Pearson BTEC Level 3 Nationals Diploma, Extended Diploma

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Learner Registration Number

Time 50 minutes

Paper reference **31627H/1B**

Applied Science

UNIT 5: Principles and Applications of Science II Biology

SECTION A: ORGANS AND SYSTEMS

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 40 marks each.
  Section A: Organs and systems (Biology).
  Section B: Properties and uses of substances (Chemistry).
  Section C: Thermal physics, materials and fluids (Physics).
- The total mark for this exam is 120.
- 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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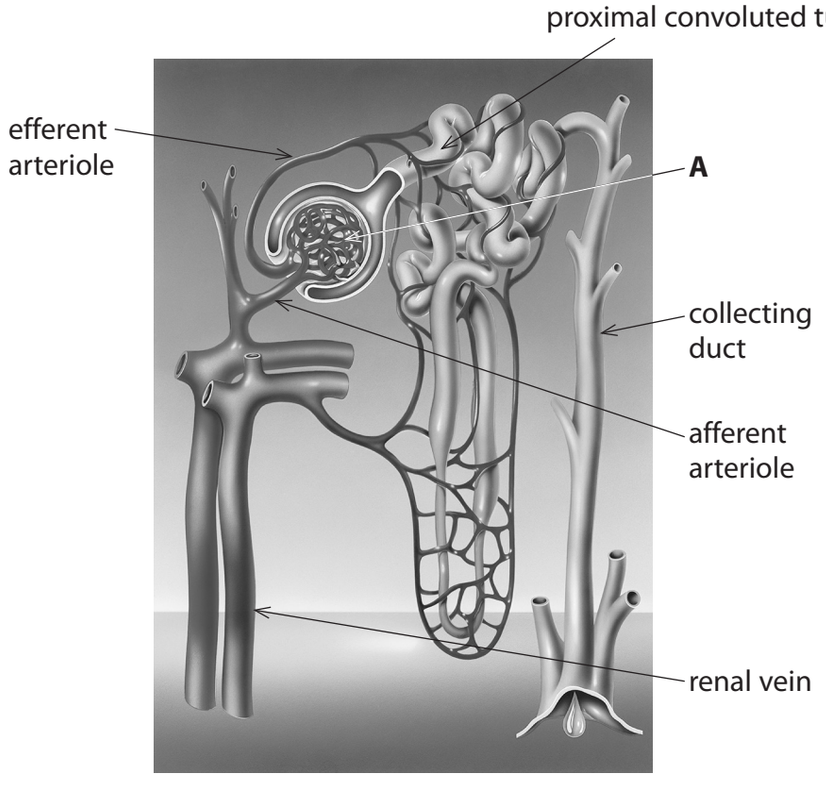
P 6 4 2 7 0 R A 0 1 1 6

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 a kidney nephron and its associated blood vessels.



Source: © John Bavosi / Science Photo Library

Figure 1

(a) Identify structure **A** in Figure 1.

(1)

.....

(b) Table 1 shows the functions of some parts of a nephron.

Complete Table 1 to show the functions of the PCT and the renal vein.

(2)

Region of nephron	Function
PCT	
A	ultrafiltration of blood
collecting duct	reabsorption of water
renal vein	

Table 1

(c) Name the hormone that regulates the reabsorption of water in the collecting duct.

(1)

.....

(d) The efferent arteriole, in structure **A** in Figure 1, has a smaller diameter than the afferent arteriole.

Explain how the difference in diameters helps the process of ultrafiltration.

(2)

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(e) Paragraph 1 describes some other functions of the nephron.

> The function of the loop of Henle is to create a very high concentration of .....**B**..... in the tissue fluid of the kidney.
>
> This high concentration causes water to leave the collecting duct.
> The water then enters the .....**C**..... .

Paragraph 1

Identify the missing words **B** and **C** in Paragraph 1.

(2)

B .....

C .....

(f) One treatment for kidney failure is transplantation with a healthy kidney taken from a donor.

Give **one** advantage and **one** disadvantage of having a kidney transplant.

(2)

Advantage

.....

.....

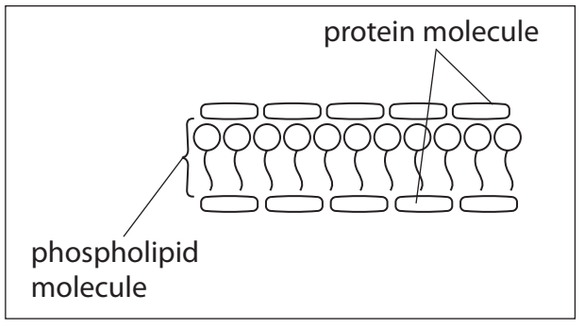
Disadvantage

.....

