

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson BTEC
Level 3
Nationals
Certificate**

Centre Number

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Learner Registration Number

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Tuesday 14 January 2020

Afternoon (Time: 40 minutes)

Paper Reference **31617H/1B**

**Applied Science / Forensic and Criminal
Investigation**

Unit 1: Principles and Applications of Science I

Biology

SECTION A: STRUCTURES AND FUNCTIONS OF CELLS AND TISSUES

You must have:

A calculator and a ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The exam comprises three papers worth 30 marks each.
Section A: Structures and Functions of Cells and Tissues (Biology).
Section B: Periodicity and Properties of Elements (Chemistry).
Section C: Waves in Communication (Physics).
- The total mark for this exam is 90.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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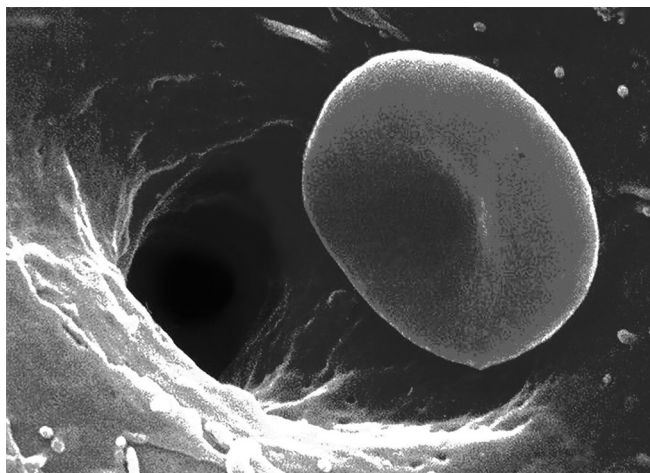


Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1 Figure 1 shows an electron micrograph of a red blood cell in a capillary.

Red blood cells are flexible.



© DR. FRED HOSSLER, VISUALS UNLIMITED /
SCIENCE PHOTO LIBRARY

Figure 1

- (a) (i) Identify the feature of red blood cells that makes them flexible.

(1)

- ☐ A biconcave structure
- ☐ B contain haemoglobin
- ☐ C high surface area to volume ratio
- ☐ D have a thin cell membrane

- (ii) Red blood cells are specialised for their function.

Identify a function of red blood cells.

(1)

- ☐ A carry out aerobic respiration
- ☐ B enable carbon dioxide transport
- ☐ C protect against pathogens
- ☐ D stimulate cell division



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(b) An unbalanced diet can increase the risk of atherosclerosis.

Fatty plaques build up in the wall of arteries causing atherosclerosis.

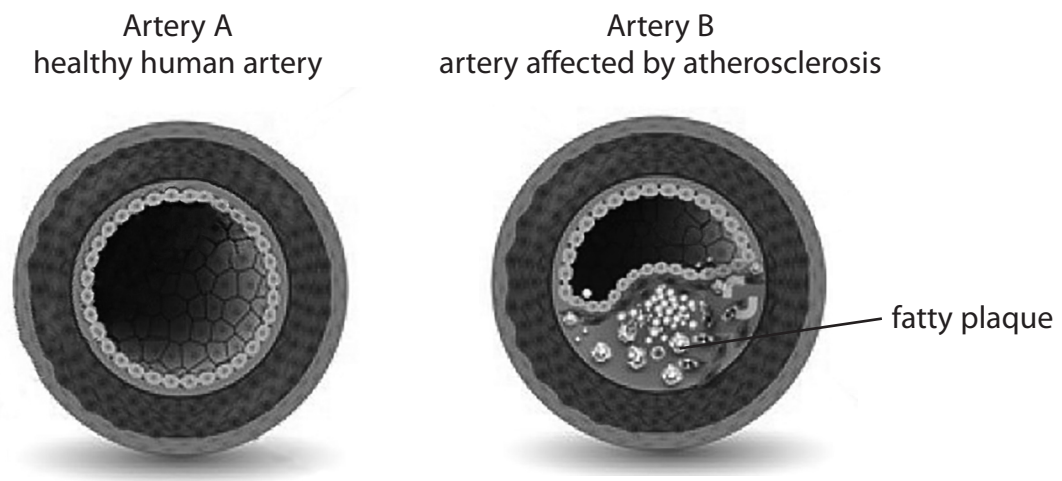
The fatty plaques reduce the diameter of the lumen of the arteries.

