BTEC Level 3 National in Applied Science: Biology

First teaching September 2016

Sample Marked Learner Work

External Assessment

Unit 1: Principles and Applications of Science I

Pearson

In preparation for the first teaching from September 2016 and as a part of the on-going support that we offer to our centres, we have been developing support materials to help you better understand the application of Nationals BTEC Level 3 qualification.

What is Sample Marked Learner Work (SMLW)?

The following learner work has been prepared as guidance for centres and learners. It can be used as a helpful tool when teaching and preparing for external units.

Each question explores two responses; one good response, followed by a poor response. These responses demonstrate how marks can be both attained and lost.

The SMLW includes examples of real learners' work, accompanied with examiner tips and comments based on the responses of how learners performed.

Below are two boxes and a tips section displaying the format. Each question will show a learner response, followed by comments on the command verbs and the content of the question. Tips may be offered where possible.

The appendix has attached a mark scheme showing all the possible responses that perhaps were not explored in the SMLW, but can still be attained.

The red box comments on the command verbs used in the question. Command typically means; to instruct or order for something to be done. Likewise, in assessments, learners are required to answer questions, with the help of a command verb which gives them a sense of direction when answering a question.

This box highlights the command verb used and comments if the learner has successfully done this, or not.

The green box comments on the content words and phrases. Content makes reference to subject knowledge that originates from the specification. Learners are required to use subject specific knowledge to answer the questions in order to gain maximum marks.

The comments include:

- *Any key words/phrases used in the learner's answer.*
- *Why has the learner gained x amount of marks? And why/how have they not gained any further marks?*
- *Any suggestions/ ideas regarding the structure of the answer.*
- *If the answer meets full marks- why it is a strong answer? What part of the content has been mentioned to gain these marks?*

Tips offer helpful hints that the learner may find useful. For example:

- *Recommended length of the answer*
- *Reference to the amount of marks awarded*
- *General advice for the learner when answering questions*

Question 1a: What is the name of the lung tissue that contains ciliated cells?

[Total marks for Q1a= 1 mark]

Ciliated cells are found in the human lung.

(a) What is the name of the lung tissue that contains ciliated cells?

1 mark

- ☒ **A** columnar endothelium
- ☒ **B** columnar epithelium
- ☒ **C** squamous endothelium
- ☒ **D** squamous epithelium

1

The question is asking the learner to select the name of the lung tissue that contains ciliated cells from the 4 options.

This is a multiple choice question and is not negatively marked.

Question 1a addresses B3 Tissue structure and function: Understand the structure and function of epithelial tissue to include columnar as illustrated by goblet cells and ciliated cells in the lungs to include their role in protecting lungs from pathogens.

Good response: In this example the learner has correctly selected B: columnar epithelium.

Ciliated cells are found in the human lung.

(a) What is the name of the lung tissue that contains ciliated cells?

1 mark

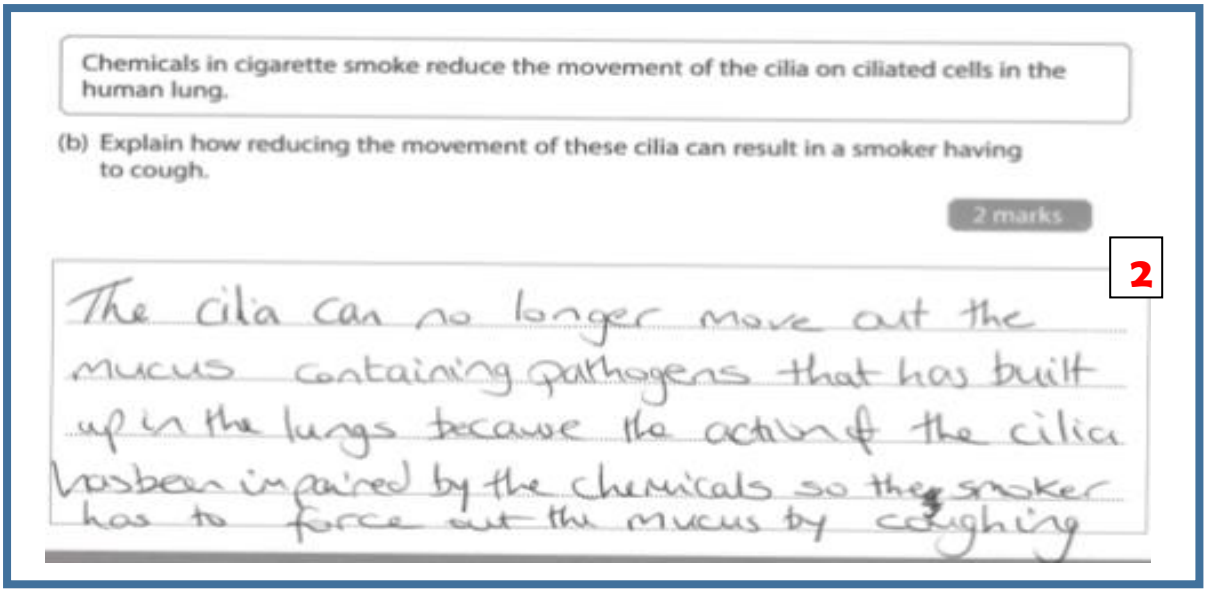
- ☒ **A** columnar endothelium
- ☒ **B** columnar epithelium
- ☒ **C** squamous endothelium
- ☒ **D** squamous epithelium

0

Poor response: In this example the learner has incorrectly selected D: squamous epithelium.

As multiple choice questions are not negatively marked in this exam the learner should be encouraged to select an answer.

Question 1b: Explain how reducing the movement of these cilia can result in a smoker having to cough. *[Total marks for Q1b= 2 marks]*



Chemicals in cigarette smoke reduce the movement of the cilia on ciliated cells in the human lung.

(b) Explain how reducing the movement of these cilia can result in a smoker having to cough.

2 marks

2

The cilia can no longer move out the mucus containing pathogens that has built up in the lungs because the action of the cilia has been impaired by the chemicals so the smoker has to force out the mucus by coughing

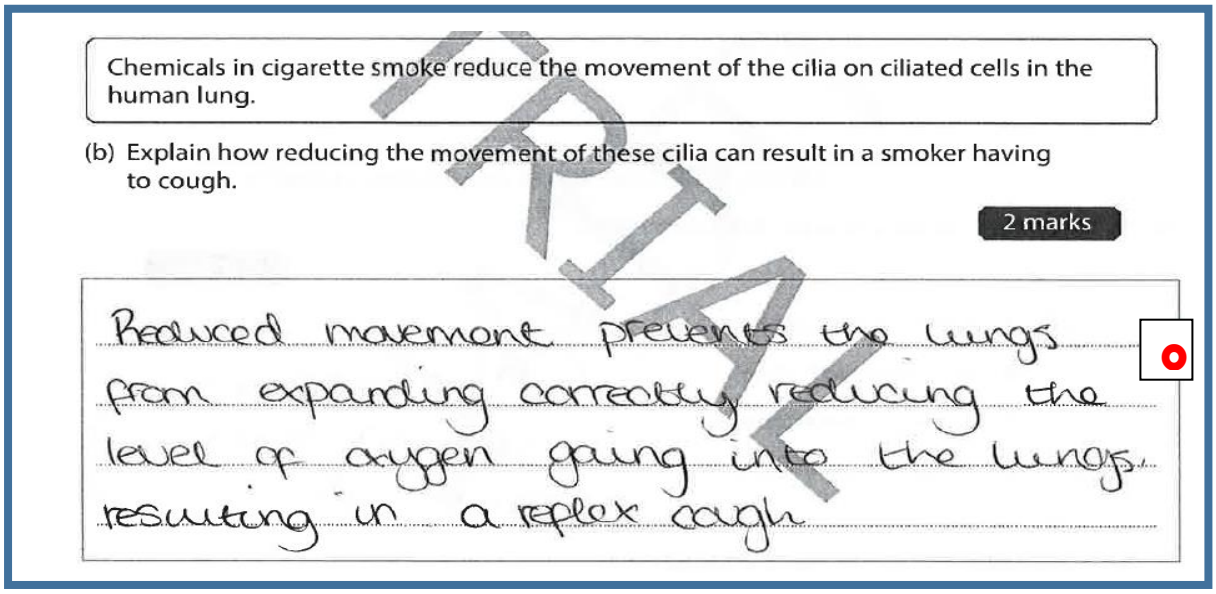
The command verb is explain.

