qualification specification reference

B2.14, B2.27

15 (b) Adrenal tumours can be benign or malignant and can be either functioning or non-functioning. Functioning tumours secrete hormones, while non-functioning tumours can become functioning over time. Adrenal tumours can secrete various hormones, including cortisol, oestrogen and testosterone.

The most common type of adrenal tumour is a benign adenoma, which may not require treatment, particularly if it is non-functional, but it will be closely monitored to ensure it does not become functioning.

Discuss the suitability of two different treatment options for adrenal tumours.

Your answer must include reasoned judgements and conclusions.

[6 marks]

AO3 = 6 marks

Award **one** mark for each discussion point for any of the following, up to a maximum of **six** marks:

- Surgical removal is an effective treatment for an adrenal tumour, but mainly for tumours that are malignant or functioning (1) as surgery carries risks / complications such as infection or damage to surrounding organs (1). Surgical removal – though likely effective if appropriate, surgical removal should likely only be considered if it is a malignant /

functioning tumour (1). Radiation – though radiation could be a suitable choice, side effects should be considered depending on the patient (1).

- Radiation therapy could be used to shrink tumours / destroy cancer cells in the adrenal gland, which may be suitable perhaps if surgery is not possible for a malignant tumour (1). It may be suitable to help control the growth of the tumour and manage symptoms (1). Though radiation could be a suitable choice, side effects should be considered depending on the patient (1). Monoclonal antibody therapy – this would be suitable as it would help reduce the symptoms associated with the hormones (1).
- Monoclonal antibody therapy could be especially useful in treating adrenal tumours as it uses antibodies that will specifically target and bind to cancer cells in the body (1). It might be useful where the antibodies can be used to block the activity of certain hormones secreted by the tumour (1).
- Talking therapies might be useful in helping individuals cope with the emotional impact of cancer diagnosis and treatment particularly as adrenal tumours may impact hormones affecting mood (1). However, talking therapies may not be suitable for everyone and does not address physical symptoms of cancer (1). Talking therapies – it is likely that talking therapies may be needed in conjunction with physical treatments for adrenal tumours (1).

Accept any other suitable response.

Qualification specification reference

B2.14, B2.27, B2.30, B2.31

16 (a) The integumentary system supports temperature regulation, identify two additional functions of the system.

[2 marks]

AO1 = 2 marks

Award **one** mark for each of the following, up to a maximum of **two** marks:

- protection (1)
- cutaneous sensation (1)
- vitamin D synthesis (1)
- excretion (1).

Accept any other suitable response.

Qualification specification reference

B2.23

16 (b)		Reduction in sweating	Reported side effects
	Anticholinergic gels	Nearly 75% of patients have ≥50% reduction in sweat production	31% experience skin reactions 24% experience dry mouth Other side effects include application site pain, dilated pupils, dry eye, dry throat, nasal dryness, throat pain, dry skin, constipation and headaches
	Botulinum toxin injections	Nearly 90% reduction in sweat production two weeks after treatment 65% reduction in sweat production 6 weeks after treatment 50% reduction in sweat production 60 months after treatment	Insufficient evidence Short-term studies suggest that injection-site pain (at times severe) is likely. Headaches, muscle soreness of the shoulder, increased facial sweating and itchy armpit skin were also reported.

Stuart ME, Strite SA & Gillard KK. (2020) A systematic evidence-based review of treatments for primary hyperhidrosis. *Journal of Drug Assessment*. 210(1):35-50

A patient visits their doctor complaining of excessive sweating and sensitivity to touch on their skin. The doctor suspects that there may be a problem with the patient’s integumentary system.

Evaluate the doctor’s suspicion that the patient’s symptoms indicate a problem with their integumentary system and the processes involved in temperature regulation.

