T Level Technical Qualification in Health

Core knowledge and understanding

Paper B

Mark scheme

v1.1: Additional sample materials
22 November 2023
603/7066/X

Internal reference: HLTH-0019-01

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 band-based descriptors and indicative content.

Band-based descriptors: each band is made up of several descriptors for across the assessment objective (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 AOs, 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 (AOs)

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 AO can be found in the qualification specification.

Section A: Body systems 1

This section is worth 35 marks, plus 6 marks for QWC and use of specialist terminology.

1 (a) **In which** one **of the following processes can small, non-polar molecules pass through the membrane?**

[1 mark]

AO1 = 1 mark

B: Diffusion (1)

Qualification specification reference

B1.9

1 (b) Figure 1 **shows the fluid-mosaic model of a cell surface membrane.**

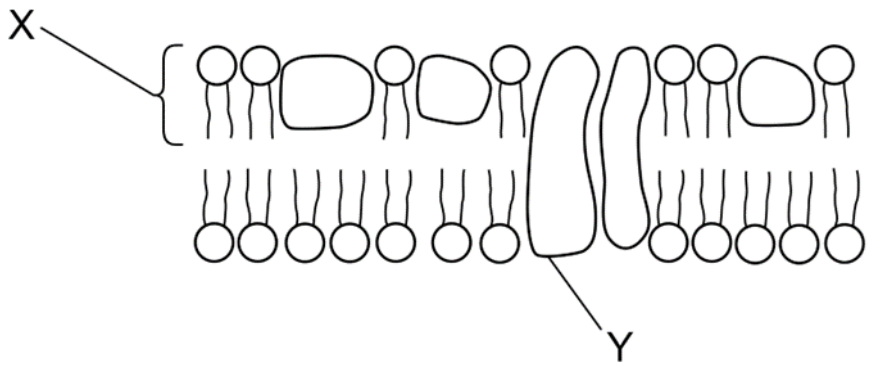


Figure 1: **structure of a cell membrane**

Name the molecules labelled X and Y.

[2 marks]

AO1 = 2 marks

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

- X = phospholipid (1)
- Y = protein (1).

Accept any other suitable response.
Ignore carrier / channel / integral.

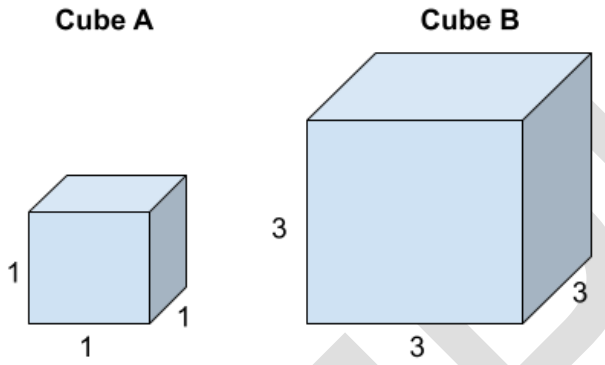
Qualification specification reference

B1.11

2 Figure 2 **shows two cubes that are being used to model the effect of surface area to volume ratio on the rate of exchange.**

The surface area to volume ratio for cube A is 6:1.

Figure 2



All measurements provided are in cm

The volume of cube B is 27 cm^3. Calculate the surface area to volume ratio of cube B and choose which cube would have the greatest rate of exchange.

[3 marks]

AO2 = 3 marks

Award **one** mark for the correct answer for surface area (SA):
SA of one face = 3 x 3 = 9
Total SA = 9 x 6 = 54 (1)

Award **one** mark for the ratio:
SA: volume ratio = 54:27 **or** 2:1 (1)

Award **one** mark for the correct choice of cube:
Cube A (1)

Qualification specification reference

B1.10

3	**There are four main categories of large molecules in the body, all with their own distinct purpose and structure. One of these categories of large molecules contains carbon, oxygen and hydrogen, and forms cell membranes.** **Give the name of this large molecule category.** [1 mark]

AO2 = 1 mark

Award **one** AO2 mark for the following:

- lipids (1).

Accept any other suitable response.

Qualification specification reference

B1.8

4 **A patient presents with chronic bronchitis, which is the long-term inflammation of the airways, that is one of the conditions known as chronic obstructive pulmonary disease (COPD).**

(a) **Explain** two **effects that long-term chronic bronchitis can have on the respiratory system and blood oxygen levels.**

[4 marks]

AO2 = 4 marks

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

- Inflammation of bronchiole muscles will reduce the diameter of the bronchioles (1) and restrict airflow into the alveoli (1).
- Reduced gas exchange with the blood (1) will result in less oxygen entering the blood and therefore oxygen levels fall (1).

Accept any other suitable response.

Qualification specification reference

B2.8

(b) **Chronic obstructive pulmonary disease (COPD) is the second most common lung disease in the UK – around 4% of people over 45 have diagnosed COPD.**

Figure 3 **shows the deaths caused by COPD per 100 000 of people diagnosed with COPD for males and females in three towns in England.**

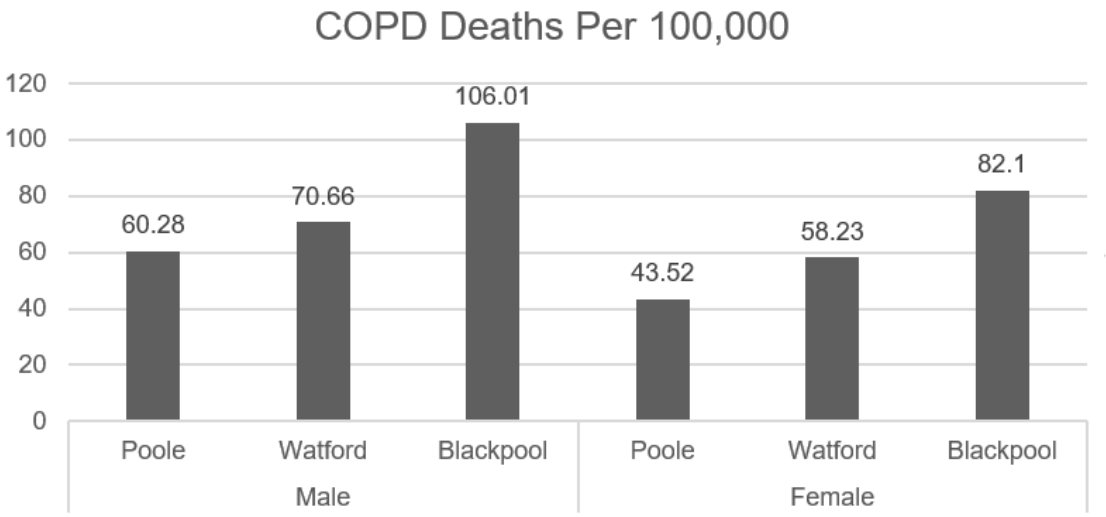


Figure 3: **COPD deaths per 100 000**

The data was obtained from GP records of patients who were being treated for COPD and was collected between 2017 and 2019.