Figure 2 shows the cross section of two arteries.

Artery A is a healthy human artery with a lumen diameter of 3.40 mm.

Artery B is a human artery affected by atherosclerosis.

Artery B has a lumen diameter of 2.72 mm.



© Tefi/Shutterstock

Figure 2

- (i) Calculate the percentage **decrease** in the diameter of the lumen in artery B compared with the lumen in artery A.

Show your working.

(3)

.....%



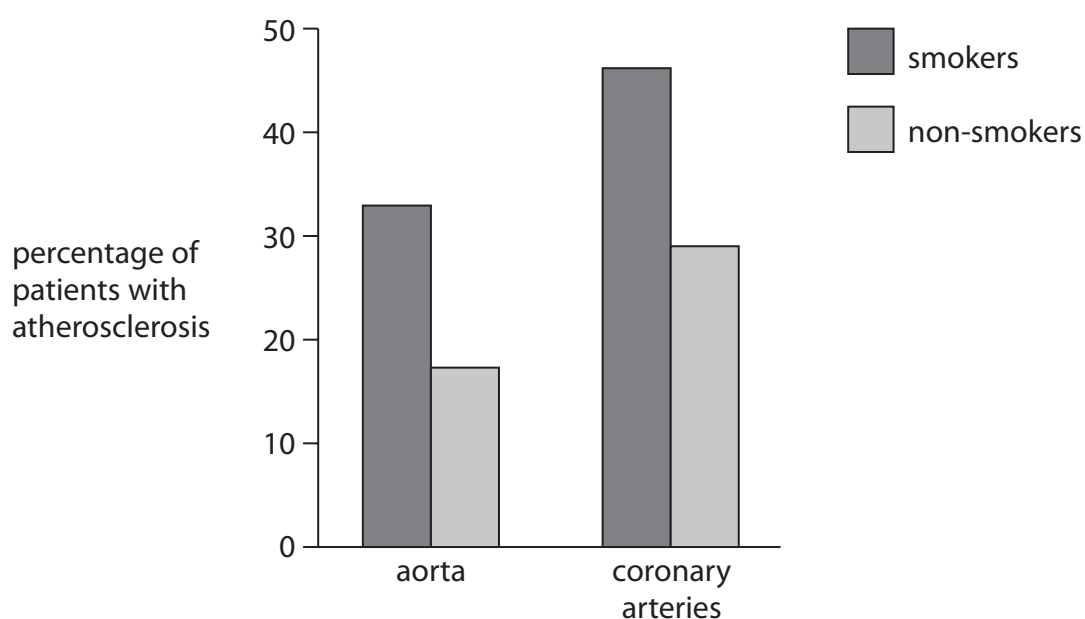
(ii) Identify the type of dietary nutrient that may contribute to the development of fatty plaques in the walls of arteries.

(1)

- ☐ A polyunsaturated fats
- ☐ B protein
- ☐ C saturated fats
- ☐ D soluble fibre

(iii) Scientists investigated how smoking affects the risk of developing atherosclerosis.

Graph 1 shows some of their results.



Source from: <https://www.nejm.org/doi/full/10.1056/NEJM199806043382302>

Graph 1

State, using information from Graph 1, **two** observations about the effect of smoking on the development of atherosclerosis.