[9 marks, plus 3 marks for QWC]

- AO1 = 3 marks
- AO2 = 3 marks
- AO3 = 3 marks
- QWC = 3 marks

Qualification specification reference

B2.23, B2.24

Band	Mark	Descriptor
3	7–9	<p>AO3 – Evaluation of the information is comprehensive, effective and relevant, showing logical and coherent chains of reasoning throughout. Informed conclusions that are fully supported with rational and balanced judgements.</p> <p>AO2 – Applied relevant knowledge of the integumentary system and temperature regulation.</p> <p>AO1 – A wide range of relevant knowledge and understanding that is accurate and detailed.</p>
2	4–6	<p>AO3 – Evaluation of the information is in most parts effective and in most parts relevant, showing in most parts logical and coherent chains of reasoning.</p>

Band	Mark	Descriptor
		<p>Conclusions supported by judgements that consider a range of the relevant arguments are evident.</p> <p>AO2 – Applied mostly relevant knowledge of the integumentary system and temperature regulation.</p> <p>AO1: Knowledge and understanding is in most parts clear and in most parts accurate, although on occasion may lose focus.</p>
1	1–3	<p>AO3 – Evaluation of information is in some parts effective and has some limited relevance with some reasoning taking the form of generic statements that include some development.</p> <p>Brief conclusions supported by judgements that consider only basic arguments and show little relevance to the question aims are evident.</p> <p>AO2 – Applied limited knowledge of the integumentary system and temperature regulation.</p> <p>AO1 – Knowledge and understanding has limited accuracy, focus and relevance.</p>
	0	No creditworthy material

Indicative content

Examiners are reminded that indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** may be implicit through the level of analysis and reasoned judgements and conclusions that the student provides.

AO1 Knowledge and understanding of the integumentary system and may include:

- sweat glands are found in epidermis
- integumentary system includes the skin, hair, nails and exocrine glands
- the integumentary system performs vital functions such as protection, excretion, cutaneous sensation, temperature regulation
- sweat glands are a type of exocrine gland
- glands produce sweat, which helps to regulate body temperature by evaporating and cooling down the body when it is too hot
- hair erector muscles contract to raise hair and trap air to insulate the skin
- arterioles dilate / constrict in response to temperature changes, controlling blood flow to the skin's surface
- sweat is secreted through tiny ducts onto the surface of the skin
- neurotransmitters can excite or inhibit the target neurone
- diseases / disorders / conditions impact physical and / or mental health

- treatments for diseases / disorders / conditions often have side effects.

AO2 Application of knowledge and understanding of the integumentary system may include:

- the patient’s symptoms of excessive sweating and sensitivity to touch may indicate an issue with their sweat glands / blood flow / sensory receptors
- the patient may have an overactive sweat gland condition, which may cause excessive sweating
- the patient may have a skin condition that affects the sensory receptors, which can cause sensitivity to touch
- if blood flow regulation in the skin is not functioning correctly, it can affect temperature regulation, leading to excessive sweating or chills
- temperature regulation is crucial in ensuring homeostasis in the body, and the integumentary system plays a crucial role in this process
- the hypothalamus also detects changes in body temperature so when the patient’s body is too hot, sweating and vasodilation occur to cool down the body
- shivering and vasoconstriction occur to warm up the patient’s body when it is too cold.

AO3 Evaluation of symptoms of the patient in relation to the integumentary system may include:

- to make a firm diagnosis, the doctor may need to perform further tests to determine the underlying cause of the issue
- the doctor’s suspicion may be reasonable as excessive sweating and sensitivity are indicative of skin conditions
- the integumentary system plays a role in sensory function and protection of the body, which includes protecting against external touch and regulating temperature, which aligns with the patient’s symptoms
- the doctor’s suspicion is not definitive as excessive sweating and sensitivity could be indicative of other health conditions such as thyroid disorders or neurological disorders
- the doctor should consider the patient’s individual circumstances such as their age / medical history / lifestyle factors when evaluating the patient’s symptoms
- diet and exercise may also affect overall health and function of the integumentary and temperature regulation systems so the doctor could consider investigating these areas
- treatment options may include medication, lifestyle changes or procedures such as surgery.

Accept any other suitable response.

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.

1	<p>The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.</p>
0	<p>There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.</p>

SAMPLE

Section C: body systems 3

This section is worth 30 marks, plus 6 marks for the quality of written communication (QWC) and use of specialist terminology.

17 (a) During the transcription process, deoxyribonucleic acid (DNA) is transcribed into messenger ribonucleic acid (RNA) using a sequence of base pairs.

Identify the missing base to complete the table below:

Deoxyribonucleic acid (DNA)	Ribonucleic acid (RNA)
Adenine	Adenine
Cytosine	Cytosine
Guanine	Guanine
Thymine	

Missing base: _____

[1 mark]

AO1 = 1 mark

Award **one** mark for the following:

- Uracil (1).

