Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 45 minutes

Paper reference **1BI0/2H**

Biology
PAPER 2
Higher Tier

You must have:
Calculator, 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 candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

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 ▶

P69321A

Q:1/1/1/1/1/

P 6 9 3 2 1 A 0 1 3 2

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 (a) Bloodworms in a pond indicate that the water is polluted.

(i) Which species also indicates that the water is polluted?

(1)

☒ **A** fertiliser

☒ **B** lichen

☒ **C** stonefly

☒ **D** sludgeworm

(ii) Bloodworms have a high level of haemoglobin in their blood.

Give a reason why this helps them survive in polluted water.

(1)

haemoglobin binds oxygen / increases the rate of diffusion / polluted water is low in oxygen

(iii) Carbon dioxide diffuses from the body of the bloodworm into the water.

Give **two** factors that affect the rate of diffusion.

(2)

1 concentration gradient (1)

2 • diffusion distance (1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Figure 1 shows part of a diseased rose plant from a garden.

(Source: © Manfred Ruckszio/Shutterstock)

Figure 1

Explain what Figure 1 indicates about the air quality in the garden.

(2)

blackspot fungus present (1)
• which indicates clean air / low sulfur dioxide (1)

(Total for Question 1 = 6 marks)

BLANK PAGE

2 (a) Figure 2 shows xylem and phloem from the stem of a plant.

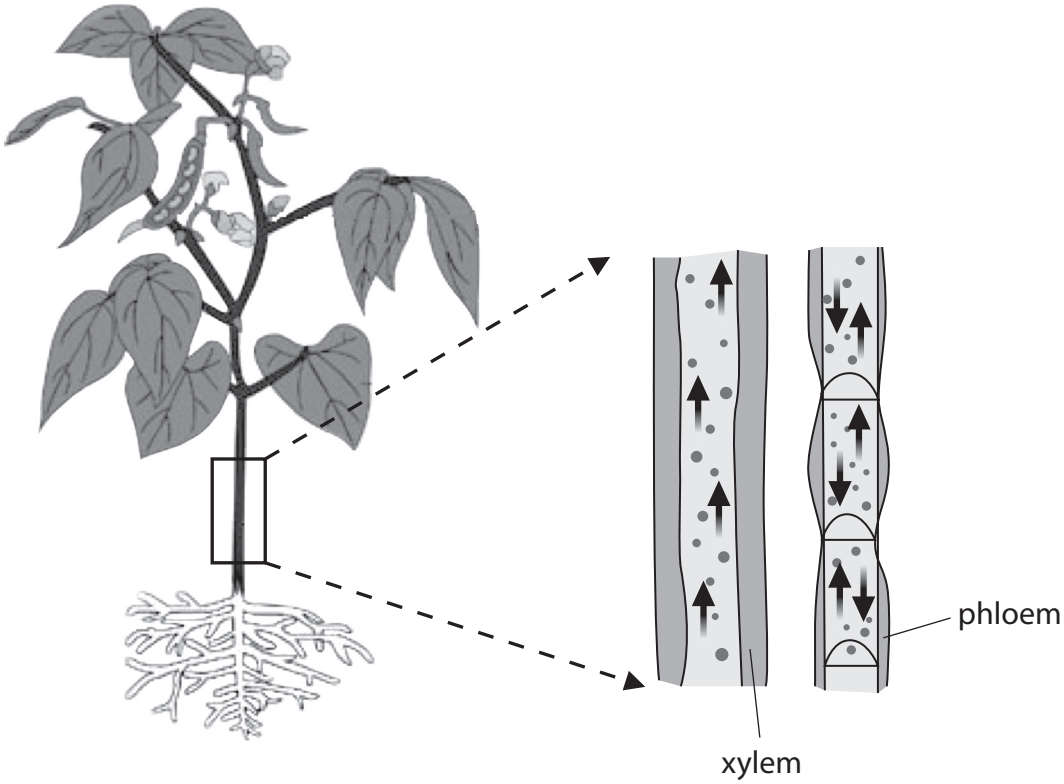


Figure 2

(i) Living cells in phloem use energy to transport sucrose.