A data scientist analysed the data shown in Figure 3 **and made the following conclusions:**

- **Men are more likely to be diagnosed with COPD than women.**
- **Treatment of COPD is more effective in women.**
- **The higher number of deaths caused by COPD in Blackpool may be linked to high levels of air pollution in Blackpool.**

Using your knowledge of COPD and understanding from Figure 3**, evaluate the accuracy of the data scientist's conclusions.**

[9 marks, plus 3 marks for QWC]

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

Band	Mark	Descriptor
3	7–9	**AO3 –** Evaluation of the extent to which the data supports the conclusions is **comprehensive, effective** and **relevant**, showing **detailed** understanding and **logical** and **coherent** chains of reasoning throughout. Conclusions are **fully** supported with **rational** and **balanced** reasoned judgements. **AO2 –** Applied all **relevant** knowledge of COPD and interpretation of data **effectively**. Application is **highly appropriate** and shows a detailed functional understanding. **AO1 –** A **wide** range of **relevant** knowledge and understanding of COPD and data interpretation, which is **accurate** and **detailed**, is evident.
2	4–6	**AO3 –** Evaluation of the extent to which the results support the conclusions is **in most parts detailed** and **effective** and **mostly relevant**, showing **mostly logical** and **coherent** chains of reasoning. Conclusions are **mostly** supported by reasoned judgements that consider **most** of the relevant arguments. **AO2 –** Applied **mostly relevant** knowledge of COPD and interpretation of data. Application is **in most parts appropriate**, showing **some** functional understanding. **AO1 –** Knowledge and understanding of COPD and interpretation of data is **in most parts clear** and **mostly accurate**, although on occasion **may lose** focus.
1	1–3	**AO3 –** Evaluation of the extent to which the results support the conclusions is **limited** in detail and is **in some parts effective** and of **some relevance**, with **some** understanding and reasoning taking the form of **generic statements** with some development. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge of COPD and interpretation of data. Application may show **limited** functional understanding. **AO1 –** Knowledge and understanding of COPD and interpretation of data shows **some** but **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 COPD and interpretation of data may include:

- COPD is a disease which affects the lungs and reduces oxygen exchange at the alveoli.
- COPD symptoms including wheezing, chest tightness and chronic coughing.
- COPD is a collection of different lung diseases (chronic bronchitis, emphysema).
- COPD can be treated but not cured.
- COPD is mainly caused by smoking.
- A small percentage of COPD cases can be caused by air pollution.

AO2 Application of knowledge and understanding of COPD and interpretation of the data may include:

- There is no data provided on levels of air pollution in any of the areas / there is no data to suggest that the levels of air pollution are higher in Blackpool than in the other areas.
- The number of deaths caused by COPD per 100 000 deaths is higher in all areas for males than females.
- There is no information around treatment methods, so it is impossible to say whether men or women have responded differently to treatment.
- There is no information provided regarding the population in the given areas, so it is impossible to say whether as a proportion of the population, men are more likely to be diagnosed with COPD. More men being diagnosed does not automatically mean that as a whole population, men are more likely to be diagnosed.
- The number of female deaths caused by COPD per 100 000 deaths in Blackpool was 82.1.
- The number of female deaths caused by COPD per 100 000 deaths in Poole was 43.52.
- The information only has data from patients who were being treated for COPD / the information does not contain data for patients who have not been diagnosed with COPD.

AO3 Evaluation of the conclusion may include:

- As there is no data provided on levels of air pollution in Blackpool, it is not possible to conclude that it is the cause of the increased number of deaths in Blackpool, which does not support the conclusion.
- As the main cause of COPD is smoking, it is unlikely that increased air pollution is the cause of the increased number of deaths in Blackpool, which does not support the fourth conclusion.
- It is not possible to support or refute the claims that men are more likely to be diagnosed with COPD, or whether the treatment is more effective in women, based on the information

provided that the scientist has analysed. Overall, some research states that women are more likely to develop COPD, which would not support the conclusions made by the scientist.

- As there is no information on the treatment given to any of the patients, it is not possible to say whether women have responded better to treatment than men.
- As the data does not contain any figures from patients who have not been diagnosed with COPD, the reliability of the data is reduced and does not support the conclusions made.

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.

Qualification specification reference

B2.10, B1.8

5 **A patient has just been diagnosed with coronary heart disease (CHD) after being admitted to hospital with a heart attack.**

Their doctor has said that there are two possible treatments that are available to them: statins or fitting stents.

Discuss the suitability of both available treatment options for the patient.

Your response must include reasoned judgements and conclusions.

[6 marks]

AO3 = 6 marks

Award **one** AO3 mark for **each** discussion point, up to a maximum of **six** marks:

- Statins slow down the build-up of fatty materials / plaque in arteries / decrease levels of cholesterol in the blood / reduce the risk of plaques breaking off (1). Stents keep the blocked artery held open, which increases blood flow to the heart, but does not prevent the build-up of plaque / plaque can continue to build up / only works in arteries the stents have been placed in (1).
- Stents only work in the artery they are put into (1). Statins work across arteries to reduce the risk of blockages (1). As the patient has already had a heart attack, a stent would open the affected artery / prevent further tissue damage (1) but statins would lower risk of further blockages in other areas of the body (1). Due to history of a heart attack, fitting a stent to the affected artery and taking statins may be the best option (1).
- Statins are easier to take / not invasive / do not require an invasive procedure (1), but stents do require an invasive procedure which increases risk of infection (1). Statins may be more acceptable to the patient to avoid a surgical procedure (1).
- Patients prescribed statins must take them every day for life (1), but even patients who have had stents are required to take blood thinning medication every day for life (1). Therefore, he will be required to take medication every day, whichever option is chosen (1).
- There is a risk of a blood clot forming on the stent or it moving, causing a heart attack and artery wall splitting (1), but there are also side effects of statins (accept named examples) (1). The patient will have to consider the overall benefits of each treatment / which side effects or risks he is willing to accept (1).
- Effect of stents is immediate (1), but statins take 4 to 6 weeks / 2 to 3 months to work / it can take 4 to 6 weeks for cholesterol levels to fall / stabilise (1). As he has already had a heart attack, a stent would treat this immediately, but statins would lower risk of further blockages in other areas of the body / As the patient has already had a heart attack, fitting a stent to the affected artery and taking statins may be the best option (1).

Accept any other suitable response.

Qualification specification reference

B2.7

6 **Parkinson's disease (PD) is a condition that affects neurones in the brain.**

Levodopa is the most commonly prescribed medicine for PD. The majority of patients respond well to the treatment and find it very effective for managing their symptoms. However, involuntary muscle movement will develop in around 75% of patients after 10 years of treatment.

Deep brain stimulation (DBS) is suitable for some PD patients. Of the patients that have received DBS for PD, around 80% felt it improved their symptoms, but there is limited data of long-term outcomes.

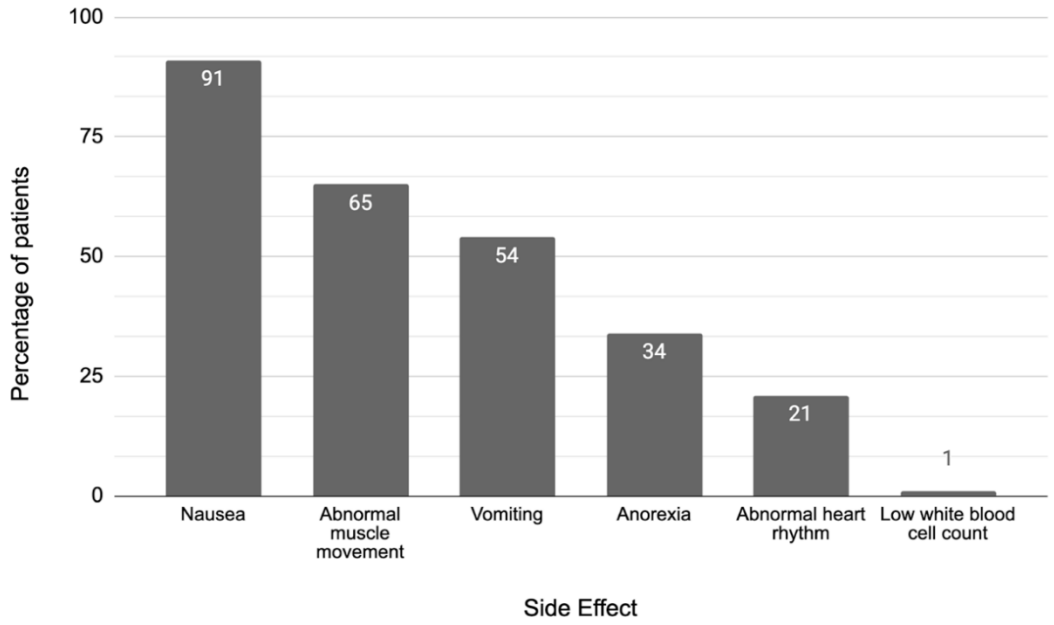


Figure 4: **Frequency of some side effects associated with Levodopa – Yahr M. D. et al. (1969) 'Treatment of Parkinsonism With Levodopa'. Archives of Neurology. 21(4)**