Good response: Learners' explanations require a justification/ exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations.

Question 1b addresses B3 Tissue structure and function: Understand the structure and function of epithelial tissue to include columnar as illustrated by goblet cells and ciliated cells in the lungs to include their role in protecting lungs from pathogens.

This question has a maximum of two marks and requires two linked statements to explain how reducing the movement of cilia can result in a smoker having a cough.

Good response: In this example the learner has correctly described the function of the cilia, which is impaired as a consequence of the tobacco chemicals in the cigarette smoke, reasoning that this impairment would affect the movement of mucus in the respiratory tract. The learner has then made a second credit worthy response by reasoning that the smoker would be required to cough to remove the mucus ("force it out").



Chemicals in cigarette smoke reduce the movement of the cilia on ciliated cells in the human lung.

(b) Explain how reducing the movement of these cilia can result in a smoker having to cough.

2 marks

Reduced movement prevents the lungs from expanding correctly, reducing the level of oxygen going into the lungs, resulting in a reflex cough

0

Poor response: The learner's answer starts with "reduced movement" but incorrectly reasons why the smoker would have a "reflex cough". Also it is not clear what the learner considers to have the "reduced movement" from their response and so lacks a clear understanding. They do not mention the build-up of mucus or that the chemicals in tobacco smoke damages the ciliated epithelial cells causing a reduction in their action to move mucus up the respiratory tract. Their response, incorrectly, discusses the expansion of lungs and level of oxygen and so is not credit worthy.

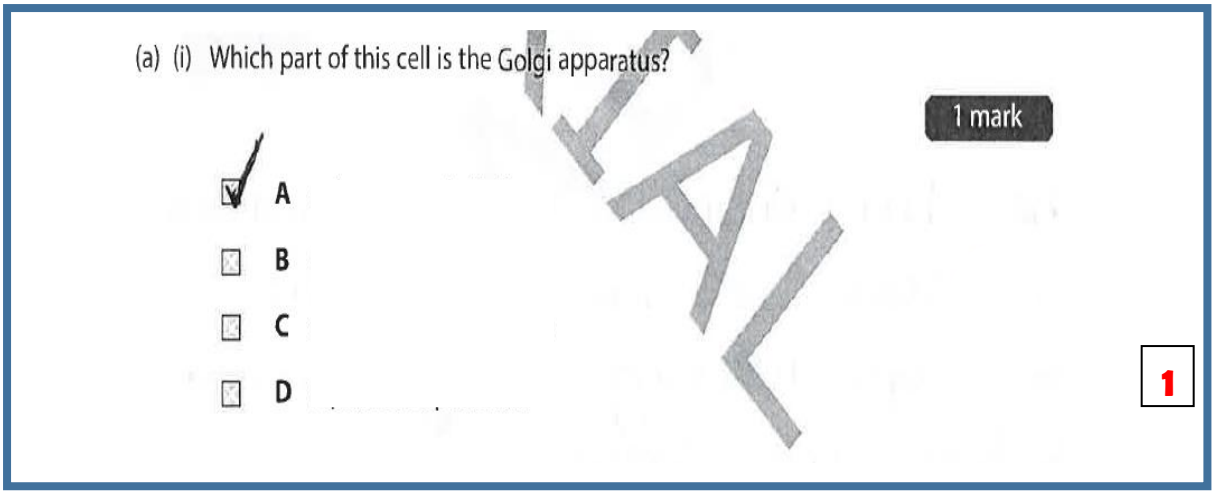
TIPS!

For 2 marks the learner should make two valid linked points.

The command verb and number of lines suggests that sentences rather than a one word response would be more appropriate.

Question 2a i: Which part of this cell is the Golgi apparatus?

[Total marks for Q2ai= 2 marks]

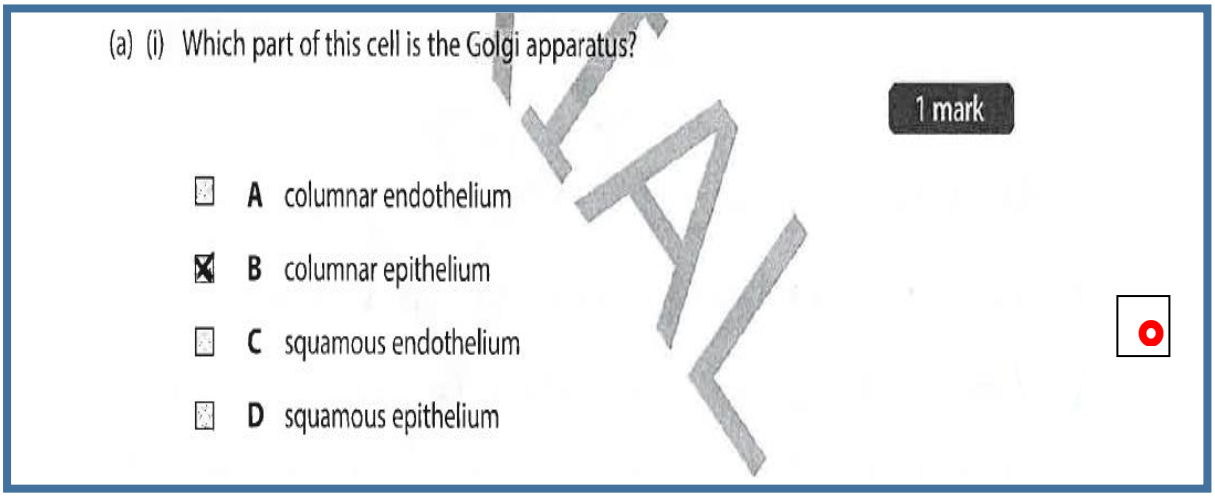


The question is asking the learner to select the part of a labelled cell is the Golgi apparatus from the 4 options.

This is a multiple choice question and is not negatively marked.

Question 2(a)(i) addresses B1 Cell structure and function: Understand the ultrastructure and function of organelles in the following cells: eukaryotic cells (plant and animal cells) – plasma membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum (smooth and rough), Golgi apparatus, vesicles, lysosomes, 80S ribosomes, mitochondria, centriole.

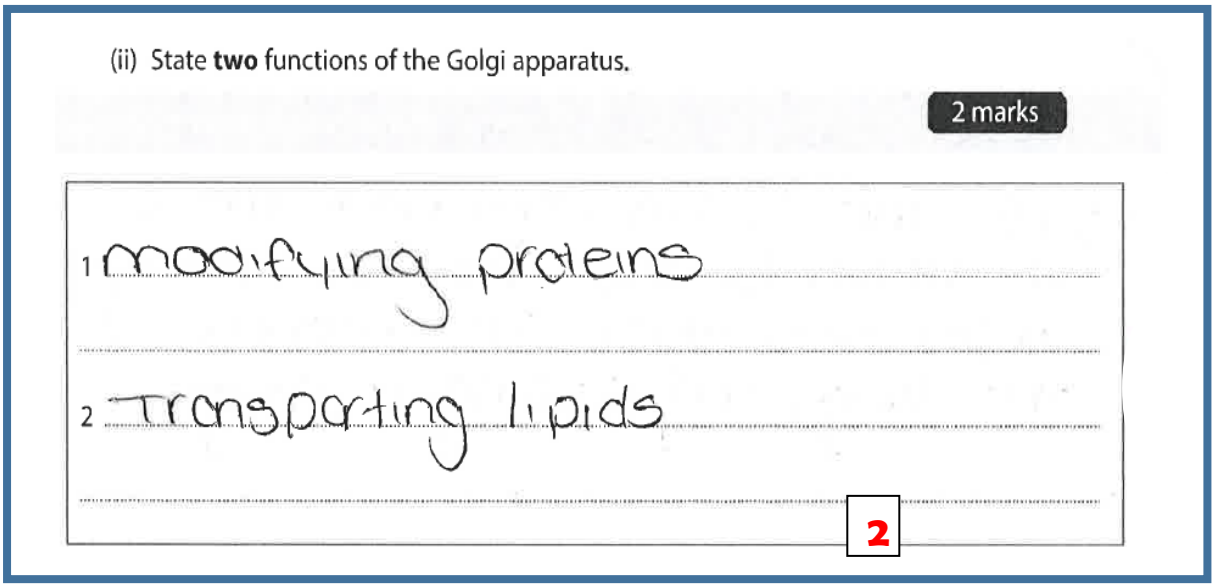
Good response: In this example the learner has correctly selected A.