Which organelles release energy in living cells?

(1)

- ☒ **A** vacuoles
- ☒ **B** mitochondria
- ☒ **C** nuclei
- ☒ **D** ribosomes

(ii) Describe **two** features of the structure of xylem vessels that can be seen in Figure 2.

(2)

1 thick walls (1)

2 • continuous / hollow tubes / no end walls (1)

(b) A scientist investigated how the flow of air affected the rate of transpiration in a plant.

A fan was used to change the flow of air.

The volume of water taken up by the plant was measured.

Figure 3 shows the results of this investigation.

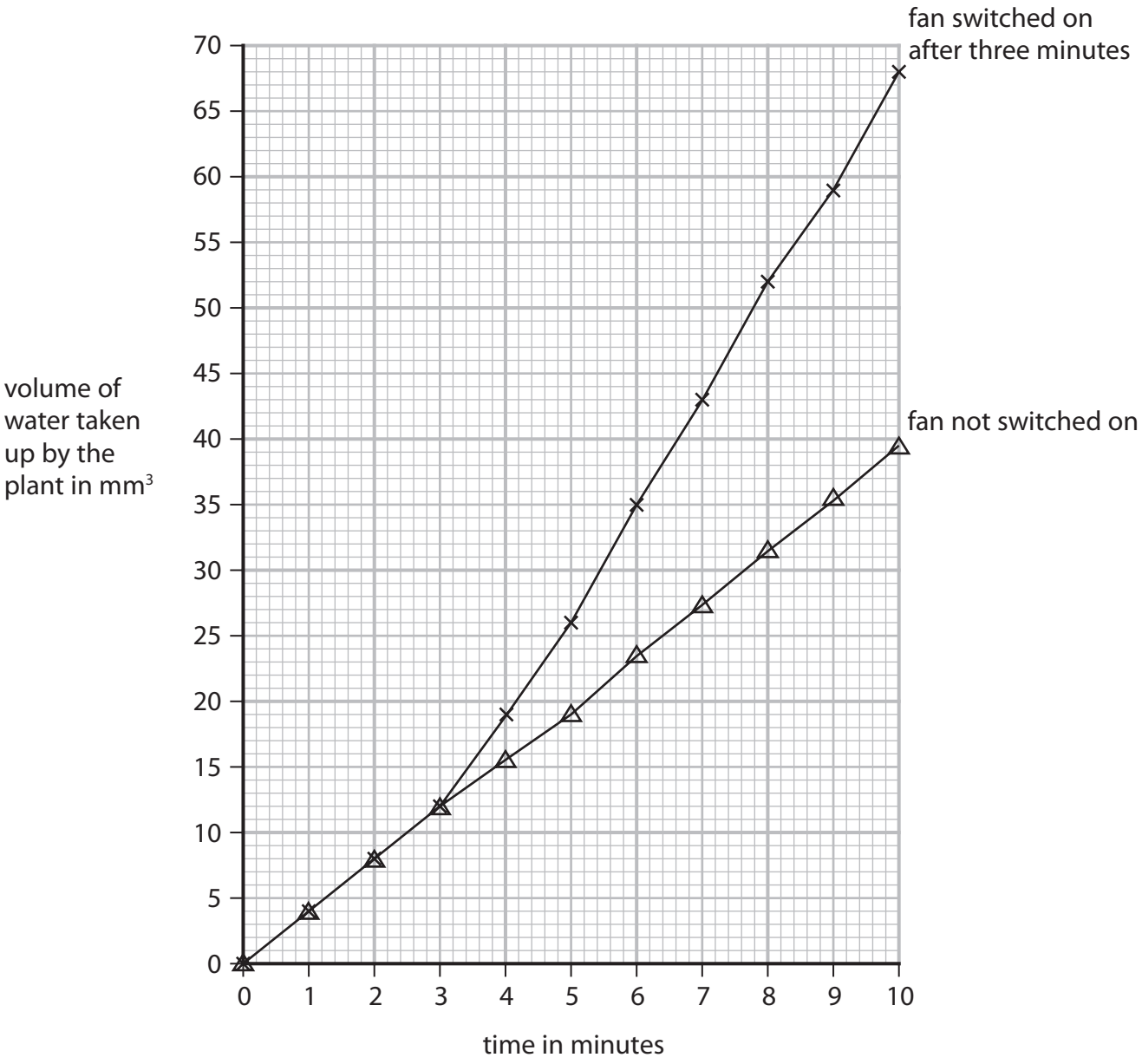


Figure 3

(i) Explain why switching on the fan caused a change in the volume of water taken up by the plant.