Qualification specification reference

B1.13

17 (b) Give two differences between the structure of DNA and the structure of RNA.

[2 marks]

AO1 = 2 marks

Award **one** mark for each of the following, up to a maximum of **two** marks:

- DNA forms a double helix / is double stranded and RNA does not form a double helix / is single stranded (1)
- DNA is larger / longer than RNA (1)
- DNA has deoxyribose and RNA has ribose (1).

Accept any other suitable response.

Qualification specification reference

B1.13

17 (c) The complementary base-pairing found in DNA molecules is important during the copying of DNA during mitosis.

Suggest two reasons why.

[2 marks]

AO2 = 2 marks

Award **one** mark for each of the following, up to a maximum of **two** marks:

- it makes sure the DNA copied is identical / without errors / has the same sequence of nucleotides / nucleotides are in the same / correct order / sequence of bases (1) as any change could result in mutations / genetic disorders
- it allows for the forming of hydrogen bonds between the strands / makes sure the strands can bond together correctly (1) to ensure accuracy / stability of DNA replication during mitosis.

Accept any other suitable response.

Qualification specification reference

B1.13

18 Mitochondrial myopathy is a term for a group of conditions caused by faulty mitochondria.

A healthcare assistant suggests that the symptoms of mitochondrial myopathy will be primarily muscle weakness, including weakness of arms and legs, exercise intolerance, difficulty moving the eyes and heart problems.

Justify the healthcare assistant's suggestion of muscle weakness being a common symptom of mitochondrial myopathy.

[3 marks]

AO3 = 3 marks

Award **one** mark for each justification, up to a maximum of **three** marks:

- The healthcare assistant's suggestion that muscle weakness is a common symptom of mitochondrial myopathy can be justified by ATP being essential in muscle contraction (1). ATP is used to break the cross-bridge between the actin and myosin that enables the myosin heads to detach from the actin filaments (1). Without enough ATP, myosin heads cannot change shape or angle to bind to the actin filament, preventing muscle contraction and leading to muscle weakness (1).

- The healthcare assistant's suggestion that muscle weakness is a common symptom of mitochondrial myopathy can be justified by the fact that ATP is required for the myosin heads to move into the 'cocked' position that is essential for muscle contraction (1). ATP binds to the myosin heads, which produces a change in the shape and angle moving the heads into the high energy state (1) and without enough ATP, the myosin heads cannot move into this position, preventing muscle contraction and resulting in muscle weakness (1).
- The claim can be justified as ATP is needed for myosin to detach from actin after completing one power stroke (1). However, without enough ATP, myosin remains attached to actin, preventing muscle relaxation (1), which leads to muscle weakness due to it becoming fatigued from not being able to release tension (1).

Accept any other suitable response.

Note: Do not accept 'energy is produced / made'

Qualification specification reference

B1.3, B2.2

19	Patient 1 is an overweight 68-year-old smoker who exercises less than 30 minutes per week. During this activity, they experience chest pains, are out of breath and feel exhausted. Explain two reasons why they may be experiencing these symptoms.	[4 marks]
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AO2 = 4 marks

Award **one** mark for each explanation point, up to a maximum of **four** marks:

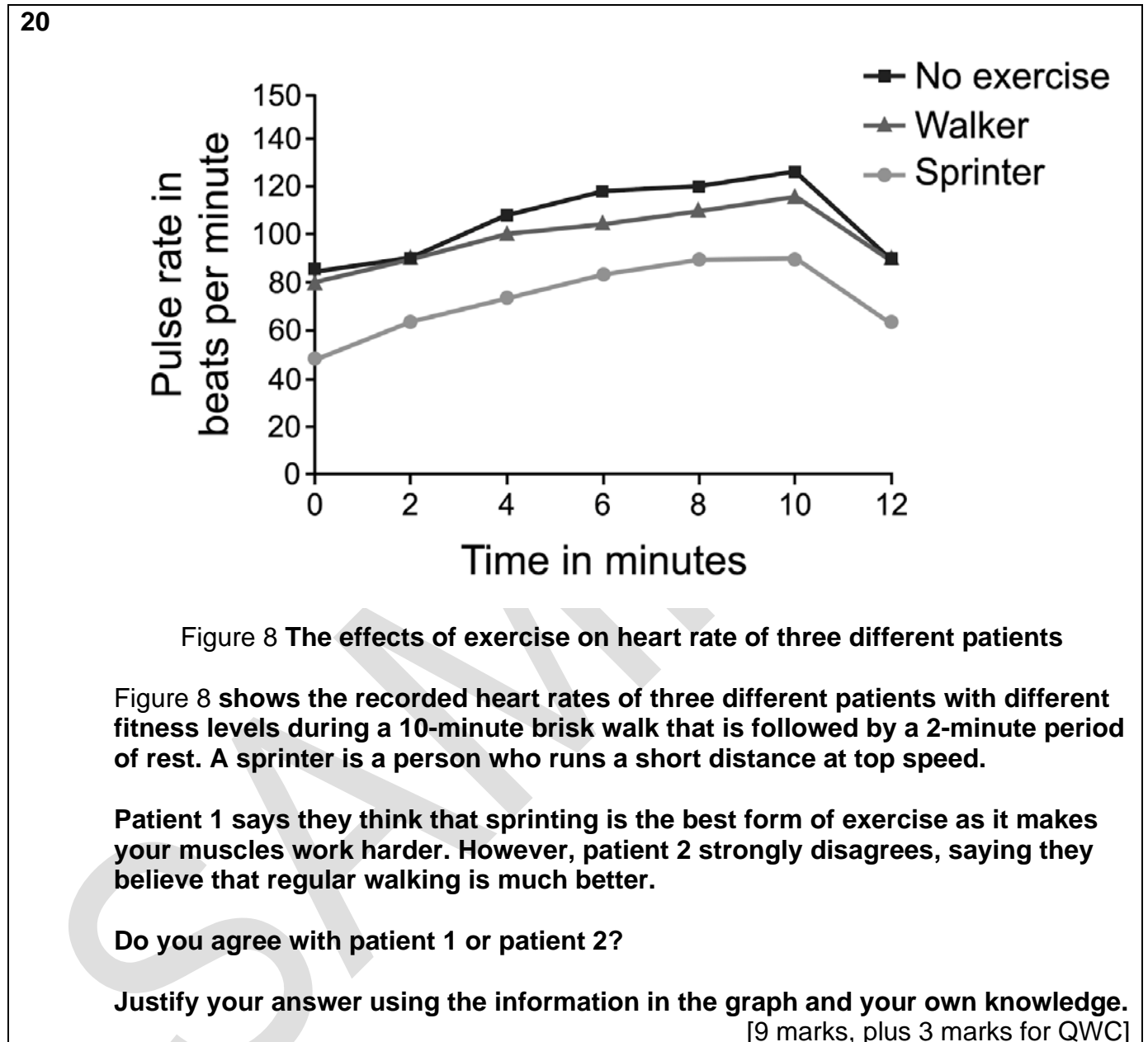
- patient 1's lifestyle puts him at risk of cardiovascular disease, which may increase fatty deposits / atherosclerosis in the arteries (1), and this may result in reduced blood flow, causing chest pain / shortness of breath (1)
- cardiovascular disease can also reduce gas exchange in the lungs leading to lower blood oxygen levels (1); oxygen is necessary for aerobic respiration / energy production, so the reduced exchange may result in patient 1's tiredness / chest pain (1)
- patient 1's lifestyle means that he may be more at risk of cardiovascular disease, which could increase fluid on the lungs (1), and this may result in reduced gas exchange so the low levels of blood oxygen may be experienced as tiredness (1)
- patient 1's lifestyle may increase his risk of cardiovascular disease / fluid build-up in the lungs, which can lead to reduced gas exchange / low blood oxygen levels (1) resulting in his symptoms as the body works harder to produce ATP (1)

Accept any other suitable response.

Note: Do not accept 'energy is produced / made' in place of 'energy is released' or 'ATP is produced'