Poor response: In this example the learner has incorrectly selected B. The correct answer is A.

Question 2a ii: State two functions of the Golgi apparatus.

[Total marks for Q2ai= 2 marks]



(ii) State **two** functions of the Golgi apparatus.

2 marks

1 modifying proteins

2 Transporting lipids

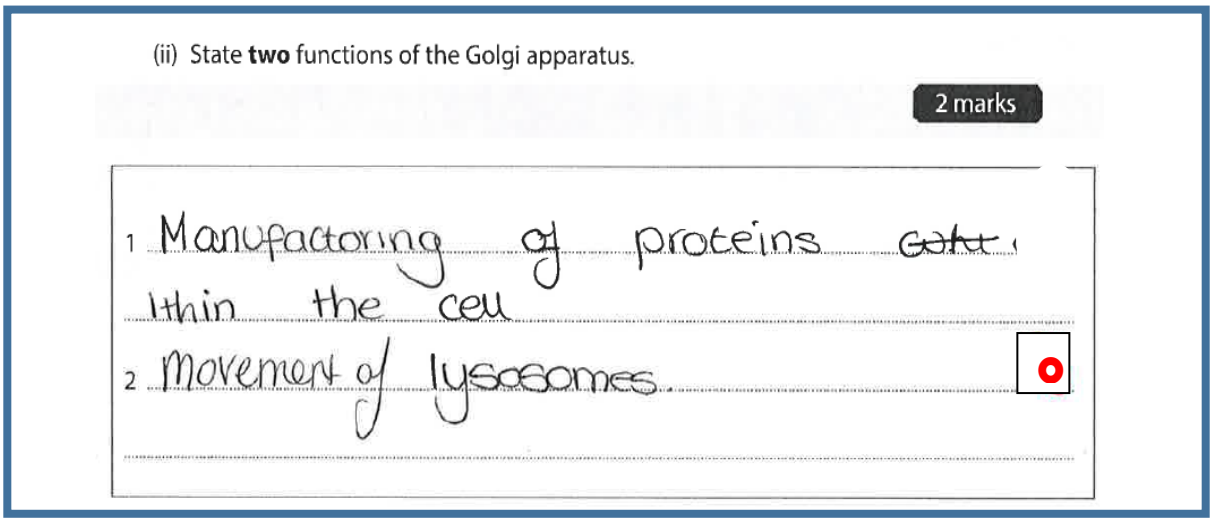
2

The command verb is state.

Question 2(a)(i) addresses B1 Cell structure and function: Understand the ultrastructure and function of organelles in the following cells: eukaryotic cells (plant and animal cells) – plasma membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum (smooth and rough), Golgi apparatus, vesicles, lysosomes, 80S ribosomes, mitochondria, centriole.

The language in the learner's response is sufficiently scientifically accurate to be credit worthy. They have referred to 'modifying proteins' and 'transporting lipids' and so have received maximum marks.

Good response: The learner has provided scientifically accurate response to access the two marks available.



(ii) State **two** functions of the Golgi apparatus.

2 marks

1 Manufactoring of proteins ~~Golgi~~ ithin the cell

2 Movement of lysosomes.

0

Poor response: The learner's response is incorrect. If they had written modifying, sorting of packaging proteins instead of "manufacturing of proteins" and formation of lysosomes instead of "movement of lysosomes" this response would have received full marks.

The command verb state would usually indicate a short response is required and not necessarily long sentences

Question 2a iii: Name an organelle found in a plant cell that is not present in this animal cell. *[Total marks for Q2aii= 1 mark]*

(iii) Name an organelle found in a plant cell that is not present in this animal cell.

1 mark

cell wall.

1

The command verb is name.

Good response: The learner has recalled the relevant information.

Question 2aiii addresses B1 Cell structure and function: Understand the similarities and differences between plant and animal cell structure and function.

The question requires the learner to recall an organelle that is found in plant cells and not the animal cell. Chloroplast, tonoplast or amyloplast are also other correct responses to this question.

(iii) Name an organelle found in a plant cell that is not present in this animal cell.

1 mark

Vacuole is found in plants and not animal cells.

0

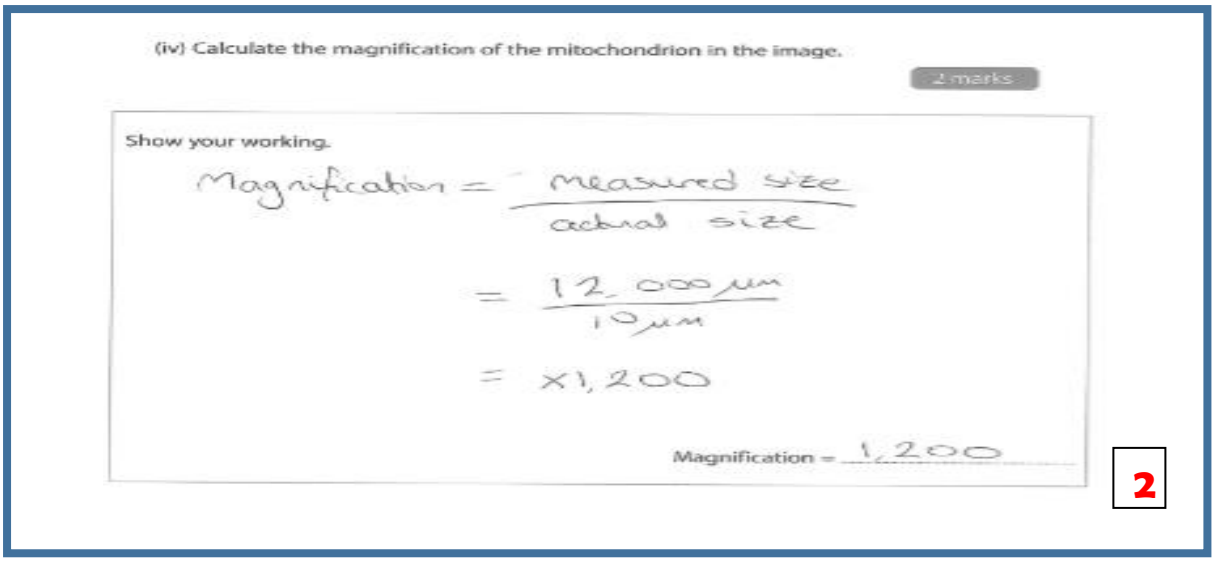
Poor response: The learner has answered with 'vacuole' which, while present in plant cells, is also found in the animal cell. Any one of cell wall, chloroplast, tonoplast or amyloplast would have been correct.

TIPS!

The command verb name would usually indicate a short response is required and full sentences may not be necessary required.

Question 2a iv: Calculate the magnification of the mitochondrion in the image.

[Total marks for Q2a iv= 2 marks]



The command verb is calculate. The definition of Calculate is "Learners obtain a numerical answer, showing relevant working. If the answer has a unit, this must be included."

