Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Learner Registration Number

Pearson BTEC Level 3 Nationals Certificate, Extended Certificate, Foundation Diploma, Diploma, Extended Diploma

Tuesday 23 May 2023

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 ▶

Pearson

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 the five levels of organisation in a multicellular organism.

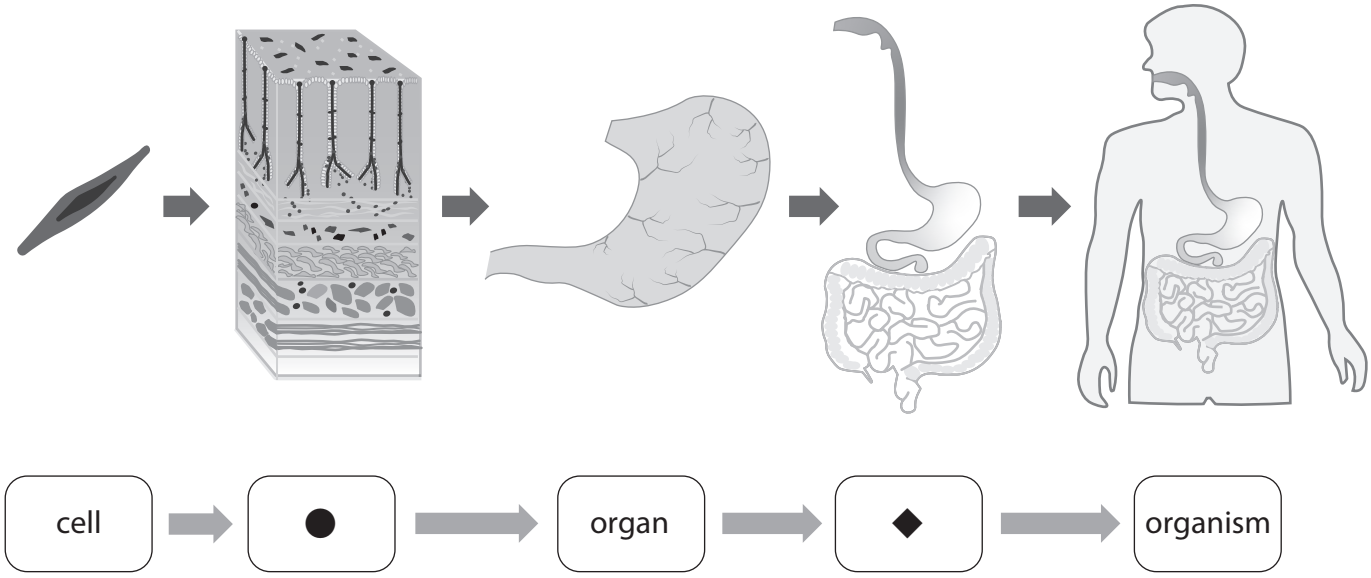


Figure 1

(a) Identify the missing words represented by the shapes ● and ◆ in Figure 1.

(2)

● .....

◆ .....

(b) Figure 2 shows a light microscope that can be used to view cells.

(Source: ©PAL)

Figure 2

(i) The objective lens magnification of a light microscope can be calculated by:

$$\text{objective lens magnification} = \frac{\text{magnifying power}}{\text{eye piece lens magnification}}$$

Calculate the objective lens magnification of the light microscope with a × 10 eye piece lens magnification and a × 40 magnifying power.

(2)

Show your working.

objective lens magnification = × .....

(ii) Identify the maximum resolving power (resolution) of a light microscope.