(3)

fan causes air to move / creates wind / increased air flow (1)

• water (vapour) removed (from around leaf) (1)

• increased {rate of diffusion / evaporation / transpiration} (of water vapour from leaf) (1)

(ii) Give **one** reason why the volume of water taken up by the plant was also measured when the fan was not switched on.

(1)

to compare (the effect) / as a control

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(2)

68 – 52 / 16 (1)
(16 ÷ 2)
8 (mm3 per minute)

..... mm^3 per minute

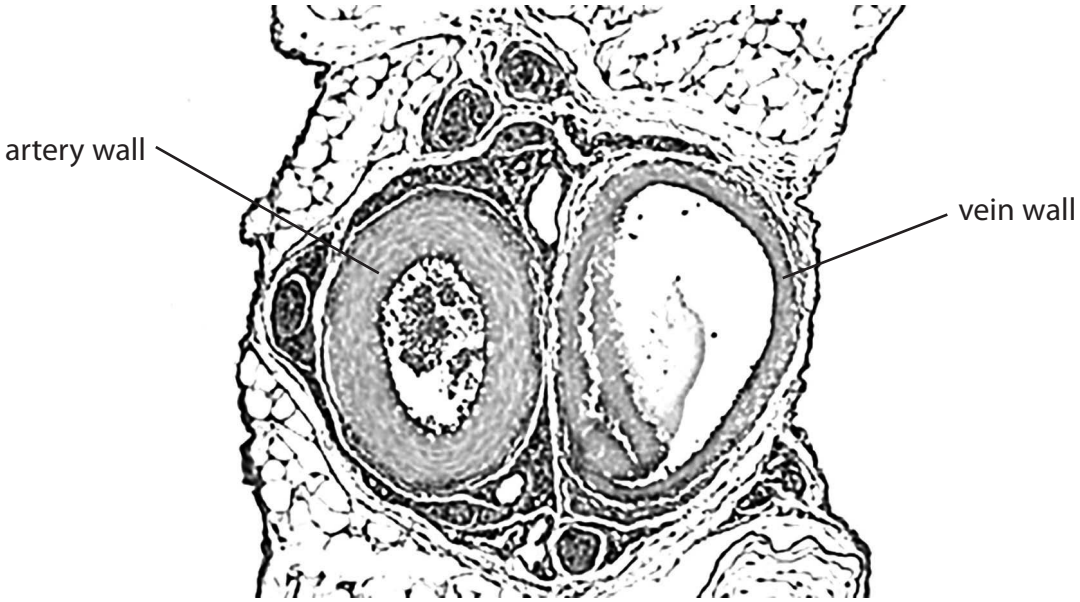
(Total for Question 2 = 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

3 (a) Figure 4 shows a cross-section of an artery and a vein.



(Source: © The University of Kansas Medical Center)

Figure 4

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 4.

(2)

artery has {thicker / more muscular} wall (1)

• because of the (blood) pressure (higher in artery than in vein) (1)

(ii) Name **one** structure that is found in veins but not found in arteries.