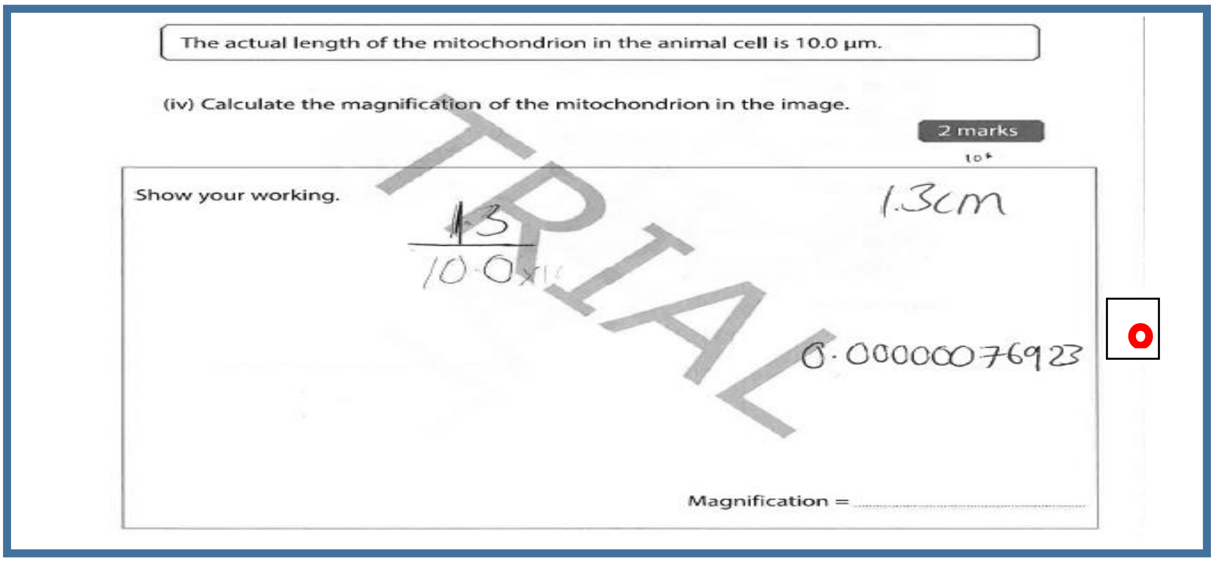
Question 2(a)(iv) addresses B1 Cell Structure and function, calculate magnification and size of cells and organelles from drawings or images.

Good response: The first mark is awarded for correct substitution following conversion of values to the same unit.
12 000 ÷ 10

The second mark is awarded for the answer
× 1200

If the correct answer is given without showing the working, both marks can be awarded. However, it is advisable to show the working so that the response will gain the 'error carried forward' mark, even if the final answer is incorrect.

In this example the working out is clear. The measurement of the mitochondria has been converted into µm so that the magnification equation can be used correctly.



The actual length of the mitochondrion in the animal cell is 10.0 µm.

(iv) Calculate the magnification of the mitochondrion in the image.

2 marks

Show your working.

1.3cm

$\frac{13}{10.0 \times 10}$

0.0000076923

Magnification = ...

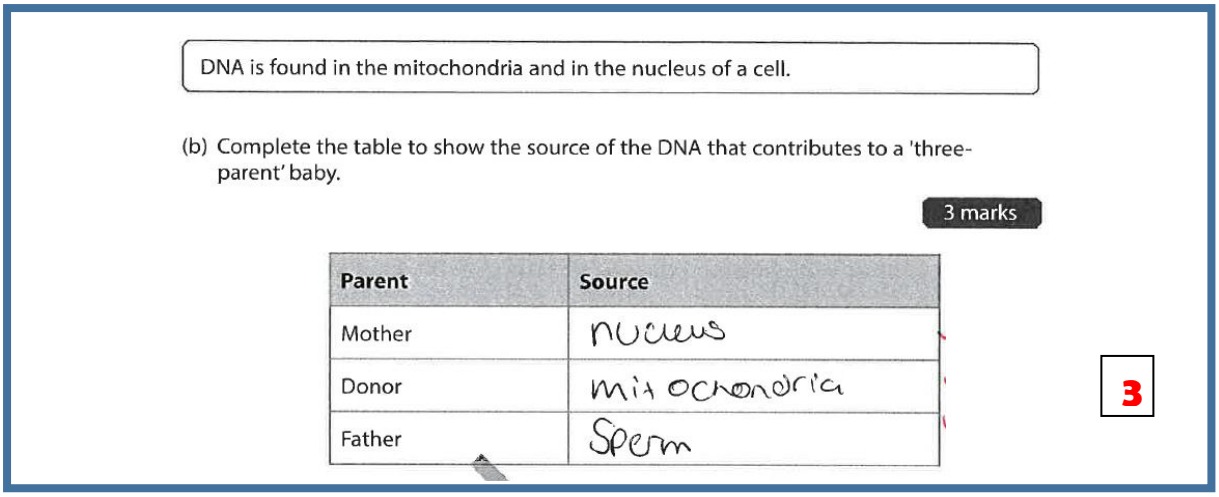
0

TRIAL

Poor response: In this example the working out is not clear. The measurement of the mitochondria has not been converted into µm so the magnification equation cannot be used correctly.

- The learner should be encouraged to state the equation and show any rearrangement of the equation as required
- The learner should be encouraged to ensure values are converted to correct units if required.
- The learner should be encouraged to show all working out, substituting in values and showing a logical approach to the calculation.

Question 2b: Complete the table to show the source of the DNA that contributes to a 'three- parent' baby. *[Total marks for Q2b= 3 marks]*



DNA is found in the mitochondria and in the nucleus of a cell.

(b) Complete the table to show the source of the DNA that contributes to a 'three-parent' baby.

3 marks

Parent	Source
Mother	nucleus
Donor	mitochondria
Father	Sperm

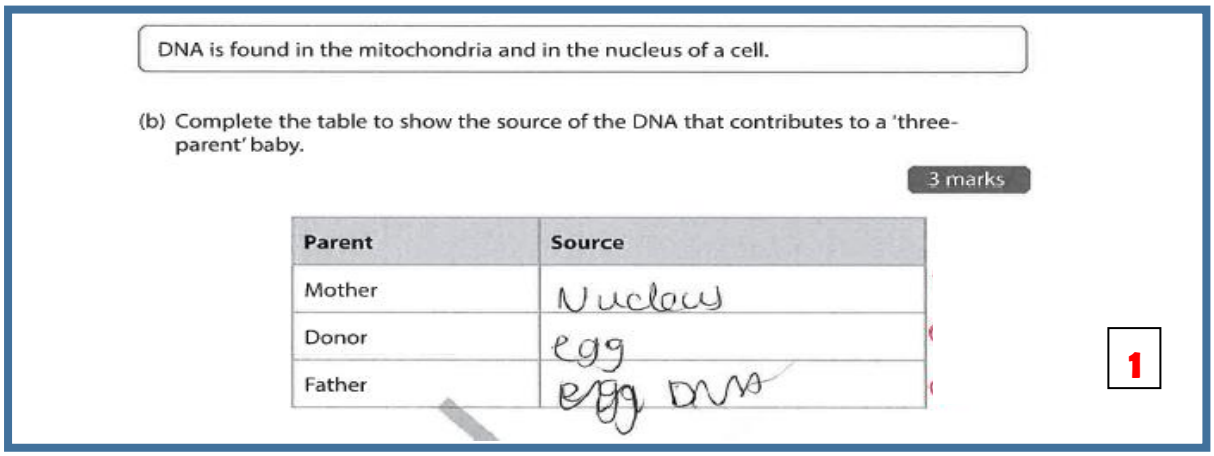
3

The command verb is complete. The learner is being asked to complete a table with key words.

Good response: The learner has correctly completed the table.

Question 2(b) addresses B2 Cell specialisation understand cell specialisation in terms of structure and function, to include sperm and egg cells in reproduction

Good response: The learner has correctly completed the table. In studying the specialisation of the egg and sperm cells the learner has been able to identify that the source of the DNA that contributes to a three parent baby. The mother's DNA is from the nucleus of the egg cell. The father's DNA is from the sperm (or nucleus would also be an acceptable answer). The Donor egg's mitochondria are also a source of DNA. Mitochondrion structure would have been studied in the B1 section of the specification as so the learner would be expected to know that the mitochondrion within the donor egg cell would be a source of DNA.