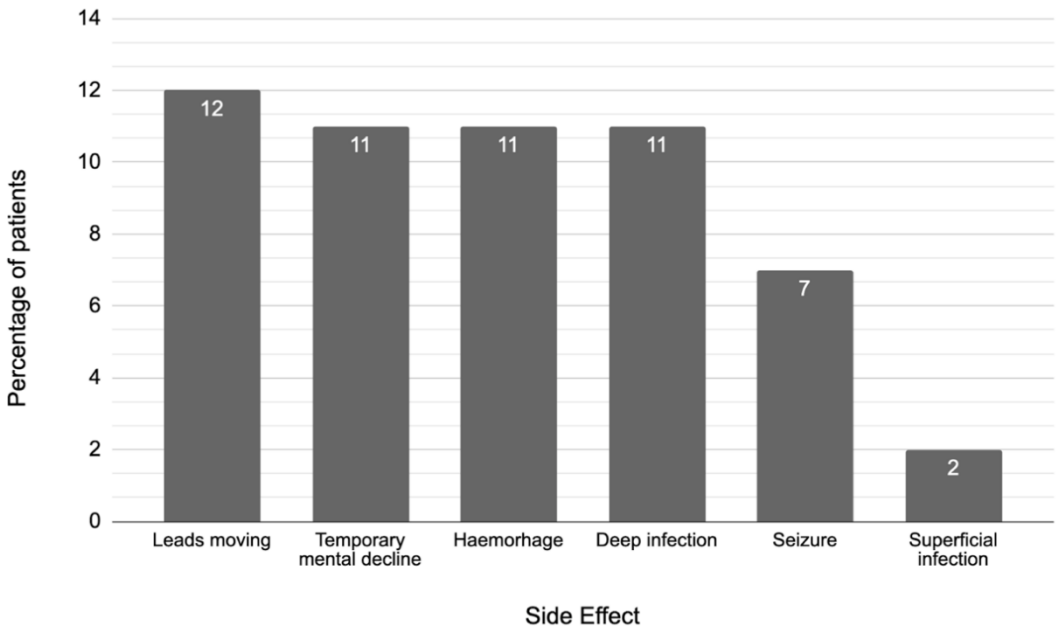


Figure 5: **Frequency of some side effects associated with deep brain stimulation – Morishita, T. et al. (2017) 'Postoperative lead migration in deep brain stimulation surgery: Incidence, risk factors, and clinical impact'. PLOS One. 12(9)**

Using the information provided and your own knowledge, evaluate the statement:

'Levodopa is the safest and most effective treatment for Parkinson's disease'.

[9 marks, plus 3 marks for QWC]

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

Band	Mark	Descriptor
3	7–9	**AO3 –** Evaluation of the statement is **effective** and **relevant**, showing **logical** and **coherent** chains of reasoning. Analysis of the information provided relating to the treatment of PD with levodopa is **effective**. Conclusions are **fully** supported with **rational** and **balanced** reasoned judgements. **AO2 –** Applied **relevant** knowledge of PD and its treatment with levodopa to the given context. **AO1 –** Knowledge and understanding of the information provided relating to PD and its treatment is **clear** and **accurate**, although on occasion **may lose** focus.
2	4–6	**AO3 –** Evaluation of the statement is **in most parts effective** but of **limited relevance**. Analysis of the information provided relating to the treatment of PD with levodopa is **mostly** used effectively. Conclusions are **mostly** supported by reasoned judgements that consider **most** of the relevant arguments. **AO2 –** Applied **mostly relevant** knowledge of PD and its treatment with levodopa to the given context. **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 the statement is **minimal** and **limited** in effectiveness and relevance. Analysis of the information provided relating to the treatment of PD with levodopa is **ineffective** and **minimal**. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge of PD and its treatment with levodopa to the given context. **AO1 –** Knowledge and understanding of PD and its treatment shows very **limited** accuracy, focus and relevance.
	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** will be implicit through the level of evaluation and reasoned judgements and / or conclusions that the student provides.

AO1 Knowledge and understanding may include:

- PD is a disease which affects the nerve cells in the brain, particularly those that make the neurotransmitter called dopamine.
- Dopamine allows messages to be sent to the parts of the brain that co-ordinate movement.
- With the loss of dopamine-producing nerve cells, these parts of the brain are unable to work normally, causing symptoms of PD to appear.
- Common symptoms include tremors (shaking), slowness of movement and rigidity (stiffness), but there are more.
- It is a progressive disease which means it gets progressively worse over time.
- PD can be treated but not cured.
- The actual cause of PD is unknown, but researchers think it is a combination of age, genetic and environmental factors that cause the dopamine-producing nerve cells to die.
- Levodopa is the most common treatment for PD.
- Levodopa controls symptoms.
- Levodopa does not slow progression of the disease but does relieve / help with symptoms.
- Levodopa has some side effects.
- DBS requires brain surgery.
- DBS surgery implants electrodes into the brain.
- DBS targets certain areas of the brain with electricity.
- DBS changes brain activity.

AO2 Application of knowledge and understanding of PD and interpretation of the data may include:

- PD cannot be cured, and levodopa does not slow the progression of the disease; after 10 years of treatment with levodopa, 75% of patients will develop involuntary muscle movement.
- Levodopa helps to control the symptoms of PD by increasing the amount of dopamine in the brain.
- Levodopa caused nausea in 91% and abnormal muscle movement in 65% of patients.
- DBS targets areas of the brain which changes some of the electrical signals in the brain that cause the symptoms of PD.
- DBS might be offered if drug treatments become less effective at easing symptoms.
- A greater / higher percentage of patients experienced side effects with levodopa than with DBS.
- The number of patients tested / observed / interviewed is unknown in each study / sample size might be small / not representative of population which means the results / study might not be accurate / reliable / valid.
- Around 80% of patients that received DBS felt it improved their symptoms, but there is limited data on long-term outcomes.
- DBS requires brain surgery which carries risks such as infection, bleeding or stroke during the surgery, as well as anaesthetic complications.
- DBS can change brain activity and cause temporary mental decline in 11% of patients, therefore there is a possibility that it could exacerbate the patient's symptoms.

AO3 Evaluation of the statement may include:

- Around 80% of patients that received DBS felt it improved their symptoms and a lower percentage of patients experienced each type of side effect compared to levodopa, which does not support the statement that levodopa is the safest and most effective treatment for PD.
- There is limited data on the long-term outcomes with DBS, therefore there could be additional side effects and it is known that DBS requires brain surgery which carries risks such as infection, bleeding or stroke during the surgery, as well as anaesthetic complications. This supports part of the statement: levodopa is the safest.
- Involuntary muscle movement develops in 75% of patients after 10 years of treatment, which confirms levodopa does not stop or slow progression and does not support the statement that it is the most effective.
- The data on side effects of levodopa is from a paper published in 1969. There have been many improvements / modifications to the medicine / levodopa is now combined with other drugs / carbidopa to reduce the nausea. This means the proportion of patients experiencing nausea / other side effects could now be much lower / the reliability of the data is lower, so it is not possible to conclude that levodopa is the safest.
- The side effects are very different for each treatment, and it is hard to judge / qualify whether one is more serious than another, which means it is not possible to conclude that levodopa is the safest.

Accept any other suitable response.

Qualification specification reference

B2.19

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 QWC and use of specialist terminology.