Qualification specification reference

B1.3 B2.7, B2.8, B2.9



AO1 = 3 marks
AO2 = 3 marks
AO3 = 3 marks
QWC = 3 marks

Qualification specification reference

B1.29

Band	Mark	Descriptor
3	7–9	<p>AO3 – Evaluation of the arguments is comprehensive, effective and relevant, showing logical and coherent chains of reasoning throughout. Analysis of the data is used to effectively inform conclusions that are fully supported with rational and balanced judgements.</p> <p>AO2 – Applied all relevant knowledge of exercise and the effects on heart rate.</p> <p>AO1 – A wide range of relevant knowledge and understanding, which is accurate and detailed, is evident.</p>
2	4–6	<p>AO3 – Evaluation of the arguments is in most parts effective and mostly relevant, showing in most parts logical and coherent chains of reasoning. Analysis of the data is in most parts accurate. Conclusions are supported by judgements that consider most of the relevant arguments.</p> <p>AO2 – Applied mostly relevant knowledge of exercise and the effects on heart rate.</p> <p>AO1 – Knowledge and understanding is in most parts clear and in most parts accurate, although on occasion may lose focus.</p>
1	1–3	<p>AO3 – Evaluation of the arguments is minimal and limited in effectiveness and relevance. Conclusions are tenuous and mostly unsupported and have little relevance to the question.</p> <p>AO2 – Applied limited knowledge of exercise and the effects on heart rate.</p> <p>AO1 – Knowledge and understanding shows limited accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

Examiners are reminded that the indicative content reflects content-related points that a student may make but is not an exhaustive list, nor is it a model answer. Students may make all, some or none of the points included in the indicative content, as its purpose is as a guide for the relevance and expectation of the responses. Students must be credited for any other appropriate response.

AO1 and **AO2** may be implicit through the level of evaluation and reasoned judgements and / or conclusions that the student provides.

AO1 Knowledge and understanding of the relationship between exercise, heart rate, respiration and the need for glucose and oxygen during exercise may include:

- normal heart rate is 60 to 100 beats per minute (bpm)
- bpm is a measure of how many times the heart completes the cardiac cycle in 1 minute

- exercise increases heart rate
- respiration increases in muscles during exercise
- respiration requires glucose and oxygen
- muscles need more oxygen and glucose during exercise
- muscles need to remove more waste / carbon dioxide during exercise
- someone that exercises regularly will usually have a lower heart rate at rest.

Note: Award marks for any other accurate information the student has included from prior knowledge or outside reading

AO2 Application of knowledge and understanding interpreting and comparing changes in heart rate during exercise and rest, and understanding the relationship between heart rate, oxygen, demand, and carbon dioxide in muscles during exercise may include:

- pulse rate increased in all people during exercise
- pulse rate decreased in all people during period of rest
- the heart rate of the walker and the no exercise person is very similar throughout the experiment
- the heart rate of the sprinter is lower than the other two people's heart rates throughout the experiment
- muscles need more oxygen and glucose during exercise due to an increased rate of respiration
- muscles need to remove more waste / carbon dioxide during exercise due to an increased rate of respiration
- increased carbon dioxide levels will quickly be detected and cause an increase in heart rate
- the heart rate increases to move blood around the body more quickly to meet oxygen demands
- after exercise, the heart rate reduces as the demand for oxygen falls
- walking places less demand on muscles compared to sprinting so will consume oxygen at a lower rate
- walking places less demand on muscles compared to sprinting so will produce less carbon dioxide and heart rate will not increase as much

Note: Students are not expected to know that walking is an aerobic activity and sprinting is anaerobic, or the details of anaerobic respiration for core component section B; they may know it from previous studies or outside reading and would be awarded if they included it here

AO3 Evaluation and justification of the statement may include:

- Best is a subjective term, what is the best exercise for one person / situation may not be best for another; therefore it is not possible to agree with patient 1 or patient 2.
- It is difficult to make links between heart rate and how effective the exercise is as we have no other information about the individuals; therefore, neither patient 1 nor patient 2's statements can be supported / it is hard to agree with patient 1 or patient 2.
- It is a very small sample size (one in each category), which reduces validity of the results; therefore, neither patient 1 nor patient 2's statements can be supported.