DNA is found in the mitochondria and in the nucleus of a cell.

(b) Complete the table to show the source of the DNA that contributes to a 'three-parent' baby.

3 marks

Parent	Source
Mother	Nucleus
Donor	egg
Father	egg DNA

1

Poor response: This response scores 1 mark for correctly identifying the source of DNA from the mother. The other two responses are incorrect.

Question 3a: State one other lifestyle factor that increases the risk of atherosclerosis. *[Total marks for Q3a= 1 mark]*

Heart disease caused by atherosclerosis is a major problem in the UK.

Smoking cigarettes and drinking alcohol are lifestyle factors that increase the risk of atherosclerosis.

(a) State **one** other lifestyle factor that increases the risk of atherosclerosis.

1 mark

lack of exercise

1

Question 3(a) addresses B3 Tissue structure and function: Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis. The question requires the learner select one other lifestyle factor that can increase the risk of atherosclerosis beyond the two already stated in the stem of the question.

Good response: The learner has selected 'lack of exercise' which is correct. The learner could have chosen from stress or diet with specific mention to too much fat, cholesterol, carbohydrate or salt. Mention of poor diet without qualification would not have been acceptable.

Heart disease caused by atherosclerosis is a major problem in the UK.

Smoking cigarettes and drinking alcohol are lifestyle factors that increase the risk of atherosclerosis.

(a) State **one** other lifestyle factor that increases the risk of atherosclerosis.

1 mark

smoking cigarettes is a lifestyle factor that increases the risk of atherosclerosis.

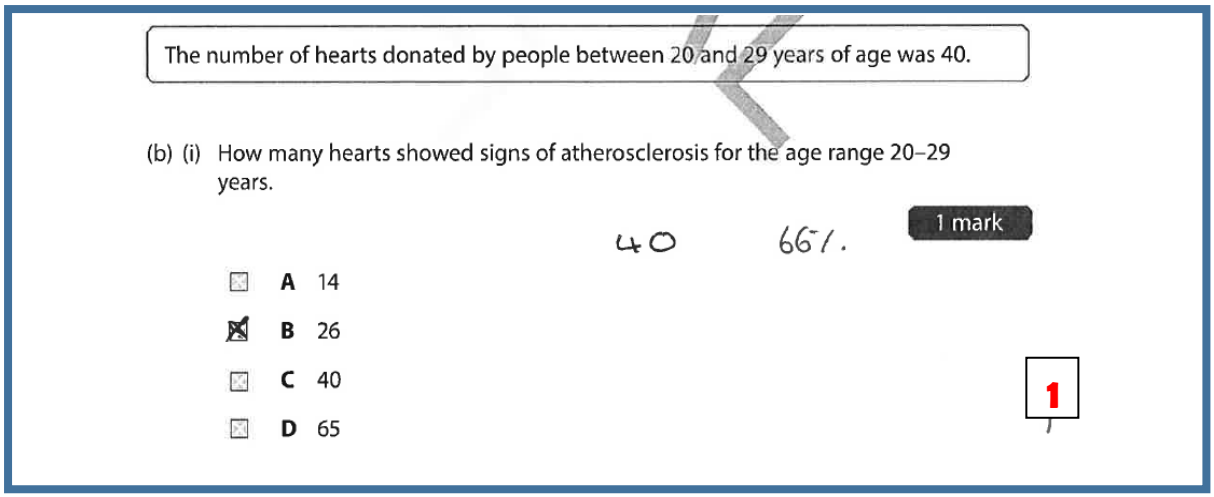
0

Poor response: The learner has selected 'smoking cigarettes' which, while a relevant factor, has already been mentioned in the question and is therefore unacceptable. The learner could have chosen from lack of exercise, stress, or diet with specific mention to too much fat, cholesterol, carbohydrate or salt. Mention of poor diet without qualification would not have been acceptable.

TIPS!

- The learner should read the stimulus to the question carefully to ensure that the information is used appropriately
- The learner should be advised that simply repeating information from the stimulus does not gain any credit.

Question 3b i: How many hearts showed signs of atherosclerosis for the age range 20-29 years. *[Total marks for Q3b i= 1 mark]*



The number of hearts donated by people between 20 and 29 years of age was 40.

(b) (i) How many hearts showed signs of atherosclerosis for the age range 20–29 years.

1 mark

40 66%.

- ☐ **A** 14
- ☒ **B** 26
- ☐ **C** 40
- ☐ **D** 65

1

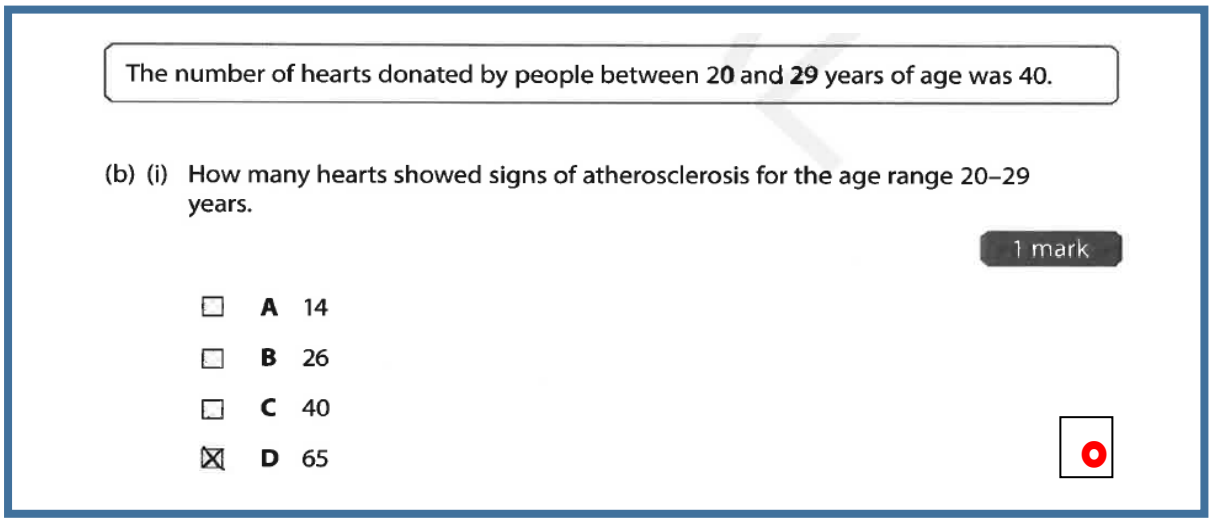
The question is asking the learner to select the number of heart showing signs of atherosclerosis from the 4 options.

This is a multiple choice question and is not negatively marked.

As well as the information in the graph the information in the stimulus of the question must be used by the learner to ensure that this question is answered correctly.

Question 3(a) addresses B3 Tissue structure and function: Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis.

Good response: In this example the learner has correctly selected B.
The learner has taken 65% from graph and has noticed the label on the y-axis. This is a percentage of hearts that showed signs of atherosclerosis for the age range 20-29 years. The text box provides additional information that 40 hearts in the age groups were used and therefore the correct answer is 65% of 40, 26.



The number of hearts donated by people between 20 and 29 years of age was 40.

(b) (i) How many hearts showed signs of atherosclerosis for the age range 20–29 years.

1 mark

- ☐ **A** 14
- ☐ **B** 26
- ☐ **C** 40
- ☒ **D** 65

0

Poor response: In this example the learner has incorrectly selected D. The learner has taken 65 straight from graph but has failed to notice the label on the y-axis. This is a **percentage** of hearts that showed signs of atherosclerosis for the age range 20-29 years. The text box provides additional information that 40 hearts in the age groups were used and therefore the correct answer is 65% of 40, 26.

- The learner should read the stimulus to the question carefully to ensure that the information is used appropriately
- The learner must analyse the graph and the axes more carefully to understand the range and how the values are represented.