7 (a) Figure 6 **shows a single nephron, with its blood supply, from a kidney.**

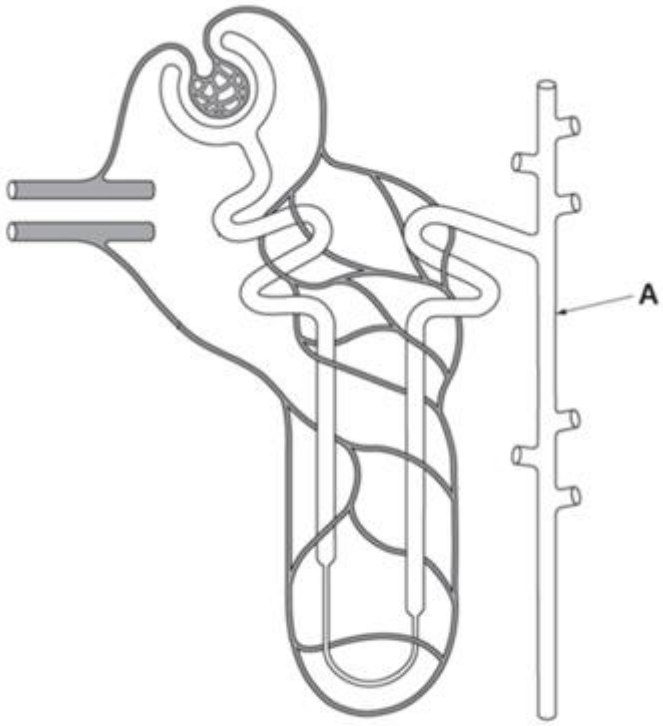


Figure 6: **Structure of the nephron**

Name the part of the nephron labelled A.

[1 mark]

AO1 = 1 mark

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

- **Part A** = collecting duct (1).

Qualification specification reference

B2.20

(b) **Selective reabsorption occurs in the proximal convoluted tubule.**

Describe one **way in which the cells of the proximal convoluted tubule are adapted for reabsorption.**

[1 mark]

AO1 = 1 mark

Award **one** mark for any **one** of the following, up to a maximum of **one** mark:

- Cells are covered with microvilli that provide a large surface area for absorption (1).
- Cells contain many mitochondria for active transport (1).
- Cells contain specific carrier proteins that facilitate the movement of substances across membrane (1).

Accept any other suitable response.

Qualification specification reference

B2.20

A patient gave a sample of urine and then rapidly drank 1000 cm^3 of distilled water.

Urine was then collected at regular intervals, and the volume of each sample and its salt concentration were measured.

The results are shown in Figure 7**.**

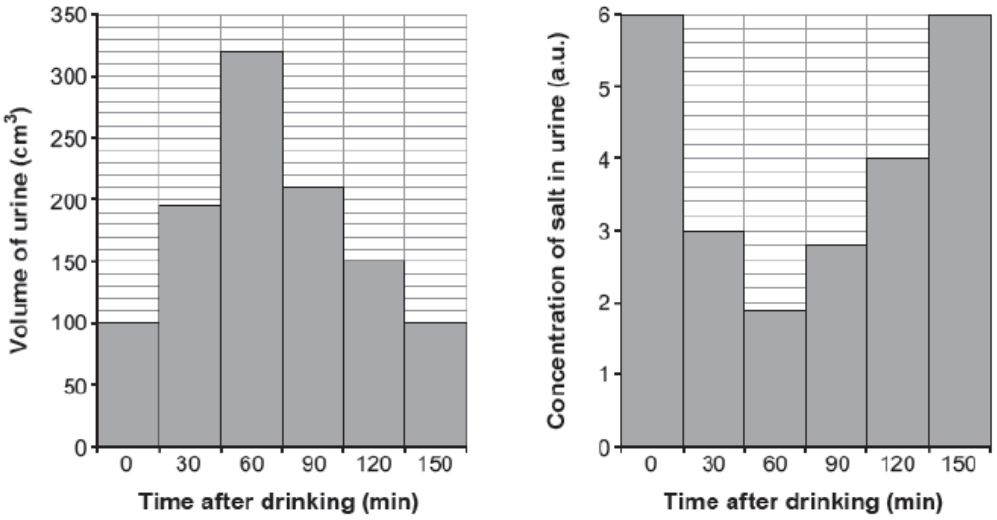


Figure 7: **Volume of urine and salt concentration after drinking distilled water**

(c) **Using knowledge of osmoregulation,** explain **the relationship between water intake and the volume of urine produced and its salt concentration.**

[4 marks]

AO2 = 4 marks

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

- As the water is taken in, it is absorbed into the blood so the water potential rises (1); osmoreceptors in the hypothalamus detect increase in water potential until the optimum levels are reached (1).
- Once the optimum levels are reached, less water is reabsorbed and therefore needs to be excreted, and therefore urine levels are increased (1) and large volumes of dilute urine produced, which reduces the level of salt in urine (1).

Accept any other suitable response.

Qualification specification reference

B2.21

8 (a) **State the structure within the nephron which surrounds a mass of blood capillaries known as the glomerulus.**

[1 mark]

AO1 = 1 mark

Award **one** mark for the correct answer:

- Bowman's capsule (1).

Qualification specification reference

B2.20

(b) **A 52-year-old patient has been diagnosed with chronic kidney disease (CKD). Their doctor has suggested that they should start dialysis immediately and may require a kidney transplant in the future.**

The patient considers the option of a kidney transplant and the option of dialysis.

Evaluate the potential impact of each course of treatment.

[6 marks]

AO3 = 6 marks

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

- Complications with kidney transplants include organ rejection difficulties matching tissue type / blood group (1), whereas dialysis can result in a higher risk of developing infections (1). Organ rejection requires the patient to take immunosuppressive medications, which have negative side effects, further increasing risk of infection (1).
- Successful kidney transplants have better long-term survival rates than those on dialysis (1); however, this is major surgery and associated with risks such as organ damage (1). Dialysis is a less invasive treatment which does not require major surgery (1).
- There is a shortage of organs available for transplantation which can result in long waiting times, which can have detrimental effects on the patient's physical and mental health (1), whereas dialysis can quickly improve symptoms after treatment has begun, such as fatigue and breathlessness, but carries side effects such as nausea, vomiting and low blood pressure (1). Due to the shortage of organs, it may well be the case that the patient would have to go on dialysis prior to an organ becoming available (1).
- Although kidney transplants are initially more expensive than dialysis (1), they can be more cost effective in the long run because they eliminate the ongoing need for dialysis treatment (1). Furthermore, dialysis can be inconvenient and restrictive (for example, those on dialysis must restrict their diets) (1).
- Dialysis requires frequent hospital visits and being confined to a machine for long periods of time (1), whereas a kidney transplant will improve the patient's quality of life long term (1). Overall, patients on dialysis have a shorter life expectancy than those who undergo a successful kidney transplant (1).

Accept any other suitable response.

Qualification specification reference

B2.22

9 **A new skin patch is being developed for people who have type 1 diabetes. The skin patch is placed directly on the skin and can take readings automatically.**

The patch can be worn 24 hours a day and sends readings to a monitor automatically to replace the need for manual testing.

It measures the level of glucose in their blood.

The device takes a measurement every 60 seconds.

The monitor sounds an alarm if the blood sugar level gets too high or too low.

Explain two **reasons why using the new monitor is an improvement on manual monitors.**

[4 marks]

AO2 = 4 marks

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

- The new device takes readings much more regularly than manual monitors do (1), therefore it can notify a person of an issue much quicker than manual monitors can (1). As the person using the patch does not need to rely on remembering to take their own blood sugar levels (1), it can help prevent the blood sugar from getting too high or low in the time period between them testing their levels (1).

Accept ‘blood sugar’ instead of ‘blood glucose’.

Accept any other suitable response.

Qualification specification reference

B2.16

10 **As people get older, they become less fertile. Production of sperm slows, and they become less motile with more changes to chromosomes. The number of ova reduces with age and are more likely to have changes to chromosomes. Eventually, ovaries stop releasing eggs.**

Related health complaints that can affect fertility also increase with age (for example, uterine fibroids).

In vitro fertilisation (IVF) treatment means it is now possible for people in their 60s to have children, but not everyone thinks this is a good idea.

Evaluate reasons for and against people in their 60s having IVF treatment to have children.