(1)

☒ **A** 0.02 µm

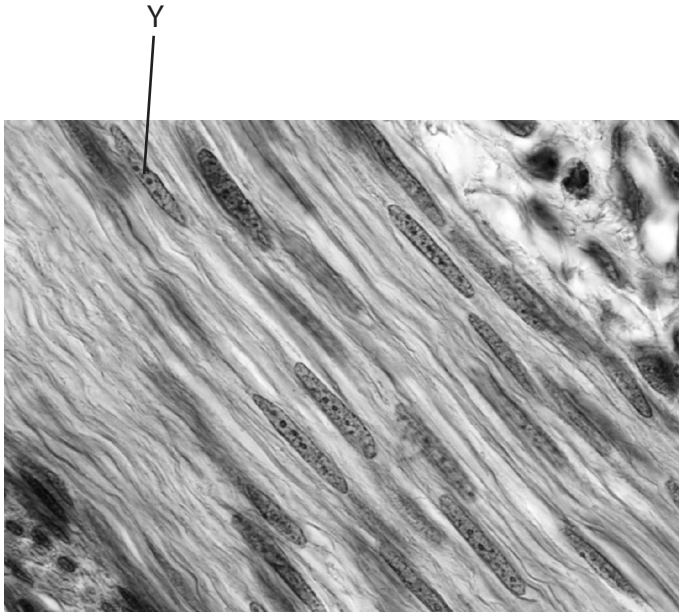
☒ **B** 0.2 µm

☒ **C** 2 µm

☒ **D** 20 µm

(Total for Question 1 = 5 marks)

2 (a) Figure 3 shows an electron micrograph of some smooth muscle cells.



magnification × 400

(Source: © PAL)

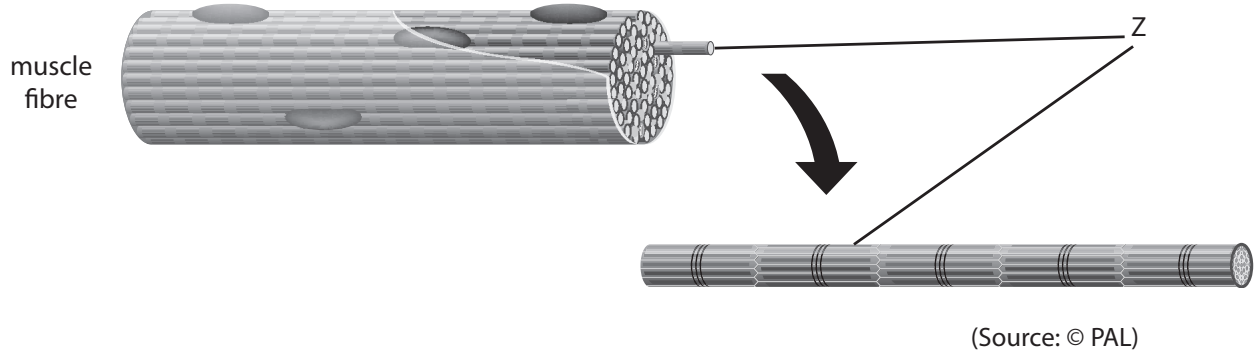
Figure 3

Identify the cell component labelled Y in Figure 3.

(1)

- ☒ **A** cell membrane
- ☒ **B** Golgi apparatus
- ☒ **C** nucleus
- ☒ **D** rough endoplasmic reticulum

(b) Figure 4 shows a diagram of a skeletal muscle fibre.



(Source: © PAL)

Figure 4

Identify the structure labelled Z in Figure 4.

(1)

(c) Figure 5 shows a sarcomere when a muscle is relaxed.

Draw a sarcomere when the muscle has contracted.

(2)