- The sprinter likely uses more muscle groups, and they are likely using more power than the walker, meaning their heart will become stronger / more efficient at beating with training, this means that a brisk walk will not raise the heart rate of a sprinter as much as a walker, which is shown in the graph – the sprinter’s heart rate is lower than the heart rate of the walker and person who does not exercise – this supports patient 1’s statement.
- Measuring heart rate after a brisk walk does not determine whether walking or sprinting are better forms of exercise; therefore, it is not possible / difficult to use the graph to support / agree with patient 1 or patient 2.
- The sprinter’s lower heart rate in the graph is likely due to previous training, increasing the efficiency of their heart rate, but as we have no other information on the participant it is hard to draw conclusions; therefore patient 1’s statement cannot be supported, and it is difficult to agree with patient 1 or patient 2.
- Walking will not place as high a demand on muscles and organ systems to work compared to sprinting, which may be more appropriate for certain individuals, so patient 2 might be right.
- Walking will still increase heart strength compared to no exercise and will do it without the same increased risk of severe body responses or injury from sprinting, so patient 2 might be right.
- Walking places a lower demand on the heart, which may be more appropriate for some individuals so patient 2 might be right in the case of some people, but not for everyone.
- Sprinting may be more enjoyable to some individuals than walking is, making them more likely to carry out the exercise – some exercise is better than none; therefore, it is not possible to agree with patient 1 or patient 2.
- Walking may be more enjoyable to some individuals than sprinting is, making them more likely to carry out the exercise – some exercise is better than none; therefore, it is not possible to agree with patient 1 or patient 2.
- Sprinters may be more likely to carry out other exercises than walkers, such as long distance running and strength training, which may affect these results / it is hard to know whether the effect is from the sprinting alone, which makes it difficult to agree to use the graph to agree with / support patient 1 or patient 2.

Accept any other suitable response

Qualification specification reference

B1.29

Note: Reasoned judgements may be awarded as part of the analysis or within the conclusions

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.

1	<p>The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.</p>
0	<p>There is no answer written or none of the material presented is creditworthy. OR The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.</p>

SAMPLE

21	<p>A patient has been diagnosed with breast cancer. The cancer has spread to the lymph nodes, which is impacting the cardiovascular system, digestive system and respiratory system.</p> <p>Evaluate the use of radiation in the treatment for the patient.</p> <p>Your response should demonstrate an understanding of:</p> <ul style="list-style-type: none"> • the principles of the mechanism of therapeutic radiation • considerations about the impact on normal function of the cardiovascular, digestive or respiratory system. <p style="text-align: right;">[9 marks, plus 3 marks for QWC]</p>
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AO1 = 3 marks
AO2 = 3 marks
AO3 = 3 marks
QWC = 3 marks

Qualification specification reference

B1.25, B2.5, B2.8, B2.11, B2.31

Band	Mark	Descriptor
3	7–9	<p>AO3 – Evaluation of the benefits and risks of radiation is comprehensive, effective and relevant, showing detailed, logical and coherent chains of reasoning throughout on the properties and interaction of radiation and its therapeutic use in the treatment of breast cancer. Informed conclusions that are fully supported with rational and balanced judgements are evident.</p> <p>AO2 – Applied all relevant knowledge of radiation and its therapeutic use to the given context, for example, for the treatment of breast cancer.</p> <p>AO1 – Knowledge and understanding of the properties and interaction of radiation and the impact on the body systems is clear and fully accurate with sustained focus.</p>
2	4–6	<p>AO3 – Evaluation of the benefits and risks of radiation is in most parts effective and mostly relevant, showing mostly logical and coherent chains of reasoning. Conclusions supported by judgements that consider most of the relevant arguments are evident.</p> <p>AO2 – Applied all relevant knowledge of radiation and its therapeutic use to the given context, for example, for the treatment of breast cancer. There may be a few errors.</p> <p>AO1 – Knowledge and understanding of the properties and interaction of radiation and the impact on the body systems is mostly clear and generally accurate, although on occasion may lose focus.</p>

Band	Mark	Descriptor
1	1–3	<p>AO3 – Evaluation of the benefits and risks of radiation is in some parts effective and of some relevance, with some reasoning taking the form of generic statements with some development on the properties and interaction of radiation and its therapeutic use in the treatment of breast cancer. Brief conclusions supported by judgements that consider only basic arguments and show little relevance to the question aims are evident.</p> <p>AO2 – Applied limited knowledge of the radiation and its therapeutic use to the given context, for example, in the treatment of breast cancer.</p> <p>AO1 – Knowledge and understanding of the properties and interaction of radiation and the impact on the body systems shows some but limited accuracy, focus and relevance.</p>
	0	No creditworthy material.

Indicative content

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AO1 and **AO2** may be implicit through the level of analysis and reasoned judgements and conclusions that the student provides.

AO1 Knowledge and understanding of therapeutic radiation may include:

- radiotherapy works by damaging the DNA of cancerous cells
- the radiation beam therapy aims directly at the cancer
- the beams penetrate deep into the body
- cell DNA becomes damaged and the cancer cells stop dividing
- cells die, they are broken down and removed by the body
- this takes place over a prolonged period of time
- radiotherapy may be combined with other therapies (for example, chemotherapy)
- radiotherapy involves gamma rays that are emitted from the decay of radioactive isotopes.