[9 marks, plus 3 marks for QWC]

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

Qualification specification reference

B2.29

Band	Mark	Descriptor
3	7–9	**AO3 –** Evaluation is **comprehensive**, **effective and relevant**, showing **detailed** understanding and **logical** and **coherent** chains of reasoning throughout. Application of information relating to fertility and hormones used in IVF treatment is used **effectively and linked with** their own knowledge. Makes informed conclusions that are **fully** supported with **rational** and **balanced** reasoned judgements. **AO2 –** Application of all **relevant** knowledge of IVF treatment for infertility. Application of all **relevant** knowledge that logically links the role of different hormones to their use in IVF and a clear explanation of how IVF increases the chance of a successful pregnancy. Application is **highly appropriate** and shows a detailed functional understanding, and the context is **well considered** throughout. **AO1 –** A **wide** range of **relevant** knowledge and understanding of IVF treatment, which is **accurate** and **detailed**, is evident.
2	4–6	**AO3 –** Evaluation of the impacts is **in most parts effective** and **mostly relevant**, showing **mostly logical** and **coherent** chains of reasoning. Conclusions are supported by reasoned judgements that consider **most** of the relevant arguments. **AO2 –** Applied **mostly relevant** knowledge of IVF treatment and **mostly relevant** knowledge of the role of hormones used in IVF. Application of knowledge may not clearly link the role of different hormones to their use in IVF, and the logic used in explaining how IVF increases the chance of a successful pregnancy may not be linked to hormones. Application shows **some** functional understanding and **linking** of the role of hormones to their use in IVF. **AO1 –** Knowledge and understanding of IVF treatment is **in most parts clear** and **mostly accurate**, although on occasion **may lose** focus.
1	1–3	**AO3 –** Evaluation of impacts of IVF treatment is **in some parts effective** and of **some relevance**, with **some** understanding and reasoning taking the form of **generic statements** with some development. **May not be linked** to the information given in the question. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge and understanding of IVF treatment **or limited** knowledge and understanding of how IVF can increase the chances of a successful pregnancy. Application may show a **lack** of functional understanding. **AO1 –** Showed **some** knowledge and understanding of IVF treatment **or some** knowledge and understanding of the role of hormones in the menstrual cycle, but with **limited** accuracy, focus and relevance.
	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** will be implicit through the level of evaluation and reasoned judgements and / or conclusions that the student provides.

AO1 Knowledge and understanding may include:

- Follicle-stimulating hormone (FSH) is released from the pituitary gland.
- FSH stimulates growth and maturation of follicles in the ovary (reference to the structure of how the ovum matures).
- FSH stimulates oestrogen release.
- Oestrogen stimulates the development of uterus lining and stimulates the release of luteinising hormone (LH).
- LH causes the follicle to burst and release ova from the ovary.
- Oestrogen stimulates growth and thickening of the lining of the uterus.
- Progesterone prepares the uterus lining for a fertilised egg to implant.
- Progesterone helps maintain the uterus lining.
- IVF involves suppressing the natural menstrual cycle using FSH, LH and human chorionic gonadotropin (hCG).
- IVF involves daily injections or nasal sprays to suppress the natural menstrual cycle.
- FSH is given every day prior to ova collection.
- FSH stimulates maturation of the ova.
- hCG has a similar effect to LH.
- hCG is given to produce the final maturation of the ova and their release.
- Ova are collected via a needle from mature follicles within the ovar.
- Sperm are collected and the most active sperm are selected.
- Ova and sperm are mixed in a laboratory.
- Ova is fertilised by injecting a single sperm.
- Fertilisation takes place and embryos continue to grow in the laboratory.
- Cell development is monitored in the laboratory.
- Embryo inserted into the uterus.
- hCG may be given after embryo transfer.
- Factors such as age, IVF cycle, sperm and ova quality, and quality of embryos affect the number of embryos transferred.

AO2 Application of knowledge and understanding may include:

- Older people will not have a menstrual cycle, meaning no eggs will be released. LH or hCG stimulates the release of an egg from an ovary (ovulation) so there is an increased number of eggs that can be collected and used in the treatment.

- Older people have an increased risk of chromosomal abnormalities in their sperm and ova which may lead to health conditions in their children, which can be monitored through the IVF process.
- There is an increased risk of complications in pregnancy in older patients, which may be detrimental to the health of the embryo and patient.
- There is an increased risk of health complaints with age that impact fertility, which will be addressed through the use of hormone treatments.

AO3 Evaluation may include:

- IVF can improve the chances of pregnancy in older people who may have decreased fertility due to age-related factors. However, response to ovarian stimulation through hormones such as FSH can vary, which can affect the success rate of IVF. Overall, IVF allows people to control the timing of their pregnancy and can improve a person's mental health and wellbeing.
- There is an increased risk of complications in pregnancy in older patients, which may be detrimental to the health of the embryo and patient; however, IVF has been shown to improve pregnancy outcomes in these situations and pregnancy at any age carries significant risk to the pregnant person and the foetus. Overall, reduced risk of preterm birth and other complications is important when considering the safety of the patient and child.
- Genetic screening can be carried out on embryos to select those that do not have genetic conditions, which would mean that older people should not have an increased risk of having a child with a genetic condition. However, some people disagree with genetic screening.
- Donor eggs and sperm can be used in IVF, which increases the chance of successful implantations, reduces the risk of genetic conditions in the foetus and allows those with maturity and life experience to become parents.

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.

11 **Endometriosis is a long-term debilitating medical condition that affects around 190 million people worldwide.**

The condition affects the cells that typically line the uterus, as they move to other parts of the body.

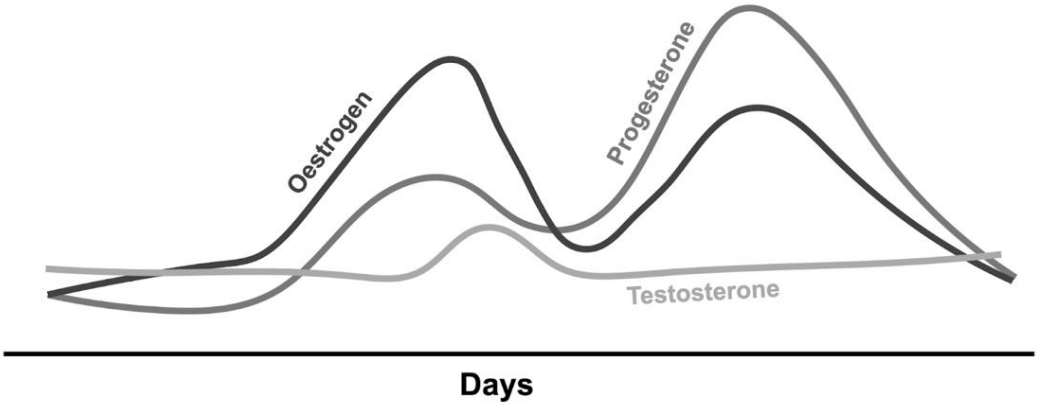


Figure 9: **Changes in hormone levels across the menstrual cycle**

Using the information from Figure 9**, discuss how doctors could treat endometriosis using sex hormones.**

[9 marks, plus 3 marks for QWC]

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

Qualification specification reference

B2.28

Band	Mark	Descriptor
3	7–9	**AO3 –** Discussion is **comprehensive**, **effective and relevant**, showing **detailed** understanding and **logical** and **coherent** chains of reasoning throughout. Analysis of the information is **effectively linked with** the effect of the treatment and their own knowledge. **AO2 –** Application of all **relevant** knowledge of hormone levels to endometriosis and endometrial cells is **highly appropriate** and shows a detailed functional understanding, and the context is **well considered** throughout. **AO1 –** A **wide** range of **relevant** knowledge and understanding of the role of female sex hormones in menstruation, which is **accurate** and **detailed**.
2	4–6	**AO3 –** Discussion is **in most parts effective** and **mostly relevant**, showing **mostly logical** and **coherent** chains of reasoning. Conclusions are supported by reasoned judgements that consider **most** of the relevant arguments. **AO2 –** Applied **mostly relevant** knowledge of hormone levels to endometriosis. Application of knowledge may not clearly link hormone levels to endometriosis logically but shows **some** functional understanding and **links**. **AO1 –** Knowledge and understanding of the role of female sex hormones in menstruation is **in most parts clear** and **mostly accurate**, although on occasion **may lose** focus.
1	1–3	**AO3 –** Discussion is **in some parts effective** and of **some relevance**, with **some** understanding and reasoning taking the form of **generic statements** with some development. **May not be linked** to the information given in the question. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge and understanding of the impact of hormone levels on endometriosis **or limited** knowledge and understanding of endometriosis. Application may show a **lack** of functional understanding. **AO1 –** Showed **some** knowledge and understanding of the role of female sex hormones in menstruation, but with **limited** accuracy, focus and relevance.
	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** will be implicit through the level of evaluation and reasoned judgements and / or conclusions that the student provides.