(1)

VALVES

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)

60 ÷ 100 = 0.6 (1)

(300 ÷ 100) = 3 (dm3)

..... dm^3

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)

because (during exercise muscles) require more {oxygen / glucose} (1)

• for respiration / to release energy (1)

(Total for Question 3 = 7 marks)

DO NOT WRITE IN THIS AREA

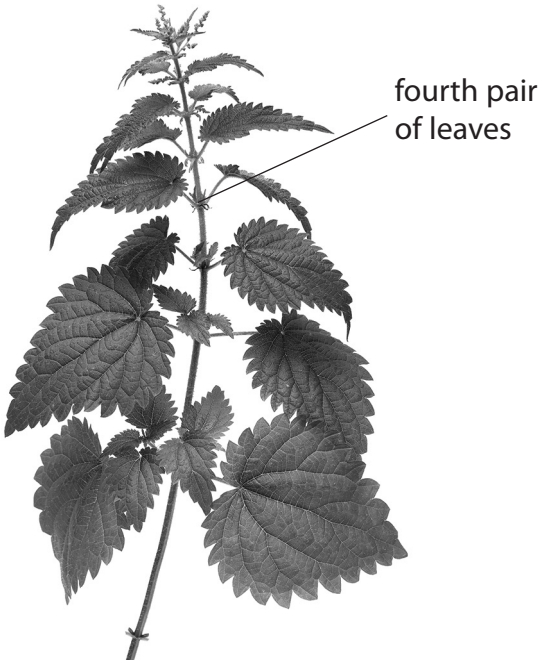
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4 A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

Figure 5a shows a nettle plant and Figure 5b shows a map of the woodland showing area A and area B.

The woodland caused area A to be in the shade.



(Source: © Alila Medical Media/Shutterstock)

Figure 5a

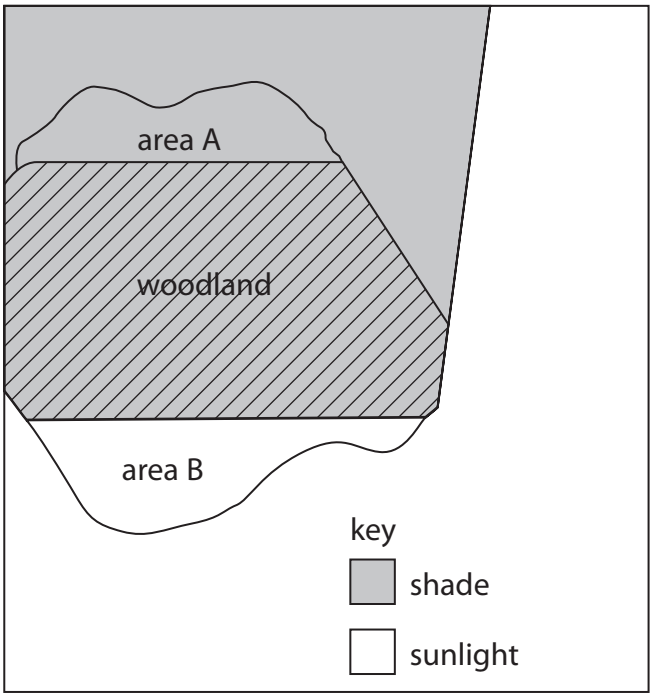


Figure 5b

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

(a) Give **one** reason why the student always measured a leaf from the fourth pair of leaves.

(1)

so the leaves are the same age (1)

(b) Figure 6 shows the results.

nettle plant	width of the leaf in millimetres (mm)	
	area A	area B
1	45	33
2	50	25
3	48	27
4	52	(48)
5	47	28
mean	48	28

Figure 6

(i) Why did the student **not** include the circled width when calculating the mean for area B?

(1)

☒ **A** it has not been measured in millimetres

☒ **B** it is an anomalous result

☒ **C** it is a repeat result

☒ **D** it is the mode value

(ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight.

(2)

the leaves in the {shade / area A} are wider (1)

• to give a larger surface area / to absorb more light (1)

(c) The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles.

The student also saw a toad eating a large beetle.

Large beetles eat ladybirds.

Ladybirds eat caterpillars.

(i) Give the food chain for these feeding relationships.

(3)

(ii) Frogs also eat large beetles.

Figure 7 shows the energy transferred between these animals.