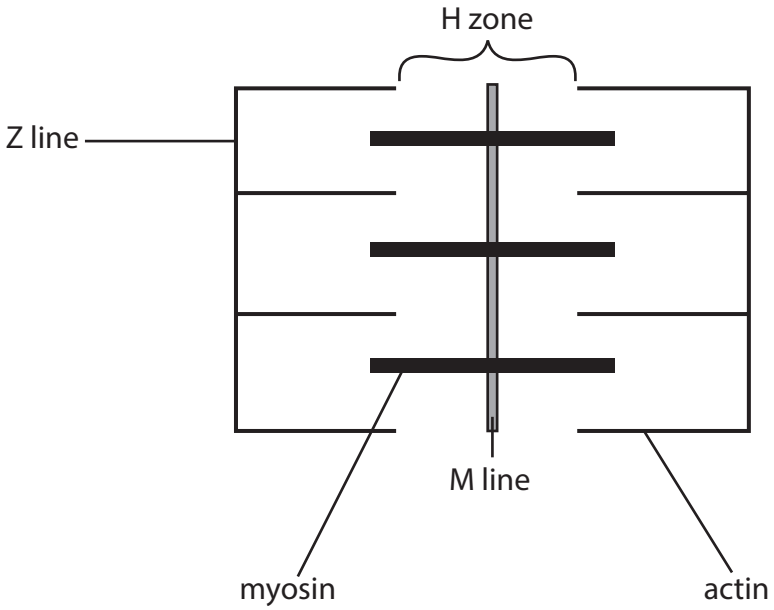


Figure 5

(d) Table 1 shows the average percentages of fast and slow twitch muscle fibres in the legs of two athletes.

athlete	slow twitch muscle fibre (%)	fast twitch muscle fibre (%)
marathon runner	80	20
100 m sprinter	20	80

Table 1

Explain why a higher percentage of fast twitch muscle fibres enables a sprinter to run short distances at fast speeds.

(3)

(Total for Question 2 = 7 marks)

3 Bacterial cells are stained so that they can be viewed and identified using a light microscope.

Gram-negative and Gram-positive bacteria stain differently using a Gram stain.

(a) Identify the cell component in Gram-positive bacteria that causes them to appear purple after Gram staining.

(1)

- ☒ **A** capsule
- ☒ **B** cell wall
- ☒ **C** nucleoid
- ☒ **D** plasmids

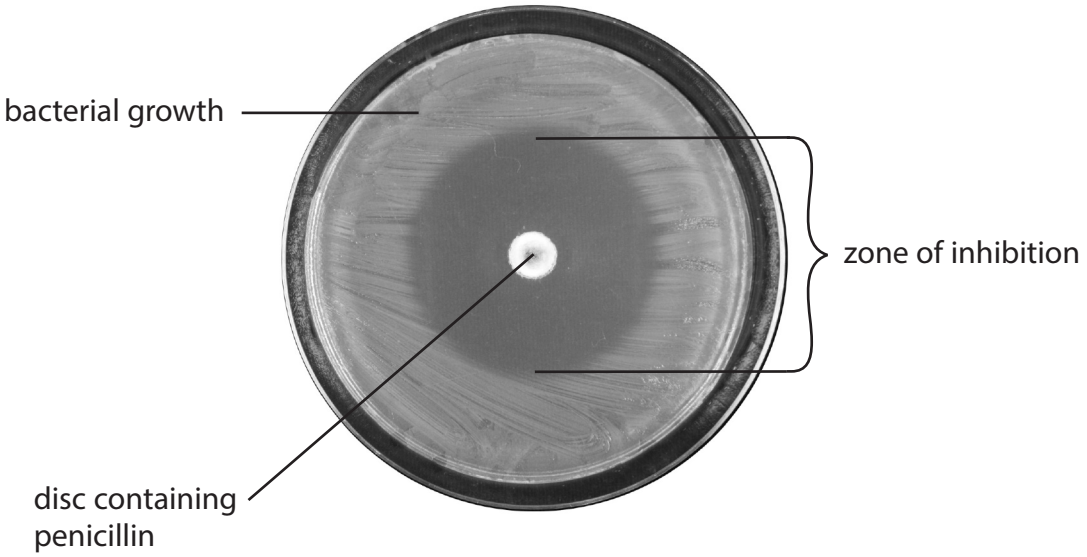
(b) Gram-positive bacteria were spread onto a nutrient agar plate.

A disc of filter paper was soaked in the antibiotic penicillin.

The disc was then placed in the centre of the nutrient agar plate.

Figure 6 shows the results after the plate had been incubated at 30 °C for 24 hours.

The zone of inhibition is the area where the bacteria have not grown.



(Source: © PAL)

Figure 6

(i) In Figure 6, the zone of inhibition has a radius of 12 mm.

Calculate the area of the zone of inhibition.

area of the zone of inhibition = πr^2

$\pi = 3.14$

r = radius

(2)

area of the zone of inhibition = ... mm^2

(ii) Explain why penicillin inhibits the growth of Gram-positive bacteria.

(3)

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.....

.....