AO1 Knowledge and understanding may include:

- Endometriosis is a chronic inflammatory disorder which can be treated but has no cure.
- When progesterone levels are high, oestrogen levels are low.
- Increasing progesterone levels causes the uterine lining to thicken further.
- Progesterone maintains the lining of the uterus.
- Menstruation / a fall in progesterone levels causes the uterine lining to break down.
- As oestrogen and progesterone levels increase, signals are sent to the hypothalamus and pituitary gland which inhibit the release of FSH and LH.
- In endometriosis, cells may grow outside of the uterus on the ovaries, fallopian tubes, intestines, rectum, bowel or in the pelvic cavity.
- Endometriosis causes chronic inflammation of the female reproductive system.
- Symptoms of endometriosis include severe pain through menstruation and ovulation, chronic pelvic pain and fatigue.
- Endometriosis has been associated with depression and anxiety, and reduced quality of life.
- Endometrial cells outside the uterus build up and break down in the same way that cells within the uterus do during the usual menstrual cycle.
- Oestrogen promotes the growth of new blood vessels around endometriosis lesions.
- Treatments for endometriosis include pain relief medication, non-steroidal anti-inflammatory drugs (NSAIDs), hormone-based treatments and surgery (laparoscopy and hysterectomy).

AO2 Application of knowledge and understanding may include:

- Oestrogen plays a role in the growth and maintenance of endometrial cells outside of the uterus as well as those inside it.
- Negative feedback mechanisms involving oestrogen and progesterone may impact the growth of endometrial tissue.
- Growth of new blood vessels provides oxygen and nutrients to the cells for them to grow and survive.
- During the breakdown stage, the cells growing outside the uterus are not able to leave the body through menstruation, which leads to swelling, bleeding into surrounding tissues, pelvic or lower back pain and scarring.
- Endometrial growths may cause infertility by blocking fallopian tubes or forming scar tissue that may bind organs together.

- Progesterone can reduce the growth of endometrial tissue outside of the uterus by suppressing oestrogen levels and promoting cell differentiation and cell death.

AO3 Discussion may include:

- Hormone treatments such as the oral contraceptive pill can attempt to reduce the production of oestrogen in the body. By keeping oestrogen levels low, cell build-up inside and outside of the uterus can be reduced, which would then reduce inflammation and the relevant symptoms of endometriosis, improving quality of life. However, hormonal treatments can have adverse mental and physical side effects such as mood change, irregular bleeding and weight gain.
- Hormone treatments suppress the production of natural hormones in the body and may activate the negative feedback mechanism to suppress the production of FSH and LH; however, this can vary according to the individual and the treatments can have both beneficial and harmful effects.
- Hormone treatments can inhibit the production of oestrogen in order to prevent cell build-up inside and outside of the uterus; however, hormone treatment has no effect on adhesions, which can cause organ damage.
- Hormones can be given through an intrauterine device (IUD). The Mirena coil releases progesterone into the womb to maintain high levels of progesterone and low levels of oestrogen. This can help to inhibit the growth of endometrial cells and reduce endometriosis symptoms; however, it does not always stop ovulation and implanting an IUD is invasive.
- Symptoms of endometriosis can be temporarily improved through using hormonal treatments; however, patients have a high relapse rate when treatment is discontinued – whereas surgeries, such as laparoscopy, can be used to remove areas of endometriosis tissue which helps to improve symptoms, but are invasive and high risk.
- Although surgical procedures are invasive, they may be used for patients who do not respond to hormone therapy. Infertility related to endometriosis can sometimes be treated by the surgical removal of tissue, which cannot be treated with hormones.
- Very few hormone treatments provide pain relief, one of the main symptoms of endometriosis. Pain is treated using NSAIDs which carry common side effects that may impact a patient's daily life, such as stomach ulcers, vomiting and diarrhoea. Many treatments for pain relief are not suitable for patients trying to conceive.
- Other medications block the production of oestrogen (for example, gonadotropin-releasing hormone (GnRH) agonists or testosterone). This medication slows the growth of cells and prevents the body from menstruating, causing a temporary menopause in patients, which can cause many physical and mental symptoms such as bone density loss and be detrimental to those wanting to conceive later in life.

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 C: Body systems 3

This section is worth 30 marks, plus 6 marks for QWC and use of specialist terminology.

12 **Just under half of people in the UK have an organism called *Helicobacter pylori (H. pylori)* living in their stomachs.**

Most people that have it are unaffected, but in about 15% it causes stomach ulcers, inflammation and indigestion. It is also strongly linked to increased risks of developing stomach cancer.

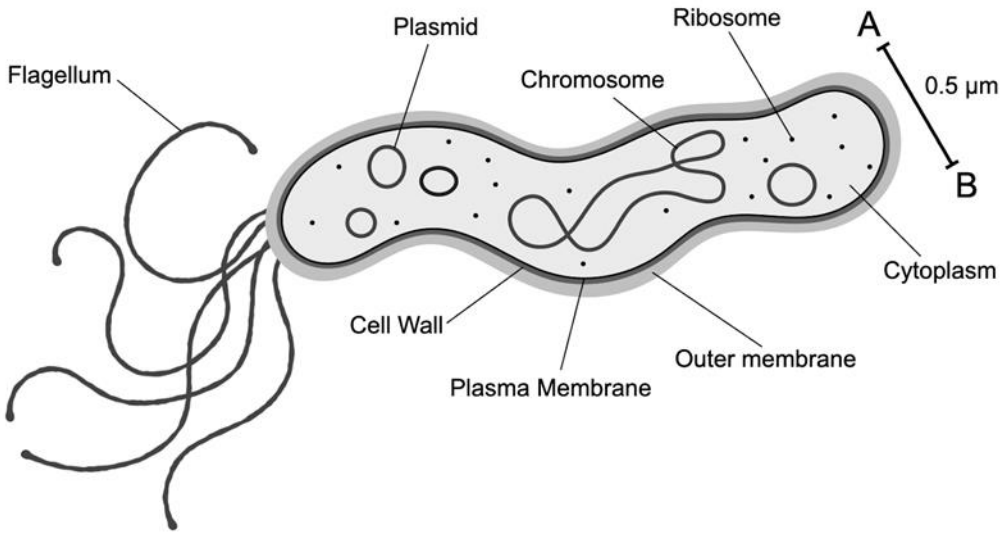


Figure 10: **Features of *Helicobacter pylori (H. pylori)***

(a) **Identify what type of basic cell type the micro-organism *H. pylori* is and give** one **feature that justifies your decision.**

[2 marks]

AO2 = 2 marks

Award **one** mark for identifying the cell type:

- prokaryotic (1).

Award **one** mark for an appropriate feature, up to a maximum of **one** mark:

- It does not have a nucleus (1).
- It has a single, circular chromosome (1).
- It has plasmids (1).

Accept any other suitable response.

Qualification specification reference

B1.2

(b) **The distance between points A and B on** Figure 10 **is 18 mm under magnification and represents the width of the cell.**

The actual width of the cell is 0.5 µm.

The equation used to calculate magnification is:

$$\textbf{magnification} = \frac{\textbf{size of image}}{\textbf{size of object}}$$

1 mm = 1000 µm

Calculate the magnification used in this diagram.

Show all workings out within your response.

[3 marks]

AO2 = 3 marks

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

- 18 mm = 18 000 µm (1)

OR

- 0.5 µm = 0.0005 mm (1)

Allow a correct conversion of a reasonable value for the distance between A and B measured by the student using the exam paper.