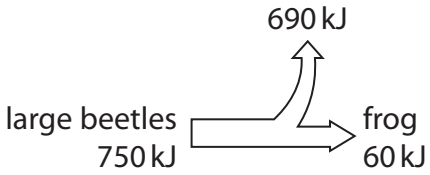


Figure 7

Calculate the percentage efficiency of energy transfer from the large beetles to the frog.

(2)

substitution

60 ÷ 750 = 0.08 (1)

x100

8 (%)

..... %

(iii) Give **two** reasons why only some of the energy in the biomass of the large beetles is transferred to the biomass of the frog.

(2)

1 not all the beetle is eaten (1)

2 • not all the beetle can be digested (1)

(Total for Question 4 = 11 marks)

DO NOT WRITE IN THIS AREA

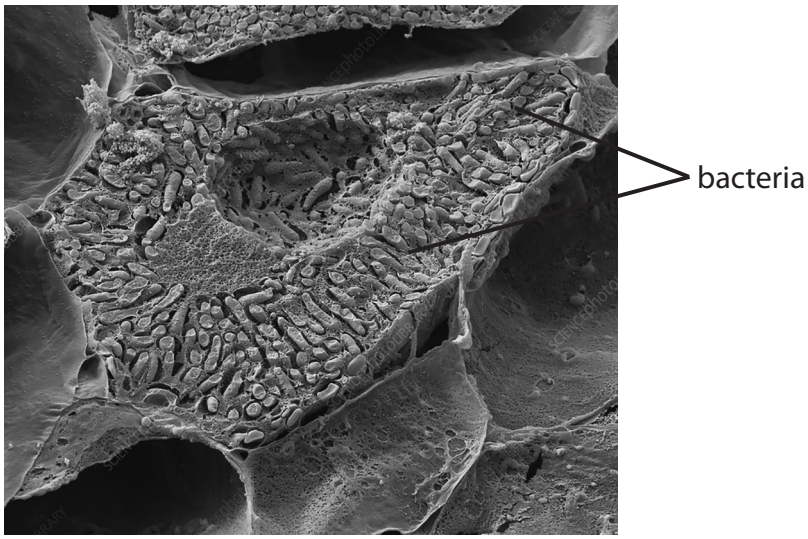
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

5 (a) Figure 8 shows a cross-section of a root nodule on a leguminous plant.

Bacteria in the root nodule provide the leguminous plant with nitrogen compounds.

The leguminous plant provides the bacteria with sugars.



(Source: © Nigel Downer / Science Photo Library)

Figure 8

(i) Which term describes the relationship between this leguminous plant and the bacteria?

(1)

- ☒ **A** parasitism
- ☒ **B** indigenous
- ☒ **C** biodiversity
- ☒ **D** mutualism

(ii) The width of this root nodule is 7.5 mm.

Give the width in μm.

(1)

7500 (μm)

..... μm

(b) Figure 9 shows part of the nitrogen cycle.

dead animals and plants $\xrightarrow{X}$ ammonia $\xrightarrow{Y}$ nitrates

Figure 9

(i) Identify the types of microorganism involved in process X and process Y.

(2)

X decomposers

Y nitrifying (bacteria)

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

leguminous crops planted (1)

• that have nitrogen-fixing bacteria (1)

• in root (nodules) (1)

(iii) Explain why increased nitrate levels in the soil improve crop yield.

(2)

nitrates are needed to make {protein / amino acids} (1)

• which are needed for growth (1)

(Total for Question 5 = 9 marks)

6 (a) The combined contraceptive pill contains artificial versions of oestrogen and progesterone.

(i) Explain how the combined contraceptive pill prevents pregnancy.

(2)

inhibits {FSH / LH} (1)

• which prevents {maturation of a follicle / ovulation} (1)

(ii) When taken correctly, the combined pill can be over 99% effective.

Taking the combined pill can lead to weight gain.

Give **one** other disadvantage of using the combined pill as the only method of contraception.

(1)

doesn't prevent STI

(b) Excessive weight gain and obesity increase the likelihood of developing type 2 diabetes.

Explain the effect of type 2 diabetes on the body.