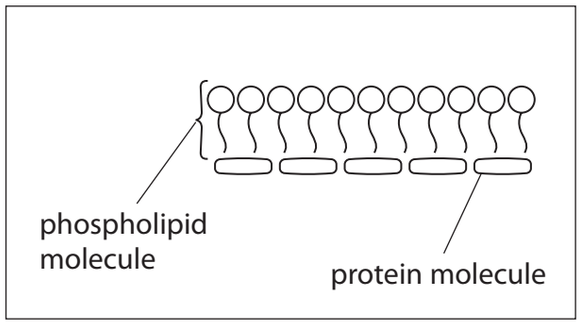
.....

(Total for Question 1 = 10 marks)

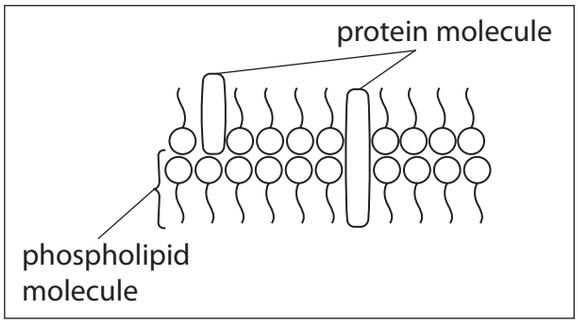
2 (a) The structure of the eukaryotic cell surface membrane is described by 'the fluid mosaic model'.



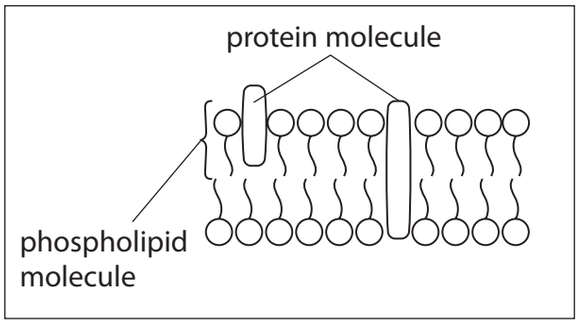
A



B



C



D

Which diagram correctly shows the fluid mosaic model?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) Figure 2a shows a single-celled eukaryotic organism, *Amoeba proteus*, which inhabits fresh water.

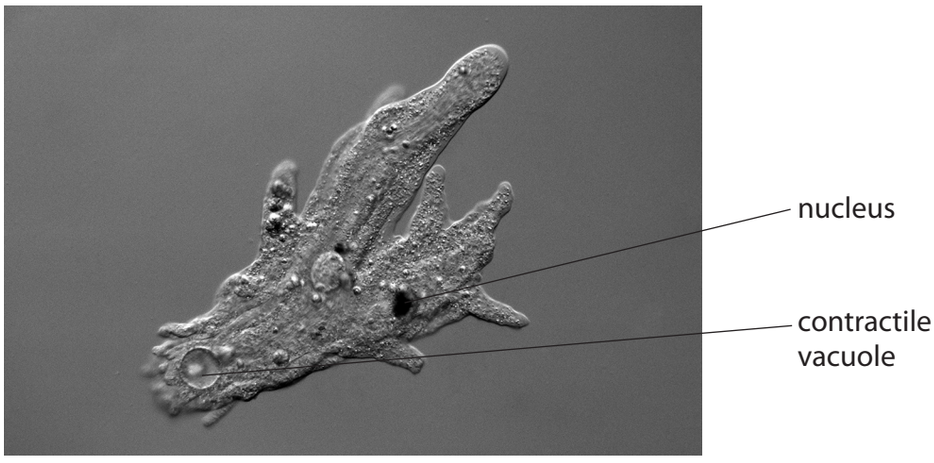


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Figure 2a

Figure 2b shows how water enters and leaves the amoeba.

Water enters the amoeba across its cell surface membrane, down a water concentration gradient, by .....**X**..... .

↓

Excess water is stored in a contractile vacuole.

↓

The contractile vacuole moves towards the cell surface membrane.

↓

The contractile vacuole fuses with the cell surface membrane.

↓

The excess water leaves the amoeba by .....**Y**..... .

Figure 2b

(i) Identify processes **X** and **Y** in Figure 2b.

(2)

X .....

Y .....

(ii) Which word describes the process of maintaining the water requirements of the amoeba?

(1)

- ☒ **A** excretion
- ☒ **B** exhalation
- ☒ **C** hypertension
- ☒ **D** osmoregulation

(c) Mitochondria produce ATP.

Which statement explains why the amoeba needs many mitochondria?

(1)

- ☒ **A** For anaerobic respiration.
- ☒ **B** For entry of water into the cell.
- ☒ **C** For movement of the contractile vacuole.
- ☒ **D** For diffusion of oxygen into the cell.

(d) Human lungs have specialised structures, such as alveoli, for gaseous exchange.

Explain why an amoeba does **not** need specialised structures, such as alveoli, for gaseous exchange.