(Total for Question 3 = 6 marks)

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4 Figure 7 shows an action potential in a neurone.

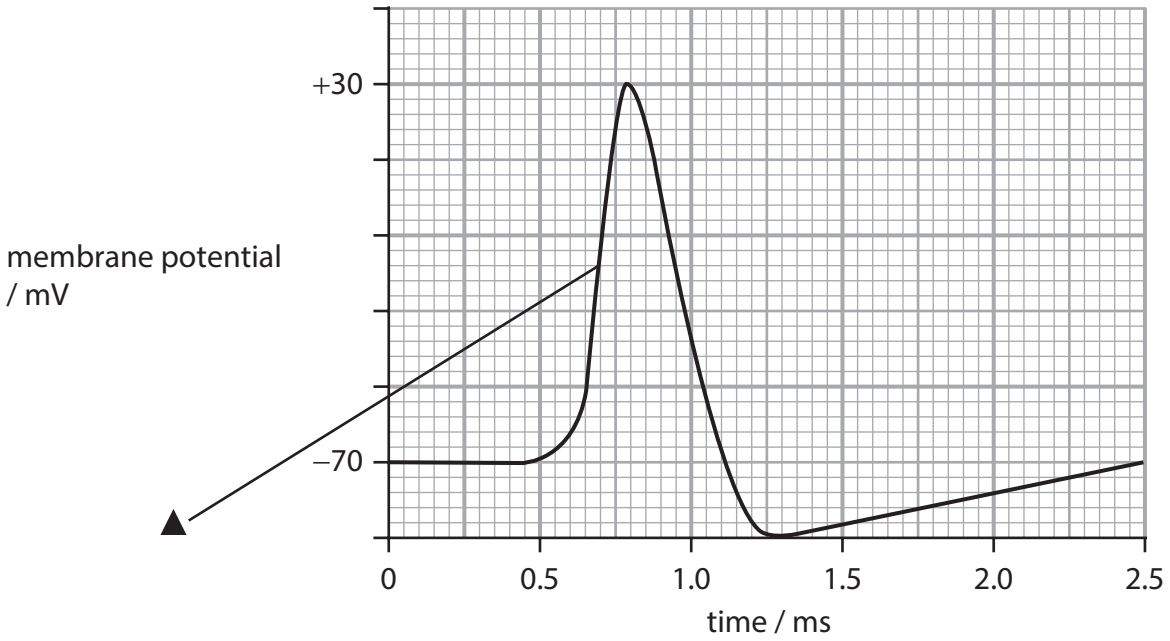


Figure 7

(a) Identify the stage of the action potential that is represented by the ▲ in Figure 7.

(1)

(b) Figure 8 shows an action potential.

The threshold value is labelled.