(3)

blood glucose levels are not regulated / high (1)

• because cells are resistant to insulin (1)

• (so the liver) does not convert glucose to glycogen (1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) A woman had unexplained weight loss and fatigue.
She had blood tests to investigate the cause of these symptoms.

Figure 10 shows the results.

blood test	woman's result	normal range
TSH level	5.6 mU/l	0.4 to 4.9 mU/l
thyroxine level	27.5 pmol/l	9.0 to 21.0 pmol/l
red blood cell count	5.2×10^6 cells/μl	4.2 to 5.4×10^6 cells/μl
glucose level	82.0 mg/dl	72.0 to 99.0 mg/dl

Figure 10

Comment on the results of these blood tests and the possible causes of the woman's weight loss and fatigue.

(4)

{TSH / thyroxine} levels are higher than normal (1)

• TSH stimulates the thyroid gland / TSH stimulates the release of thyroxine (1)

• increases metabolic rate (1)

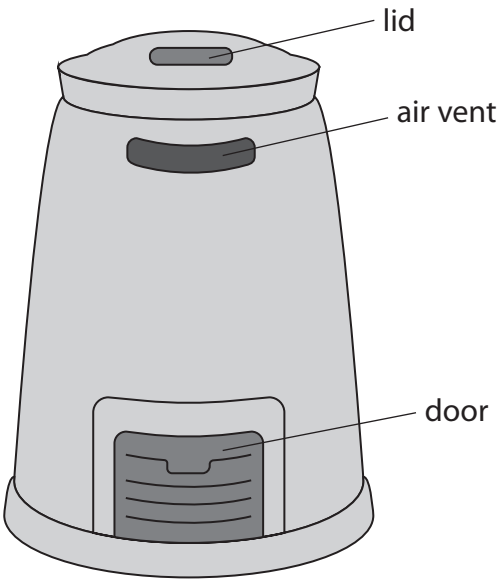
• {red blood cells / glucose} are within the normal range (1)

(Total for Question 6 = 10 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

7 (a) A gardener read information on a gardening society website about how to use a compost bin.

Figure 11 shows the compost bin and some of the instructions.



- add soil in between layers of vegetation
- mix the contents of the compost bin once a month to add air
- keep the lid on to prevent water entering

Figure 11

(i) Give **one** reason why the gardener thought the gardening society website was a good source of information.

(1)

(the gardener thought) they were experts / it was a reliable source

(ii) Give reasons why soil is added to the compost bin and why the contents are turned to add air.

(2)

to introduce microorganisms / decomposers (1)

• to provide oxygen (1)

(iii) The gardener noticed the compost bin became warm a few days after vegetation was added.

Why did the contents of the compost bin become warm?

(1)

- ☒ **A** respiration occurred and this is an endothermic reaction
- ☒ **B** respiration occurred and this is an exothermic reaction
- ☒ **C** photosynthesis occurred and this is an endothermic reaction
- ☒ **D** photosynthesis occurred and this is an exothermic reaction

(iv) The mass of the contents of the compost bin at the start was 40 kg.

After 60 days the mass of the contents was 32 kg.

Which is the rate of decay?

(1)

- ☒ **A** 1.8 kg per day
- ☒ **B** 0.66 kg per day
- ☒ **C** 0.53 kg per day
- ☒ **D** 0.13 kg per day

*(b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.

(6)

Auxins
- used in selective weed killers
- targets broad leaf plants
- kills the weeds and not narrow leaf crops
- rooting powder
- added to the end of cuttings to stimulate the growth of roots

Gibberellins
- to stimulate germination in dormant seeds
- initiate breakdown of starch
- stimulate flower formation
- promotes fruits formation
- sprayed onto plants before pollination
- stimulate development of seedless fruits