Award **one** mark for correct substitution into equation, up to a maximum of **one** mark:

- 18 000 / 0.5 (1)

OR

- 18 / 0.0005 mm (1)

Allow a correct substitution of incorrectly / not converted values.
Allow a correct substitution of a reasonable value for the distance between A and B measured by the student using the exam paper.

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

- 36 000 x (1)

Accept x 36 000 or 36 000.
Allow a correct answer of incorrectly / not converted values.
Allow a correct answer based on a reasonable value for the distance between A and B measured by the student using the exam paper.

Qualification specification reference

B1.5

(c) ***H. pylori*** **is transmitted by saliva, vomit and faecal contamination of food or water.**

Explain one **way of reducing the spread of** ***H. pylori*** **in a population.**

[2 marks]

AO2 = 2 marks

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

- Improving sanitation (1) will help prevent the spread via contaminated water (1) / faecal-oral route (1).

Allow named example of sanitation (for example, clean water or sewage disposal).

- Maintaining good oral hygiene (1) / avoiding kissing (1) / coughing into a tissue and disposing of it (1) will help prevent the spread via saliva.

Accept any other suitable response.

Qualification specification reference

B1.15

13 **A patient has been diagnosed with uterine fibroids.**

Fibroids are non-cancerous tumours made up of muscular and connective tissues from the wall of the uterus and they will not invade nearby tissue or spread around the body.

Name the category of tumour that the patient has been diagnosed with.

[1 mark]

AO1 = 1 mark

Award **one** mark for the correct name:

- benign (1).

Qualification specification reference

B2.30

14 **Radioactive iodine is a nuclear medicine treatment for an overactive thyroid and certain thyroid cancers.**

A small dose of radioactive iodine is swallowed and absorbed into the bloodstream. It will build up in the thyroid gland and begin destroying its cells.

Radioactive iodine emits radiation as beta particles and gamma rays.

(a) **Identify what a beta particle is.**

[1 mark]

AO1 = 1 mark

B: A high-speed electron (1)

Qualification specification reference

B1.25

(b) **A patient who is 35 years old and married with two children will be undergoing radioactive iodine treatment for papillary thyroid cancer that has spread to other tissues.**

Radioactive iodine is safe, effective and helps people live longer if the tumour cannot be removed or has spread. However, it does require the patient to take certain precautions to decrease the amount of radiation that other people may receive from their body and bodily fluids.

The radioactive iodine that is not collected by the thyroid will be eliminated within 2 days, mostly through urine but also through saliva, sweat and faeces.

The half-life of the isotope of iodine used in this treatment is 5.5 days.

Evaluate the impact of radioactive iodine treatment on the patient's health.

[9 marks, plus 3 marks for QWC]

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

Qualification specification reference

B1.25, B2.14, B2.15, B2.31

Band	Mark	Descriptor
3	7–9	**AO3 –** Evaluation of the impacts is **comprehensive**, **effective and relevant**, showing **detailed** understanding and **logical** and **coherent** chains of reasoning throughout. Analysis of the information provided relating to radioactivity, half-lives and elimination of the medication is used **effectively and linked with** their own knowledge of thyroid cancer and radioactive iodine treatments. Makes informed conclusions that are **fully** supported with **rational** and **balanced** reasoned judgements. **AO2 –** Application of all **relevant** knowledge of thyroid cancer and radioactive iodine treatments and the impact of these on the patient's health is **highly appropriate** and shows a detailed functional understanding, and the context is **well considered** throughout. **AO1 –** A **wide** range of **relevant** knowledge and understanding of thyroid cancer and radioactive iodine treatments, which is **accurate** and **detailed**, is evident.
2	4–6	**AO3 –** Evaluation of the impacts is **in most parts effective** and **mostly relevant**, showing **mostly logical** and **coherent** chains of reasoning. Conclusions are supported by reasoned judgements that consider **most** of the relevant arguments. Analysis of the information provided relating to radioactivity, half-lives and elimination of the medication is **in most parts appropriate** and **some** of their own knowledge of thyroid cancer and radioactive iodine treatments is mentioned. **AO2 –** Applied **mostly relevant** knowledge of thyroid cancer and radioactive iodine treatments and the impact of these on the patient that shows **some** functional understanding and **linking** between the context and their knowledge. **AO1 –** Knowledge and understanding of thyroid cancer and radioactive iodine treatments is **in most parts clear** and **mostly accurate**, although on occasion **may lose** focus.
1	1–3	**AO3 –** Evaluation of impacts of treatment is **in some parts effective** and of **some relevance**, with **some** understanding and reasoning taking the form of **generic statements** with some development. **May not be linked** to the information given in the question. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge and understanding of thyroid cancer and radioactive iodine treatment and the impact of these on the patient that shows a **lack** of functional understanding. **AO1 – limited** knowledge and understanding of thyroid cancer and radioactive iodine treatments, with **limited** accuracy, focus and relevance.

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

AO1 Knowledge and understanding may include:

- Iodine is needed for the production of thyroid hormones by the thyroid gland.
- Radioactive iodine is a treatment for thyroid cancers.
- Radioactive iodine is used to kill (ablate) cells left behind (remnant tissue) after thyroid removal (thyroidectomy).
- Beta decay is moderately ionising and has moderate penetrating power.
- Gamma rays have low ionising power and high penetrating power.
- Half-life is the time taken for half of the unstable nuclei in a sample to decay.
- It is not expected that students will cover every factor of the effect and impact of radioactive iodine treatment, but some example points that may be covered are:
    - patients asked to self-isolate to minimise risk of pathogen infection
    - patients asked to self-isolate to minimise the risk to people around them
    - patients should drink a lot of water to help flush the medication from their body
    - patients should stay in one, well-ventilated room with a bathroom connected to it
    - if a room has to be shared with others (for example, bathroom), it should be cleaned after each use
    - patients should use their own crockery and utensils
    - patients are recommended not to have sex for up to 1 month (depending on dose)
    - patients should not become pregnant for up to 1 year afterwards (depending on dose)
    - toilets, sinks, bed sheets and clothing used by the patient should be cleaned regularly
    - patients should wear slippers or socks at all times
    - patients should avoid close contact with others
    - use of a special decontaminant may be used
    - patients should avoid the use of cleaners that contain chlorine bleach
    - these measures are normally taken for 21 days.

AO2 Application of knowledge and understanding may include:

- Gamma is more dangerous externally because it has a high penetrating power / can easily penetrate the body.
- Beta is less dangerous externally because it has a low penetrating power / can only just penetrate the skin.
- Beta is more dangerous internally because that is where it can reach important tissues to damage them.

- Ingesting beta particles (from contaminated surfaces or the patient) is the biggest risk to others.
- Beta decay will cause death in cells that it enters, and other cells up to several millimetres away, so damage is restricted to thyroid cells.
- High penetrating power of gamma rays means that any from retained iodine is a risk to other people.
- Low penetrating power of beta decay means that any from retained iodine is not a risk to other people.
- Radioactive iodine eliminated in urine / sweat / faeces will be a risk to other people as it could be ingested by them. The risk from eliminated radioactive iodine will be highest in the first 2 days as most is eliminated in this time.
- A half-life of 5.5 days means that radioactive iodine will decay quickly.
- A half-life of 5.5 days means it would be considered safe in about 20 to 25 days.
- Due to the moderate penetration of beta particles, high doses are sometimes less dangerous than low doses as they usually kill the surrounding thyroid tissues that could become cancerous as a result of the radiation.