(4)

(Total for Question 2 = 9 marks)

3 Figure 3 shows the structure of a human heart and associated blood vessels, seen from the front.

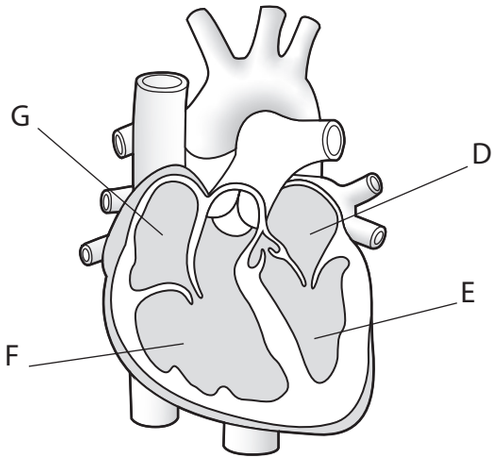

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Figure 3

(a) Draw an arrow on Figure 3 to show the direction of blood flow through the left side of the heart.

(1)

(b) A scientist measured the thickness of the muscle wall of each of the four heart chambers, D, E, F and G, shown in Figure 3.

The measurements were:

8 mm	16 mm	3 mm	3 mm

Complete Table 2 for chambers D, E and F.

Chamber G has been completed for you.

(3)

chamber	thickness of muscle wall (mm)
D	.....
E	.....
F	.....
G	3

Table 2

(c) Figure 4 shows the positions of the nodes that regulate the rhythm of the heartbeat.

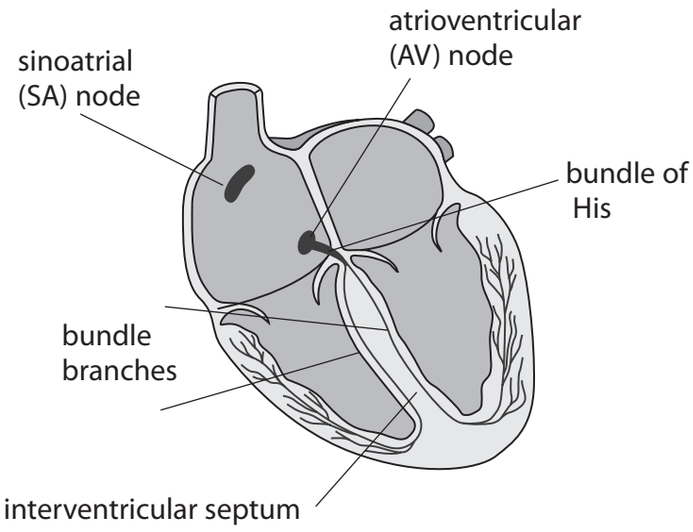

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Figure 4

The impulse first spreads from the SA node to the AV node.

Then the impulse travels through the bundle of His and the bundle branches.

There is a time delay at the AV node as the impulse spreads.

Explain why this time delay is important.

(3)

.....

.....

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.....

.....

(Total for Question 3 = 7 marks)

4 Figure 5 shows a spirometer trace for an adult human.

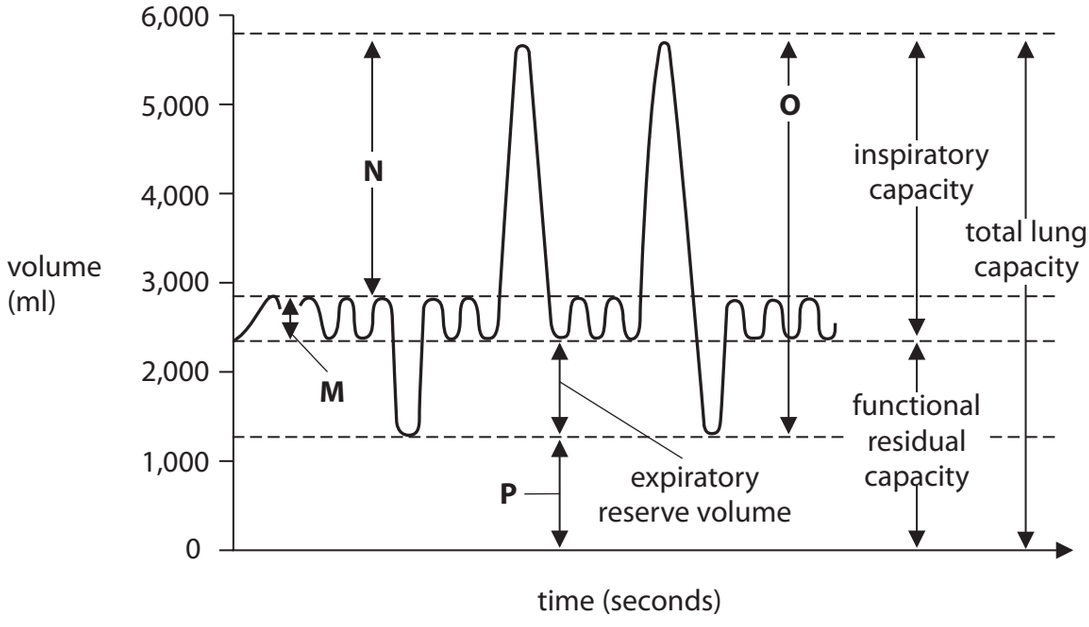

Figure 5

(a) Which letter, M, N, O or P, represents tidal volume?