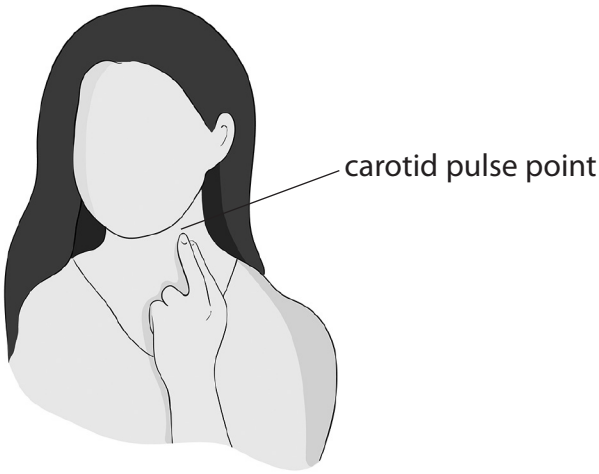
Ethene
- fruit ripening
- unripe fruit is harvested
- ethene is added so the fruits ripens for selling

(Total for Question 7 = 11 marks)

8 The effect of different types of exercise on the heart rate of an athlete was investigated.

The athlete counted the number of beats in 10 seconds at the carotid artery pulse point, as shown in Figure 12.

This measurement was used to calculate the heart rate.



(Source: © dityazemli/Shutterstock)

Figure 12

The athlete exercised for 20 minutes.

The heart rate was recorded every 5 minutes during each type of exercise.

(a) (i) State how the heart rate was calculated using this method.

(1)

multiply the number of beats (in 10 seconds) by 6

(ii) Give **two** ways of improving the method used to obtain the data needed to calculate the heart rate.

(2)

1 use a heart rate monitor / electronic device (to measure HR) (1)

2 • take readings more frequently than 5 minutes (1)

Figure 13 shows the results of this investigation.

type of exercise	heart rate in bpm				
	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes
running	90	156	168	180	180
walking	90	96	90	96	90

Figure 13

(iii) Comment on the difference in the heart rates during these types of exercise.

(3)

heart rate {remains relatively constant / fluctuates slightly} when walking (1)

• heart rate increases when running (1)

• heart rate levels off {at 15 minutes / at 180 b.p.m.} when running (1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Exercise increases adrenalin levels.

(i) State which endocrine gland secretes adrenalin.

(1)

adrenal (glands)

(ii) Explain the effect of adrenalin on liver cells during exercise.

(3)

binds to receptors (on the liver) (1)

• (triggers liver cells to) convert glycogen (1)

• into glucose (1)

(c) After high intensity exercise, the pH of muscles can decrease from pH 7.0 to pH 6.3.

Explain this change in pH.

(2)

because of lactic acid (1)

• from anaerobic respiration (1)

(Total for Question 8 = 12 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

9 (a) Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

This second sample includes some recaptured animals that have marks on them.

The population can be estimated using this equation

$$\text{population size} = \frac{\text{number marked in the first sample} \times \text{size of the second sample}}{\text{number recaptured in the second sample}}$$

A scientist used this technique to determine the change in the population size of snails in a pond from March to July.

Figure 14 shows the results.

month	number marked in the first sample	size of the second sample	number of recaptured animals	population size
March	18	22	8	50
July	12	18	10	

Figure 14

(i) Using data from Figure 14, calculate the difference in the population size from March to July.

(3)

substitution
(12 x 18 ÷10) = 21.6 (1)

whole organism (1)
= 21 / 22

(50 – 21 / 22) = 28 / 29

Difference in the population size .....

(ii) State **two** factors the scientist should control when sampling the habitat in March and July.

(2)

sample at the (same) time of day (1)

1 .....

.....

2 .....

• sample for the (same) length of time (1)

.....

(b) This pond is affected by eutrophication.

Explain **one** possible cause of eutrophication.

(2)

leaching / run off / fertilisers / dead organic matter (1)

.....

• (causes) a build up of nitrates / nitrates in the water (1)

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

*(c) Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.

(6)

Reforestation
- reforestation is planting of trees
- trees take up water from the soil
- prevents erosion and reduces flooding
- trees can be used for renewable resources
- provides habitats
- increases the rate of photosynthesis
- removes carbon dioxide and releases oxygen
- reduces greenhouse gases / global warming
- provides a source of medicines / food for consumers

Animal conservation
- increase numbers of endangered species / prevent extinction
- through controlled breeding programmes /reduction in poaching /maintaining habitats
- generating income to fund conservation projects through zoos / animal parks / ecotourism
- improves the number of animals / range of species
- maintains the food web
- maintains genetic diversity
- allows re-introduction of animals into the wild

(Total for Question 9 = 13 marks)

10 (a) When training, an athlete noticed some types of T-shirts became wetter and heavier due to sweating.