Question 3b ii: Suggest an explanation why young hearts are the best ones to use in transplants. *[Total marks for Q3b ii= 3 marks]*

(ii) Suggest an explanation why young hearts are the best ones to use in transplants.

3 marks

Young hearts are mainly used for transplants because young hearts have less atherosclerosis – according to the graph's data – this means the patient would be likely to get a longer lifespan from the transplanted heart as the young heart will give a better supply of blood to the patients cells.

3

The command verb is suggest.

Good response: The learner has given a satisfactory and reasoned explanation.

Question 3(b)(ii) addresses B3 Tissue structure and function: Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis.The question requires the learner to use the graph to discern that young hearts have less atherosclerosis.

Good response: In this example, the learner has used the graph to support their response. They have then reasoned that this would mean young hearts provide a better supply of blood (answers relating to better supply of glucose or oxygen would also be credit worthy) and therefore the heart would last longer. All three points are required for full marks.

(ii) Suggest an explanation why young hearts are the best ones to use in transplants.

3 marks

Young hearts are best to use as it doesn't cause any environmental damage. Also the nerves and tissue for yang hearts grow baan quicher than what ~~[illegible]~~ an older heart would.

0

Poor response: The learner has failed to give a satisfactory and reasoned explanation of the question's premise.

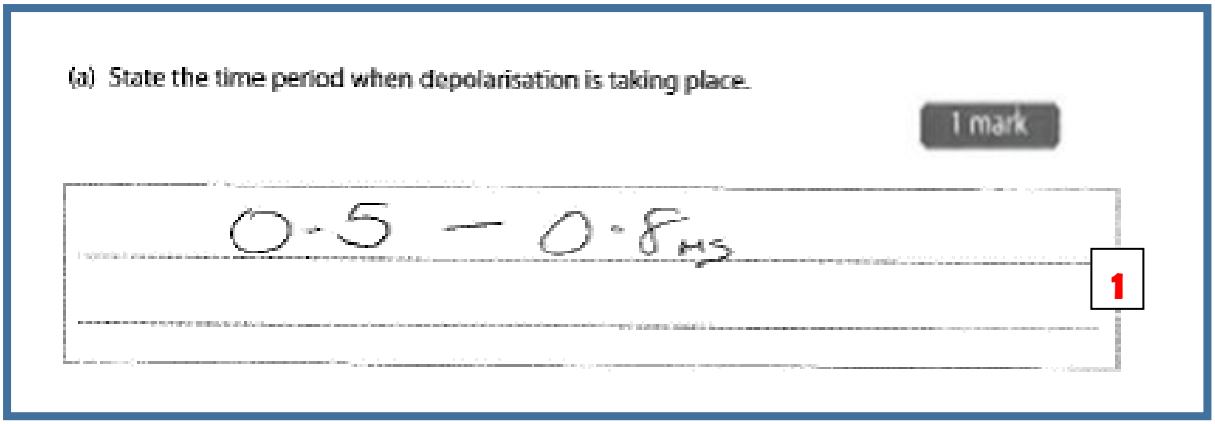
Poor response: The learner has failed to give a satisfactory and reasoned explanation of the question's premise. In their answer, the learner has cited environmental factors and rate of healing, neither of which are acceptable.

For 3 marks the learner should make at least three valid linked points.

The command verb and number of lines suggests that sentences rather than a one word response would be more appropriate.

Question 4 a: State the time period when depolarisation is taking place.

[Total marks for Q4 a-1 mark]

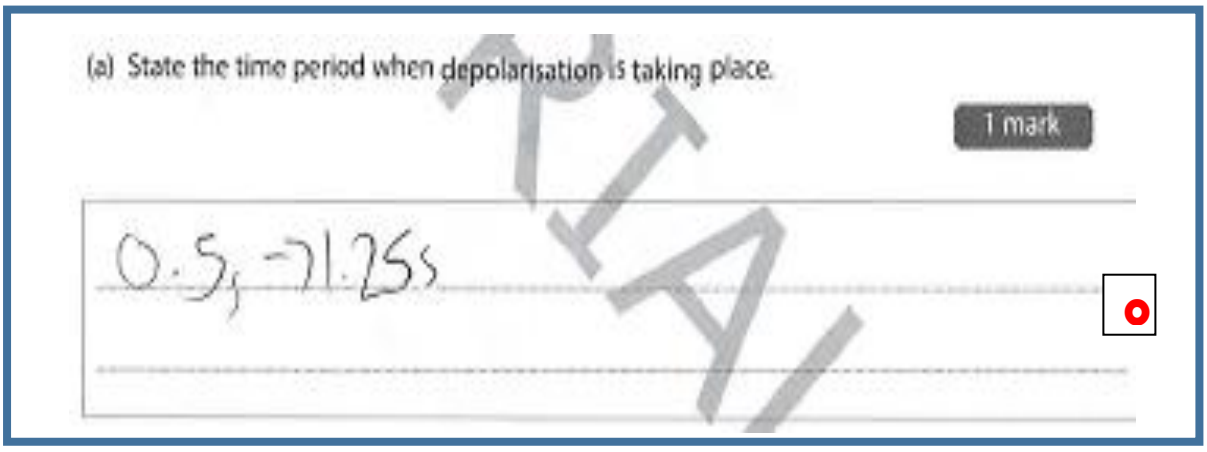


The command verb is state.

Good response: The learner has recalled the appropriate information required to interpret the diagram.

Question 4(a) addresses B3 Tissue structure and function, understand the structure and function of nervous tissue, to include: interpretation of graphical displays of a nerve impulse and electroencephalogram (ECG) recordings.

Good response: In their answer the learner has correctly identified the depolarisation period and calculated the figure correctly. Units are not required in this answer.



Poor response: The learner has not recalled the appropriate information required to interpret the diagram. The question requires that the learner understands the different parts of an action potential and identify the depolarisation period. In their answer the learner has confused the depolarisation period for the whole action potential and therefore come to an incorrect figure. Units are not required in this answer.

Question 4 b: Explain the difference in the speed of the nerve impulse along these axons. *[Total marks for Q4 b-3 marks]*

Speed of nerve impulse/ms^{-1}	
Myelinated axon	Unmyelinated axon
25	5

(b) Explain the difference in the speed of the nerve impulse along these axons.

3 marks

The nerve impulse is much slower along the unmyelinated axon. The myelinated axon has nodes of Ranvier and therefore the nerve impulse can jump from one node to the next. Depolarisation only occurs at these nodes and therefore the speed of the nerve impulse is greater in the myelinated axon

3

The command verb is explain.

Good response: The learner has provided justification and examples to explain the point required in the question.

Question 4b addresses B3 Tissue structure and function: Understand the structure and function of nervous tissue, to include: non-myelinated and myelinated neurones and the conduction of a nerve impulse (action potential) along an axon, including changes in membrane permeability to sodium and potassium ions and the role of the myelination in saltatory conduction.

Good response: The learner's first sentence is not credit-worthy as it describes what can be derived from the data. The question requires the learner to explain why there is such a difference in the speed between a myelinated and non-myelinated axon. The learner has shown their knowledge of the structure of a nerve axon and their response refers to Schwann cells in myelinated axons (nodes of Ranvier would also be acceptable) to explain that depolarisation occurs at nodes and so the impulse can "jump" along the axon and therefore has an increased speed.

Speed of nerve impulse/ms^{-1}	
Myelinated axon	Unmyelinated axon
25	5

(b) Explain the difference in the speed of the nerve impulse along these axons.

3 marks

1

The myelinated axon is shown to have 5 times a faster speed rate to the unmyelinated axon. The myelinated axon has a speed nerve impulse of 25, this is due to it being able to move faster due to nodes and therefore being allowed to jump across therefore able to go at a faster rate than the unmyelinated axon which is shown to only have a speed nerve impulse of 5.

Poor response: The learner has been unable to provide adequate justification of the point raised in the question.