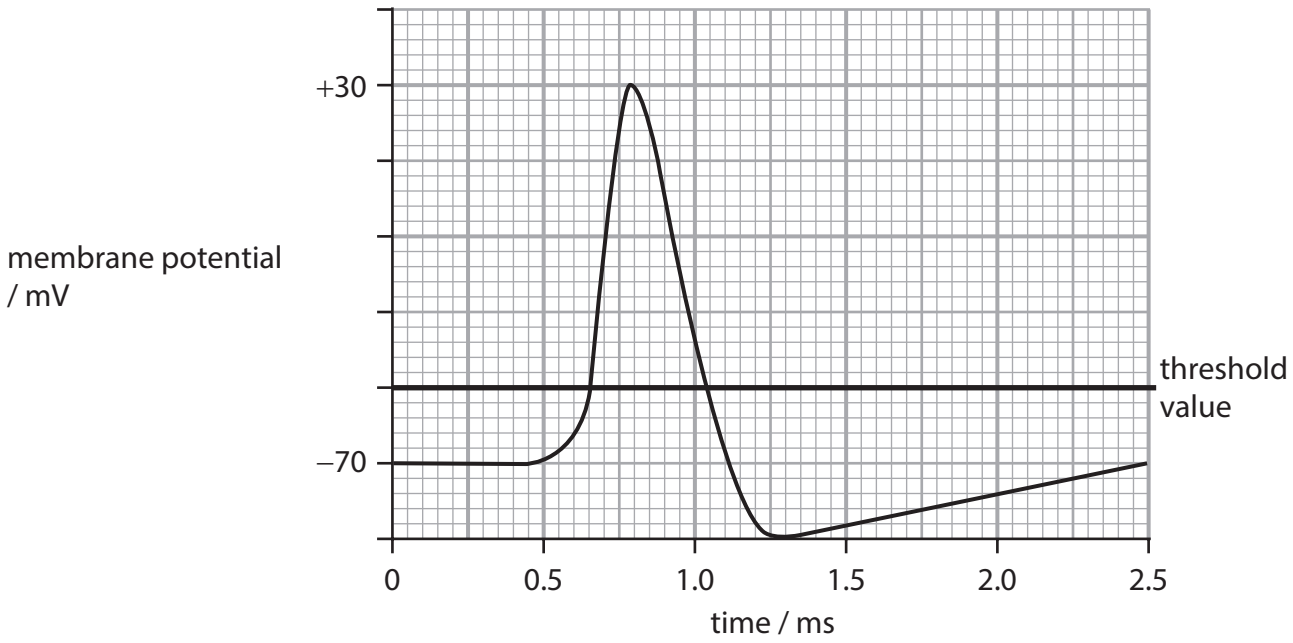


Figure 8

Give the threshold value shown in Figure 8.

(1)

..... mV

(c) Explain how an axon resting membrane potential is maintained.

(4)

.....

.....

.....

.....

.....

.....

.....

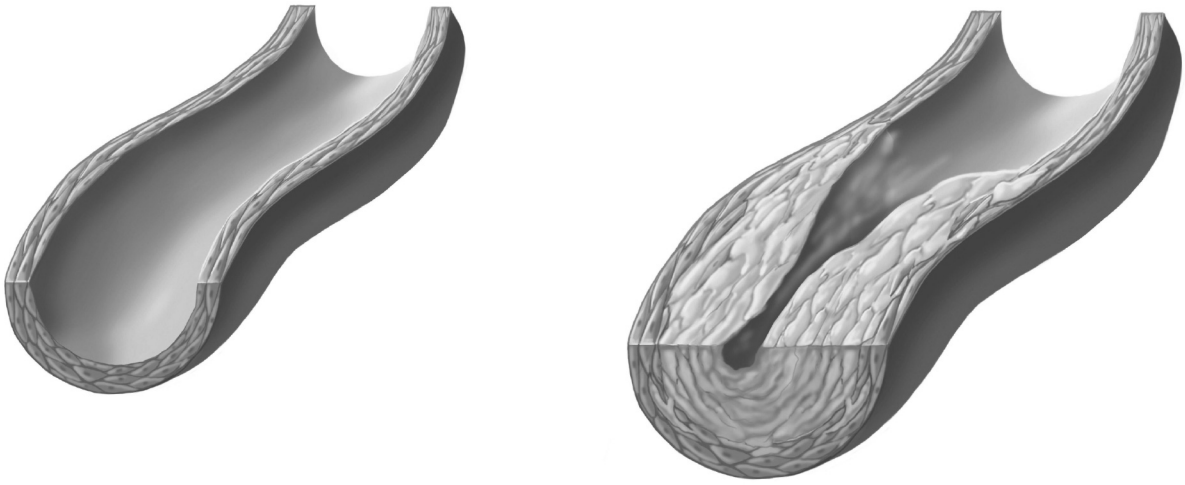
.....

(Total for Question 4 = 6 marks)

5 Arteries are lined with endothelial cells.

Damage to the lining of the arteries can lead to atherosclerosis.

Figure 9 shows part of a healthy human artery and part of an artery narrowed by an atherosclerotic plaque.



normal human artery

damaged human artery

Figure 9

Hypertension (high blood pressure) is a risk factor that can result in damage to the artery lining.

Discuss how high blood pressure can result in the lining of arteries being damaged.

(6)

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(Total for Question 5 = 6 marks)

TOTAL FOR SECTION A = 30 MARKS
TOTAL FOR EXAMINATION = 90 MARKS

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