This athlete has three T-shirts, each made of a different material.

Devise a method this athlete could use to find the best T-shirt for training.

(3)

• complete the same exercise (1)

• in the same environmental conditions (1)

• measure the change in mass for each T-shirt (1)

• the {least / most} weight gain is the best for exercise (1)

(b) Athletes often eat a high protein diet.

(i) Which is the test and result for a food containing protein?

(1)

☒ **A** Benedict's reagent is used and the solution turns brick red

☒ **B** Benedict's reagent is used and the solution stays blue

☒ **C** biuret solution is used and the solution stays blue

☒ **D** biuret solution is used and the solution turns purple

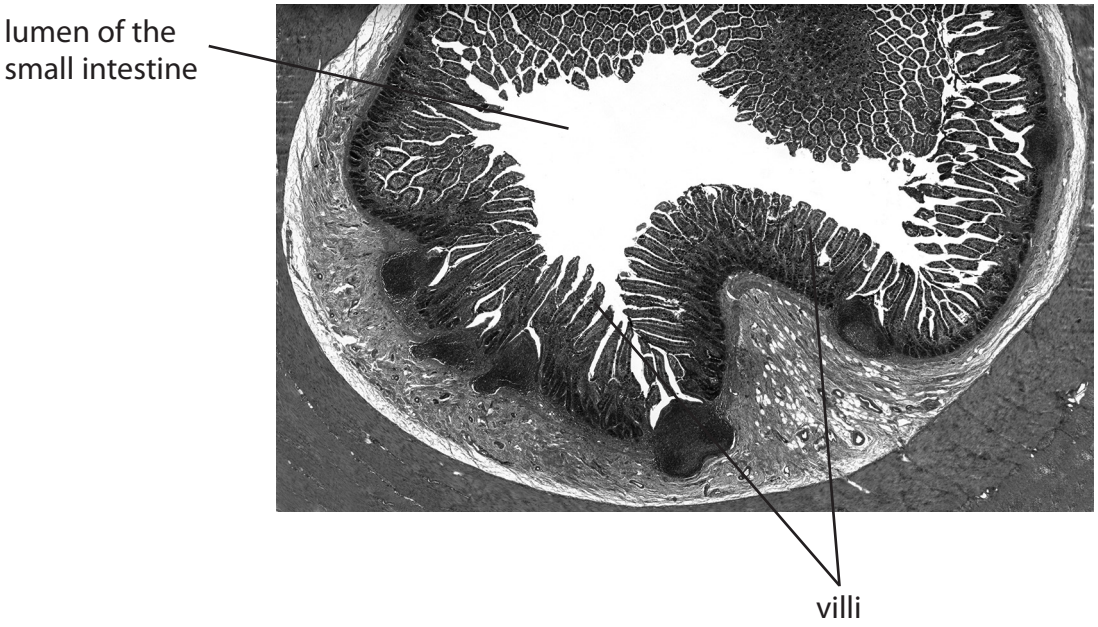
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(ii) Digested protein is absorbed in the small intestine by diffusion.

Figure 15 shows part of the small intestine.



(Source: © Science Photo Library C047/6177)

Figure 15

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.

(3)

(Fick's law states) the rate of diffusion is proportional to surface area x concentration gradient (1)

• and inversely proportional to the thickness if the membrane (1)

• increased rate of diffusion (1)

(iii) Digested protein enters the blood as amino acids.

State which component of the blood transports amino acids.

(1)

(blood) plasma

(c) Explain how high levels of amino acids in the blood cause a high concentration of urea in urine.

(4)

because excess amino acids are broken down into urea (1)

• amino acids broken down in the liver (1)

• it is then transported in the blood to the kidney (1)

• enter the nephron (1)

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

BLANK PAGE

BLANK PAGE