(2)

1

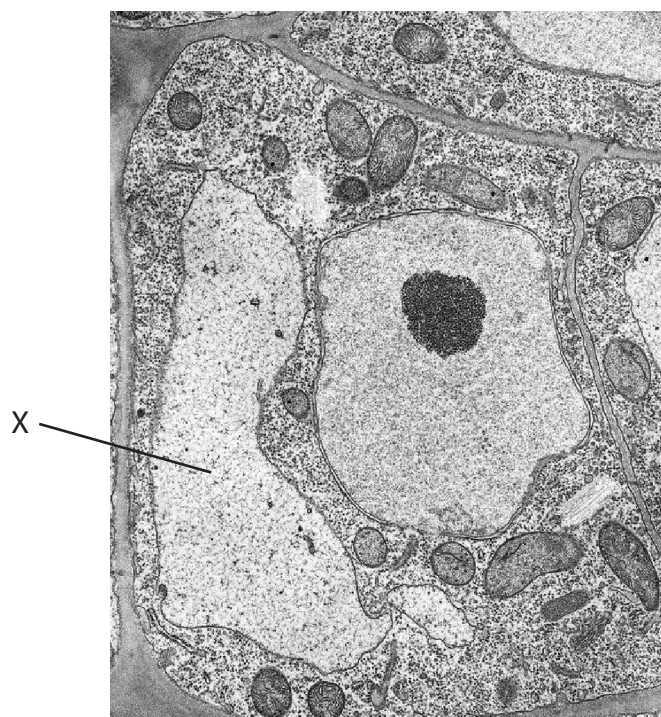
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(Total for Question 1 = 8 marks)



P 6 3 9 4 1 A 0 5 1 2

2 Figure 3 shows an electron micrograph of a plant cell.



© Credit BIOPHOTO ASSOCIATES /
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Figure 3

(a) Name the structure labelled X in Figure 3.

(1)

(b) Palisade cells in a plant contain a large number of chloroplasts.

(i) Complete Sentence 1.

(1)

A chloroplast is a type of found in palisade cells.

Sentence 1



(4)

(2)

(Total for Question 2 = 8 marks)



- 3 Gram staining is a technique used to classify bacteria as either Gram-positive or Gram-negative.

Figure 4 shows part of the method for the Gram staining technique.

- Prepare a heat-fixed smear of the bacterial culture on a slide.
- Add about five drops of crystal violet to the smear.
- Wash off any excess crystal violet.
- Add about five drops of X solution to the smear.
- Tilt the slide and decolourise with solvent (e.g. acetone-alcohol solution) until the purple colour stops running.
- Add about five drops of Y
- Use a Z to observe the bacteria.

Figure 4

(a) Name chemicals X and Y in Figure 4.

(2)

X

Y

(b) Name the piece of equipment labelled Z in Figure 4.

(1)

Z



(c) The Gram-positive bacterial cell walls appear violet/purple after the Gram staining.

Describe **two** features of Gram-positive bacterial cell walls that cause the bacteria to appear violet/purple.

(2)

1

2

(Total for Question 3 = 5 marks)



4 Some synapses in the brain contain an excitatory neurotransmitter.

The neurotransmitter is released from the pre-synaptic neurone.

The neurotransmitter diffuses across the synaptic gap.

(a) Explain how an excitatory neurotransmitter causes depolarisation of a post-synaptic membrane.

(3)

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(b) Dopamine is a neurotransmitter found in the brain.

Abnormal brain activity may occur when dopamine levels decrease.

Decreased levels of dopamine can cause visible shaking, called tremors, in people with Parkinson's disease.

Two drugs, L-Dopa and Drug M, were tested in a clinical trial to investigate how they affect tremors.

Two groups of patients, A and B, were each treated with one of the drugs for a month.

Table 1 shows the results of the clinical trial.

Group	Drug	Effect on tremors
A	L-Dopa	decreased tremors
B	Drug M	increased tremors

Table 1

Discuss the effectiveness of L-Dopa and Drug M to treat the tremors of people with Parkinson's disease.

(6)

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(Total for Question 4 = 9 marks)

TOTAL MARKS FOR SECTION A = 30 MARKS