(1)

- ☒ **A** letter M
- ☒ **B** letter N
- ☒ **C** letter O
- ☒ **D** letter P

(b) A student of mass 70 kg cycled on an exercise bike.

The student was connected to a spirometer and was breathing medical grade oxygen.

After 30 seconds, the student began to cycle vigorously.

Figure 6 shows part of the spirometer trace for the student.

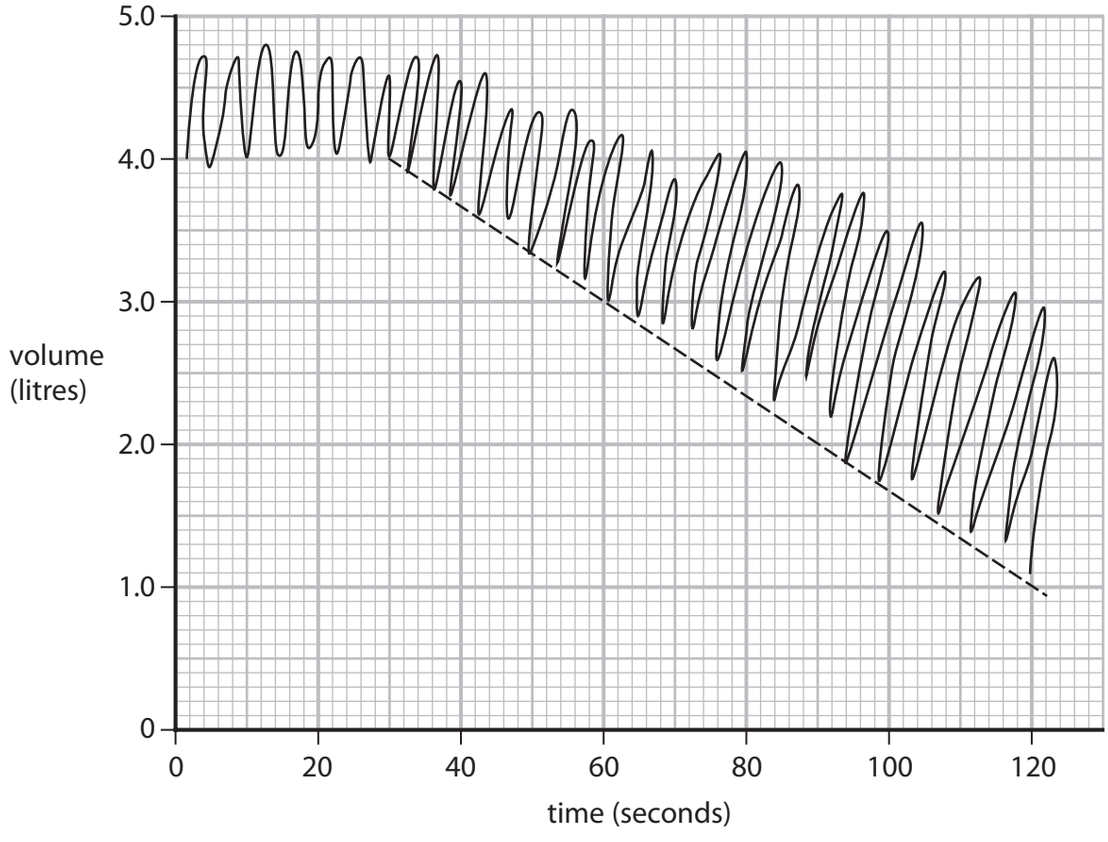

Figure 6

The rate of oxygen consumption is calculated as:

volume of oxygen consumed (ml) ÷ body mass (kg) ÷ time (s)

(i) Calculate the student's rate of oxygen consumption from 60 to 120 seconds.

(4)

Show your working.

rate of oxygen consumption = ... ml kg^{-1} s^{-1}

(ii) The student had a higher rate of oxygen consumption when cycling vigorously than when at rest.

Explain why.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 8 marks)

5 Compare the structures of arteries, veins and capillaries.

(6)

Your answer should refer to both similarities and differences.

You may use annotated diagrams and/or a table to support your answer.

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(Total for Question 5 = 6 marks)

TOTAL FOR SECTION A = 40 MARKS

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