AO3 Evaluation may include:

- Cancer affects physical health by damaging tissues and mental health with feelings of fear or anger. Treatment can improve this, helping the patient to feel better physically and more in control. However, treatment can also cause negative physical effects as side effects are common and may cause negative mental health effects too, for the rest of their life in the case of some medications. The patient may find there is an overall benefit to treatment (extending life, feeling better after treatment is finished) even if it is unpleasant at the time, or may find that the treatment was not worth the effects it caused.
- Attending hospital and taking medication may affect the patient's physical and mental health but may also bring positive feelings and benefit their physical health in the long run. The patient may or may not find there is an overall benefit.
- Supplementing iodine above normal levels can cause severe side effects which may impact their physical health; however, these may be controllable with other treatments and may be less difficult than the effects of the cancer itself.
- If the patient has other health conditions, such as kidney problems, the radioactive iodine may cause further problems with this condition. So, while the cancer may be treated and bring positive physical and mental health effects, other conditions may be worsened.
- The patient may wish to have more children in the future or may feel their family is complete. If they wish to conceive a child in the future, radiation treatment should not affect fertility. However, sperm counts and testosterone levels can be lower in those that have had this treatment. There may also be irregularities with the menstrual cycle, and people should not become pregnant for up to a year after treatment due to the (low) risk to a foetus. The patient's sex is not mentioned so students may discuss effects on males, females, intersex or a mixture.

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 patient who is a 25-year-old woman with a strong family history of breast cancer plans to discuss predictive genetic testing on the NHS with her GP.**

An inherited mutation in the BRCA1 gene is the leading risk factor for developing breast or ovarian cancers.

BRCA1 is known as a tumour suppressor gene.

Tumour suppressor genes help to prevent the uncontrolled division of damaged or abnormal cells.

Assess to what extent a mutation in the patient's BRCA1 gene could result in the formation of breast cancer.

[3 marks]

AO3 = 3 marks

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

- If the mutation is one that impairs tumour suppression, it will increase the risk of developing breast cancer (1).
- Accept converse: If the mutation does not impair tumour suppression, it will decrease the risk of developing breast cancer (1).
- The chance of a mutation impairing tumour suppression is 1 in 5 / one-fifth / 20% (1).
- Accept converse: The chance of a mutation not impairing tumour suppression is 4 in 5 / 4-fifths / 80% (1).
- A mutation is much more likely to not impair tumour suppression than impair it (1).
- Accept converse: A mutation is much more likely to impair tumour suppression than not impair it (1).

Accept any other suitable response.

Qualification specification reference

B2.30, B2.31

16 **Vaccines usually contain some form of antigen from the pathogen and are designed to prevent or reduce the seriousness of infection.**

Vaccines take a lot of time and money to develop. In addition, some people feel unwell after vaccination due to the activation of their immune system. A sore arm at the injection site, feeling tired and a mild fever are all a result of the immune system responding to the vaccine.

The common cold is a mild, viral disease of the upper respiratory tract and symptoms include a blocked nose, sore throat, mild fever and feeling tired. It is generally not lethal, although there are some rare exceptions.

The common cold can be caused by over 200 different viruses, many of which are closely related. Frequent spontaneous changes in the viral genetic sequence can lead to new strains of the viruses and considerable variation of the antigens.

Using the information provided and your knowledge of the human immune system, evaluate the statement: 'It is unlikely that a vaccine against the common cold will ever be produced.'

[9 marks, plus 3 marks for QWC]

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

Qualification specification reference

B1.16, B1.17, B1.18, B1.19, B1.21

Band	Mark	Descriptor
3	7–9	**AO3 –** Evaluation of the statement is effective and **relevant**, showing **logical** and **coherent** chains of reasoning. Analysis of the information provided relating to the common cold and vaccines is used **effectively**. Makes informed conclusions that are **fully** supported with **rational** and **balanced** reasoned judgements. **AO2 –** Applied relevant knowledge of the immune response to the given context. **AO1 –** Knowledge and understanding of the information provided relating to the common cold and vaccines is clear and **accurate**, although on occasion **may lose** focus.
2	4–6	**AO3 –** Evaluation of the statement is **in most parts effective** but of **limited relevance**. Analysis of the information provided relating to the common cold and vaccines is sometimes used effectively. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied mostly **relevant** knowledge of the immune response to the given context. **AO1 –** Knowledge and understanding of the immune response is **in most parts clear** and **in most parts accurate**, although on occasion **may lose** focus.
1	1–3	**AO3 –** Evaluation of the statement is **minimal** and **limited** in effectiveness and relevance. Analysis of the information provided relating to the common cold and vaccines is **ineffective** and **minimal**. Judgements are basic and brief; conclusions will have **limited** rationality and balance. **AO2 –** Applied **limited** knowledge of the immune system to the given context. **AO1 –** Knowledge and understanding of the immune system shows **limited** accuracy, focus and relevance.
	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** will be implicit through the level of evaluation and reasoned judgements and / or conclusions that the student provides.

AO1 Knowledge and understanding may include:

- Antigens are chemical markers on the surface of cells and micro-organisms.
- The body can recognise its self-antigens / its own antigens.
- The body can recognise non-self-antigens.
- T cells and B cells / lymphocytes in the body are activated by the non-self-antigens of micro-organisms which enter the body.
- Non-self-antigens lead to an immune response.
- Activation of T cells leads to the cell mediated response.
- Activation of B cells leads to the antibody mediated response.
- Antibodies are proteins produced in response to an antigen and are specific to that antigen.
- Antibodies will counteract the micro-organism which has the specific antigen.
- Both the cell mediated and the antibody mediated response leads to death of the micro-organism.
- Activated T and B cells lead to the production of memory cells.
- Memory cells lead to a more rapid response if they encounter the antigen again.
- Memory cells lead to a stronger response if they encounter the antigen again.
- A more rapid and stronger response to antigens can perhaps prevent a second infection.

AO2 Application of knowledge and understanding may include:

- Genetic variation within each common cold virus may lead to changes in the antigens of the virus, making the development of an effective vaccine very difficult.
- If the antigen of a virus changes, the memory cells may not recognise / respond to it and infection will still occur.
- 200 different viruses will have 200 types of antigens, making the development of an effective vaccine very difficult.
- The side effects of any vaccine must be considered against the benefits of the vaccine.
- As people encounter different common cold viruses, they will develop some immunity naturally.

AO3 Evaluation may include:

- As introduction of the antigen to a common cold virus would cause an immune response, the development of a vaccine is possible.
- As there are over 200 different common cold viruses, this may therefore require over 200 different vaccines.
- The development of 200 different vaccines is likely to be far too expensive and time consuming to carry out.
- Vaccination would require patients to receive many different vaccines which would cause huge logistical problems.
- As the common cold is not normally a serious disease, it is not a priority for the development of a vaccine.
- As there are many diseases that are much more serious than the common cold, development of vaccines to these diseases will take priority.
- As the common cold is not normally a serious disease, the risk from any possible side effects may outweigh the benefits of a vaccine.

- As many of the common cold viruses are closely related, they may have very similar antigens, therefore one vaccine may work for several types of viruses.
- As immunity to the common cold virus develops naturally throughout a person's life, there is less need for the development of a vaccine.
- As the DNA or RNA of common cold viruses can undergo frequent spontaneous changes which could change the antigen, this is likely to lessen the effectiveness of any vaccine.
- As many anti-vaccination groups have developed in recent years, this may put pressure on people not to be vaccinated.
- As misinformation about a vaccine may be rapidly spread through the population, this may cause people to be reluctant to be vaccinated.

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.

Assessment objective grid

Section A
Body systems 1

Question number	AO1	AO2	AO3	Mathematics	QWC	Total
1 (a)	1					1
1 (b)	2					2
2		3		3		3
3		1				1
4 (a)		4				4
4 (b)	3	3	3		3	9
5			6			6
6	3	3	3		3	9
Total	**9**	**14**	**12**	**3**	**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
7 (a)	1					1
7 (b)	1					1
7 (c)		4				4
8 (a)	1			1		1
8 (b)			6			6
9		4				4
10	3	3	3		3	9
11	3	3	3		3	9
Total	**9**	**14**	**12**	**1**	**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
12 (a)		2				2
12 (b)		3		3		3
12 (c)		2				2
13	1					1
14 (a)	1					1
14 (b)	3	3	3		3	9
15			3			3
16	3	3	3		3	9
Total	**8**	**13**	**9**	**3**	**6**	**30**
Totals required	**8–9 marks**	**12–14 marks**	**9–11 marks**		**6**	**30**

Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education. NCFE is currently authorised by the Institute to develop and deliver the T Level Technical Qualification in Health.

Owner: Head of Assessment Design

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	22 November 2023