Note: Accept radiation therapy / radiation beam therapy for ‘radiotherapy’

AO2 Application of knowledge and understanding of the impact on normal function of cardiac, respiratory and digestive system may include:

- radiation can affect the surrounding organs of the patient such as the heart, lungs or oesophagus
- damage to the heart has an impact on the circulation of blood around the body

- radiation in the chest area can cause lung damage / lung disease, which may result in the patient having symptoms such as breathing problems and an increased risk of heart disease
- radiation could potentially cause damage to the lungs, which would have an impact on the respiratory system, gas exchange and the transport of gases
- radiation could cause damage to the oesophagus, which would have an impact on the digestive system and nutrition
- radiation could cause inflammation to the intestines causing digestive issues.

A03 Evaluation of role of radiation in radiation therapy may include:

- some breast cancers are malignant, so although there are risks with radiation therapy they may not outweigh the risks of the breast cancer itself
- radiotherapy may not reduce the development of the cancer, meaning that the patient may go through the discomfort of treatment and side effects without actually treating the cancer
- radiotherapy may reduce the development of the cancer, meaning the discomfort of treatment and side effects may prove to be worth it in the patient's opinion
- different systems could be impacted negatively, which may have a negative consequence on lifestyle and mental health with impeded cardiac output / heart function (for example, breathlessness, pain, exercise intolerance) therefore the risks may outweigh the benefits
- radiation as well as the cancer impacting on the lungs may lead to negative effects (for example, breathlessness, pain, exercise intolerance) therefore the risks may outweigh the benefits of radiation treatment
- individuals respond differently to treatments, meaning that what suits one patient may not suit another and the risks they are willing to take is an individual decision that they should be supported through by their medical team
- radiation therapy may be a valuable treatment option for a patient with breast cancer that has spread but the impact on normal tissues should be considered.

Accept any other suitable response

Qualification specification reference

B1.25, B2.5, B2.8, B2.11, B2.31

QWC mark scheme

Mark	Descriptor
3	The answer is clearly expressed and well-structured. The rules of grammar are used with effective control of meaning overall. A wide range of appropriate technical terms are used effectively.
2	The answer is generally clearly expressed and sufficiently structured. The rules of grammar are used with general control of meaning overall. A good range of appropriate technical terms are used effectively.
1	The answer lacks some clarity and is generally poorly structured. The rules of grammar are used with some control of meaning and any errors do not significantly hinder the overall meaning. A limited range of appropriate technical terms are used effectively.

0	<p>There is no answer written or none of the material presented is creditworthy.</p> <p>OR</p> <p>The answer does not reach the threshold performance level. The answer is fragmented and unstructured, with inappropriate use of technical terms. The errors in grammar severely hinder the overall meaning.</p>
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SAMPLE

Assessment objective (AO) grid

Section A Body systems 1

Question Number	AO1	AO2	AO3	Mathematics	QWC	Total
1 (a)	1					1
1 (b)	1					1
2		1				1
3	1					1
4			6			6
5		3		3		3
6		2				2
7	3	3	3	3	3	9
8		2		2		2
9	3	3	3		3	9
Total	9	14	12		6	35
Totals required	9–10 marks	14–16 marks	10–12 marks		6	35

Section B Body systems 2

Question Number	AO1	AO2	AO3	Mathematics	QWC	Total
10	1					1
11		2				2
12		2				2
13		2				2
14	3	3	3		3	9
15 (a)		2				2
15 (b)			6			6
16 (a)	2					2
16 (b)	3	3	3		3	9
Total	9	14	12		6	35
Totals required	9–10 marks	14–16 marks	10–12 marks		6	35

Section C
Body systems 3

Question Number	AO1	AO2	AO3	Mathematics	QWC	Total
17 (a)	1					1
17 (b)	2					2
17 (c)		2				2
18			3			3
19		4				4
20	3	3	3		3	9
21	3	3	3		3	9
Total	9	12	9		6	30
Totals required	8–9 marks	12–14 marks	9–11 marks		6	30

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Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Published.	June 2023	26 June 2023
v1.1	Sample added as a watermark	November 2023	21 November 2023