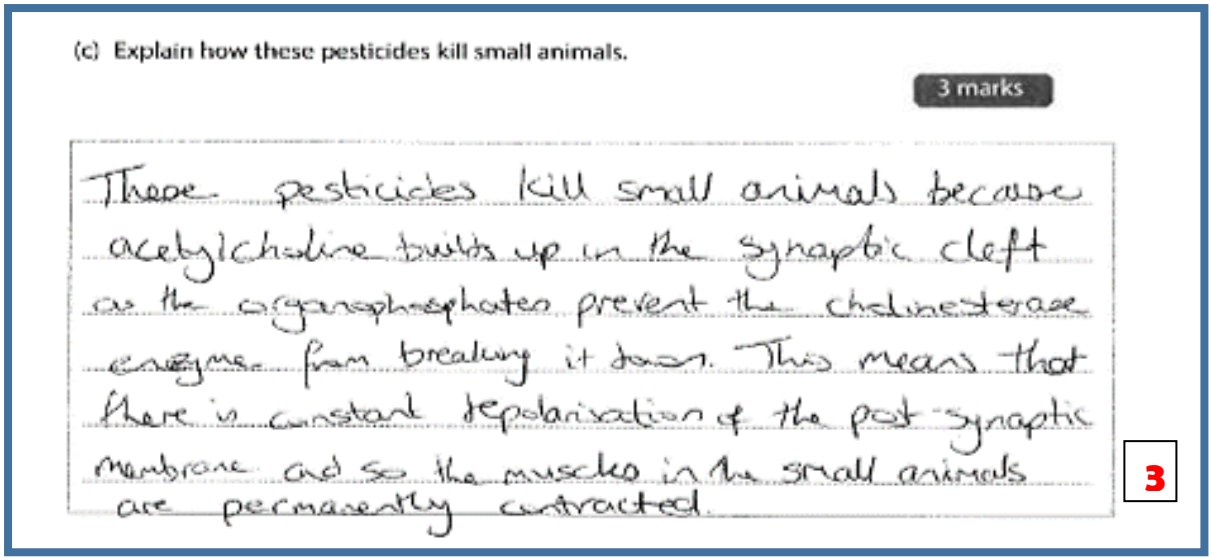
In their answer the learner has only referred to the impulse jumping across the node and therefore only been awarded a single mark. However no further credit-worthy comment has been made by the learner as they have only described the data and has not explained why there is a significant difference between the speeds of a nerve impulse in a myelinated and non-myelinated axon. The learner has not exhibited knowledge of the structure of a nerve axon in their answer.

TIPS!

- The command verb and number of lines suggests that sentences rather than a one word response would be more appropriate.
- For 3 marks the learner should make three valid linked points.
- Learners should ensure that they explain rather than describe in their responses when the command verb is explain, as this is a very common mistake.

Question 4 c: Explain how these pesticides kill small animals.

[Total marks for Q4 c-3 marks]



(c) Explain how these pesticides kill small animals.

3 marks

These pesticides kill small animals because acetylcholine builds up in the synaptic cleft as the organophosphates prevent the cholinesterase enzyme from breaking it down. This means that there is constant depolarisation of the post-synaptic membrane and so the muscles in the small animals are permanently contracted.

3

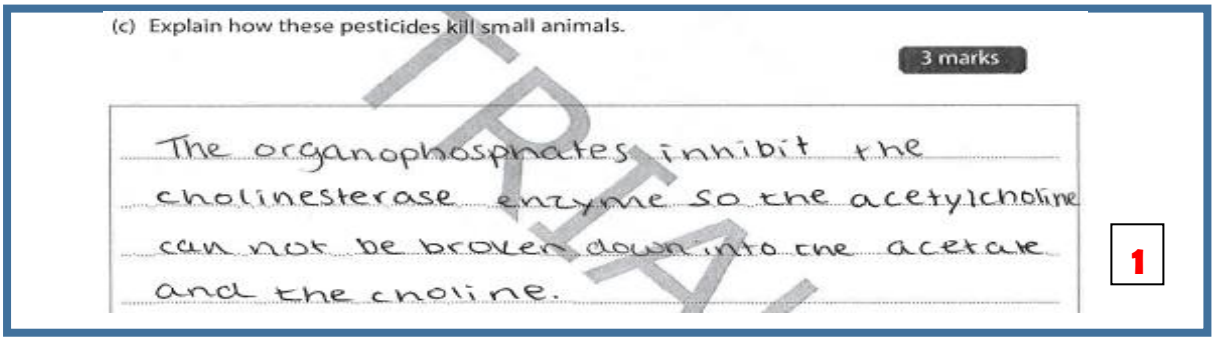
Command verb is explain.

Good response: The learner has provided an example to justify a point. The answer contains an element of reason.

Question 4(c) addresses B3 Tissue structure and function: Understand the structure and function of nervous tissue, to including synaptic structure and the role of neurotransmitters, including acetylcholine.

The answer must include reference to a build-up of acetylcholine in the cleft and also any two of the following: the constant depolarisation of the post synaptic membrane, constant action potentials (impulses to muscles would also be accepted), and the permanent contraction of the muscles.

Good response: The learner has fulfilled the criteria satisfactorily and so earned full marks.



(c) Explain how these pesticides kill small animals.

3 marks

The organophosphates inhibit the cholinesterase enzyme so the acetylcholine can not be broken down into the acetate and the choline.

1

Poor response: The learner has not provided a satisfactory example to justify a point. The question requires that the learner explain the point raised. The answer must include reference to a build-up of acetylcholine in the cleft and also any two of the following: the constant depolarisation of the post synaptic membrane, constant action potentials (impulses to muscles would also be accepted), and the permanent contraction of the muscles. The learner has fulfilled the criteria satisfactorily and so earned maximum marks.

- The command verb and number of lines suggests that sentences rather than a one word response would be more appropriate.
- The learner should read the stimulus to the question carefully to ensure that the information is used appropriately.
- For 3 marks the learner should make three valid linked points.
- Learners should ensure that they explain rather than describe in their responses when the command verb is explain.

Question 5: Discuss how this difference relates to the types of muscle fibre in his leg. *[Total marks for Q5 -5 marks]*

A young athlete is very good at long-distance running but is not good at sprinting.

Discuss how this difference relates to the types of muscle fibre in his legs.

There are 2 types of muscle fibre - slow twitch fibre and fast twitch fibre. The athlete is good at long distance running and so must have a high amount of slow twitch muscle fibre in his legs compared to fast twitch fibres (which are used for sprinting). The slow twitch fibres contain more myoglobin, which stores oxygen for aerobic respiration. They have more mitochondria so more ATP is made and they have more capillaries to deliver oxygen. This means with more slow twitch fibres there can be more aerobic respiration so less lactic acid is made and the muscles don't fatigue as quickly and so the athelete is good at running for longer. In fast twitch fibres its the opposite and anaerobic respiration takes place sooner so more lactic acid is made sooner and so the athelete fatigues sooner and so can't run for as long.

5

The command verb is discuss and this is an extended response question were the learner is expected to show structure and coherence in their written response. The learner has identified the issue that is being assessed in the question and have explored most aspects of the issue. As the command verb is discuss a conclusion is not required.

Good response: This is good response. Bottom of the Level 3 mark descriptors, 5 marks.

Question 5 addresses B3 Tissue structure and function: Understand the structure and function of muscular tissue, to include structural and physiological differences between fast- and slow-twitch muscle fibres and their relevance in sport.

Good response: The learner's response considers that there are several types of muscle fibre and identifies the type of muscle which would support the athlete's long distance run. The response then discusses the adaptations of both types of muscle fibre and relates the structural adaptations to the function of the muscle fibre. The learner's response discusses that slow twitch fibres contain more myoglobin, more mitochondria and contain more capillaries. These structures enable more aerobic respiration to take place with less lactic acid made and reasons that therefore there would be less muscle fatigue and so the athlete can run for longer. The learner's response also discusses a type of muscle fibre which would be more abundant if the athlete was a sprinter rather than a long distance runner, but does not give details of the structural adaptations of the fast twitch muscle fibre. Simply stating "the opposite" is not sufficient and they need to be explicit with the structural adaptations of fast twitch fibres to get maximum marks.

A young athlete is very good at long-distance running but is not good at sprinting.

Discuss how this difference relates to the types of muscle fibre in his legs.

The young athlete will have a slow twitch, which means that his muscle fibres contract slowly and have more mitochondria in them. The slower contraction allows the athlete to run for long periods of time. The athlete has a lot of mitochondria which provides energy to his muscles increases his endurance.

2

Poor response: This response achieves 2 marks, top of level 1 of the marking descriptors.

Poor response: The learner has been awarded two marks for this response as it does show some structure and coherence. The learner has correctly identified the type of muscle, "slow twitch", which would support the athlete's long distance run and given one structural adaptation, "more mitochondria", of this muscle fibre.

The learner's response does not discuss other relevant structural adaptations of slow twitch muscle fibres such as more myoglobin which stores oxygen and more capillaries to deliver oxygen
The response does not relate these structures to function. The learner should then discuss the consequence of these adaptations for the long distance run, such as more aerobic respiration can take place so less lactic acid made and so less muscle fatigue.
The learner does not mention another type of fibre. An abundance of fast twitch fibres would enable the athlete to be better at sprinting. Details about the structural and functional adaptations of fast twitch fibres should also be discussed for maximum marks. The learner could has discussed that fast twitch fibres contain less myoglobin, which stores oxygen, contain less mitochondria, so less ATP made and have less capillaries to deliver oxygen. The discussion could then include that therefore, more anaerobic respiration takes place so more lactic acid made so more muscle fatigue over a long distance.

- Learners should ensure that they make reference to all parts of the stimuli within the question to ensure a complete response.
- Leaners should be encouraged to structure their response before they begin to write.
- Learners should be encouraged to consider using PEE (point, evidence, explain) where appropriate in their extended response question responses.
- Learners should be encouraged to re-read their response and clearly edit if required.

Unit 1: Principles and Applications of Science I – sample mark scheme

General marking guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Learners must be rewarded for what they have shown they can do, rather than be penalised for omissions.
- Examiners should mark according to the mark scheme, not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks, if the learner's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a learner's response, the team leader must be consulted.
- Crossed-out work should be marked, UNLESS the learner has replaced it with an alternative response.
- You will not see 'or words to that effect' (OWTTE). Alternative correct wording should be credited in every answer, unless the mark scheme has specified specific wording that must be present.
- Round brackets () indicate words that are not essential, e.g. '(hence) distance is increased'.
- Error carried forward (ECF), means that a wrong answer given in an earlier part of a question is used correctly in a later part of a question.
- / indicates that the responses are alternatives and either answer should receive full credit.

Specific marking guidance for levels-based mark schemes*

Levels-based mark schemes (LBMS) have been designed to assess learners' work holistically. They consist of two parts: indicative content and levels-based descriptors. Indicative content reflects specific content-related points that a learner might make. Levels-based descriptors articulate the skills that a learner is likely to demonstrate, in relation to the assessment outcomes being targeted by the question. Different rows in the levels, represent the progression of these skills.

When using a levels-based mark scheme, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response, and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer, in response to the assessment focus/objective and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band, depending on how they have evidenced each of the descriptor bullet points.

Section A – Structures and functions of cells and tissues

Question number	Answer	Additional guidance	Mark
1(a)	• B (columnar epithelium)		(1)

Question number	Answer	Additional guidance	Mark
1(b)	An explanation that makes reference to the following points: • cilia no longer moves mucus **(1)** • therefore coughing needed to unblock airways **(1)**		(2)

Question number	Answer	Additional guidance	Mark
2(a)(i)	• A		(1)

Question number	Answer	Additional guidance	Mark
2(a)(ii)	Any two from the following points: • modifying/sorting/packaging proteins **(1)** • lipid transport in cells **(1)** • formation of lysosomes **(1)**		(2)

Question number	Answer	Additional guidance	Mark
2(a)(iii)	Any one from the following points: • cell wall **(1)** • chloroplast **(1)** • tonoplast **(1)** • amyloplast **(1)**		(1)

Question number	Answer	Additional guidance	Mark
2(a)(iv)	• substitution **(1)** 12 000 ÷ 10 • answer **(1)** × 1200	Allow answer based on ± 1 mm.	**(2)**

Question number	Answer	Additional guidance	Mark
2(b)	<table><tr><th>Parent</th><th>Source</th></tr><tr><td>Mother</td><td>Nucleus **(1)**</td></tr><tr><td>Donor</td><td>Mitochondria **(1)**</td></tr><tr><td>Father</td><td>Nucleus/sperm **(1)**</td></tr></table>		**(3)**

Question number	Answer	Additional guidance	Mark
3(a)	Any one from the following points: • lack of exercise **(1)** • diet with too much fat/cholesterol/ carbohydrate/salt **(1)** • stress **(1)**	Ignore poor diet, unless qualified.	**(1)**

Question number	Answer	Additional guidance	Mark
3(b)(i)	• B (26)		**(1)**

Question number	Answer	Additional guidance	Mark
3(b)(ii)	An explanation that makes reference to the following points: • (graph shows) young hearts have less atherosclerosis **(1)** • (so young hearts give) better supply of blood/glucose/oxygen to heart muscle cells **(1)** • (therefore) a young heart will last longer **(1)**	Allow converse, if older hearts discussed.	**(3)**

Question number	Answer	Additional guidance	Mark
4(a)	• 0.5 to 0.8 (ms)	Allow any two values in this range.	**(1)**

Question number	Answer	Additional guidance	Mark
4(b)	An explanation that makes reference to the following points: • myelinated axons have Schwann cells/nodes of Ranvier **(1)** • therefore impulse/action potential jumps from one node to the next/ saltatory conduction **(1)** • therefore depolarisation only at nodes (therefore greater speed of nerve impulse) **(1)**		**(3)**

Question number	Answer	Additional guidance	Mark
4(c)	An explanation that makes reference to the following points: • acetylcholine {remains/builds up} in cleft **(1)** Plus any two from: • (therefore) constant depolarisation of post synaptic membrane **(1)** • (and) constant action potentials/ impulses to muscles **(1)** • (so) muscles permanently contracted **(1)**		**(3)**

Question number	Indicative content
5	Answers will be credited according to the learner's demonstration of knowledge and understanding of the material, using the indicative content and levels descriptors below. The indicative content that follows is not prescriptive. Answers may cover some or all of the indicative content but learners should be rewarded for other relevant answers. **Slow twitch fibre:** • young athlete's muscle mainly composed of slow twitch fibres • these contain more myoglobin which stores oxygen • more mitochondria so more Adenosine triphosphate (ATP) made • more capillaries to deliver oxygen • therefore, more aerobic respiration takes place • so less lactic acid made • so less muscle fatigue/can run for longer **Fast twitch fibre:** • these contain less myoglobin, which stores oxygen • less mitochondria, so less ATP made • less capillaries to deliver oxygen • therefore, more anerobic respiration takes place • so more lactic acid made • so more muscle fatigue/cannot run for longer
Mark scheme (award up to 6 marks) refer to the guidance on the cover of this document for how to apply levels-based mark schemes*	

Level	Mark	Descriptor

	0	no rewardable content
Level 1	1–2	• demonstrates adequate knowledge of scientific facts/concepts, with generalised comments made • generic statements may be presented rather than linkages being made, so that lines of reasoning are unsupported or partially supported • the discussion shows some structure and coherence

Level	**Mark**	**Descriptor**
Level 2	3–4	• demonstrates good knowledge and understanding, by selecting and applying some relevant scientific knowledge facts/concepts, to provide the discussion being presented • lines of argument mostly supported through the application of relevant evidence • the discussion shows a structure that is mostly clear, coherent and logical
Level 3	5–6	• demonstrates comprehensive knowledge and understanding, by selecting and applying relevant knowledge of scientific facts/concepts, to provide the discussion being presented • line(s) of argument consistently supported throughout by sustained application of relevant evidence • the discussion shows a well-developed structure that is clear, coherent and logical