Candidate surname | Other names

Centre Number | Candidate Number

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

Friday 9 June 2023

Afternoon (Time: 1 hour 45 minutes) | **Paper reference** | **1BI0/2H**

Biology
PAPER 2

Higher Tier

You must have: Ruler, calculator | 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*.

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 ▶

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 stream flowing near a fertiliser factory.

The factory burns coal as a source of energy.

The factory releases waste into the stream and sulfur dioxide into the air.

Samples of water were taken at five points, A, B, C, D and E, as shown on Figure 1.
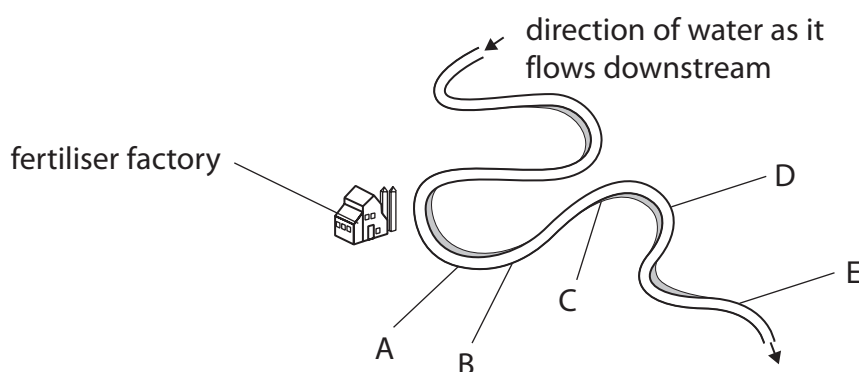
Figure 1

Figure 2 shows the oxygen concentration in the water at the five points along the stream.

point along stream	oxygen concentration (ppm)
A	1.5
B	2.7
C	3.4
D	4.4
E	4.5

Figure 2

(a) (i) Calculate how many times greater the oxygen concentration is at point E than at point A.

(1)

.... times greater

(ii) State how the oxygen concentration changes from point A to point E.

(1)

....

....

(iii) Which indicator species would be most likely to be seen in the water at point A?

(1)

⊠ **A** freshwater shrimp

⊠ **B** lichen

⊠ **C** sludgeworm

⊠ **D** stonefly

(iv) Explain where the biodiversity will be highest in the stream.

(3)

....

....

....

....

....

....

....

(b) Figure 3 shows rose leaves infected with blackspot fungus.

Figure 3

State why rose plants growing near this factory are not infected with blackspot fungus.

(1)

....

....

....

(Total for Question 1 = 7 marks)

2 People with diabetes cannot always control the concentration of glucose in their blood.

(a) Two people eat identical meals.

One person has diabetes, the other person does not have diabetes.

Figure 4 shows the concentration of glucose in the blood of these two people after eating the meals.

concentration of glucose in blood in mmol per dm^3

person with diabetes

person who does not have diabetes

time after eating the meal in hours
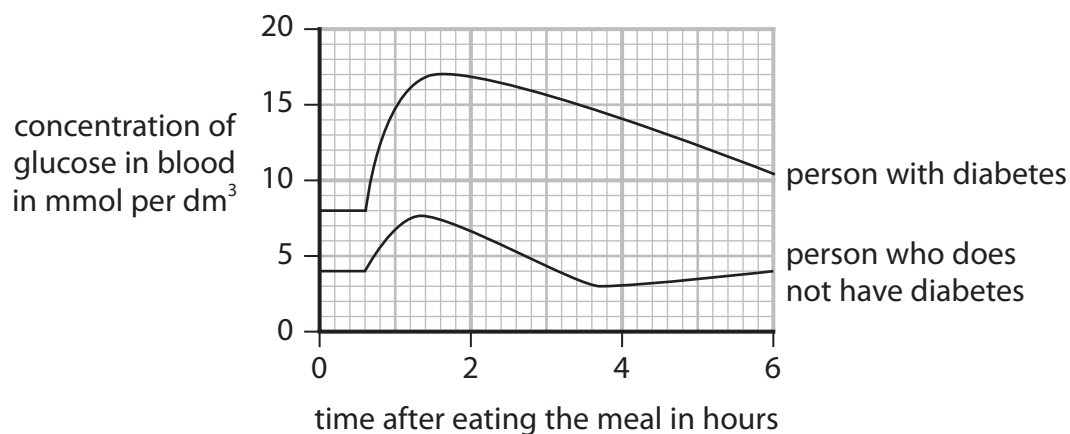
Figure 4

(i) Calculate the maximum increase in the concentration of glucose in the blood of the person with diabetes.

(1)

.... mmol per dm^3

(ii) Water moved out of the red blood cells of the person with diabetes when the concentration of glucose in the blood was above 15 mmol per dm^3.

Explain why water moved out of the red blood cells of the person with diabetes.

(2)

....

....

....

....

....

(b) The pancreas produces a hormone that causes the concentration of glucose in the blood to decrease.

(i) Name this hormone.

(1)

....

(ii) State how this hormone is transported from the pancreas to its target organs.

(1)

....

(iii) Which is the target organ for the hormone that controls the concentration of glucose in the blood?

(1)

☒ **A** kidney

☒ **B** pancreas

☒ **C** liver

☒ **D** lung

(c) Explain how type 2 diabetes can be controlled.

(3)

....

....

....

....

....

....

....

(Total for Question 2 = 9 marks)

3 Respiration occurs in cells.

(a) Why do cells respire?

(1)

☒ **A** to produce nitrogen

☒ **B** to release oxygen

☒ **C** to produce glucose

☒ **D** to release energy

(b) An athlete runs every day as part of their training.

(i) Explain why the breathing rate of the athlete increases when running.

(2)

....

....

....

....

....

(ii) When the athlete is running, their muscle cells use both aerobic respiration and anaerobic respiration.

State **two** differences between aerobic respiration and anaerobic respiration.

(2)

1 ....

....

....

2 ....

....

....

(c) Bromothymol blue (BTB) solution is an indicator of pH.

Figure 5 shows the colour of BTB at different pH levels.

pH	4	5	6	7 (neutral)	8
colour	yellow	yellowy green	light green	green	blue

Figure 5

When air is passed through green BTB, for one minute, the solution stays green.

When a person breathes out through a straw into BTB for one minute the solution turns yellow.

 (i) Explain why the air breathed out turns the BTB solution yellow.

(2)

....

....

....

....

(ii) A scientist placed pondweed into two sealed test tubes containing green BTB solution.

Test tube A was kept in the dark.
Test tube B was kept in the light.
All other conditions were kept the same.
Figure 6 shows these test tubes at the start of the investigation.

A
in dark

B
in light
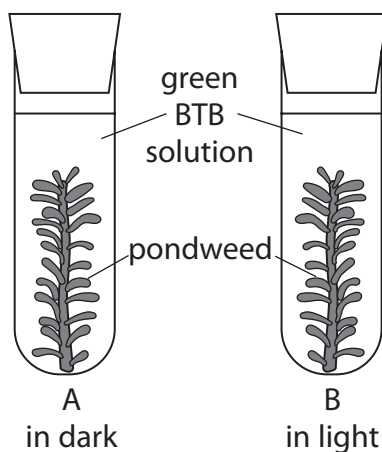
Figure 6

Figure 7 shows the colour of the BTB solution after 5 hours.

Tube A (in dark)	Tube B (in light)
yellowy green	green

Figure 7

Explain the results for tube A and tube B shown in Figure 7.

(2)

....

....

....

....

....

(Total for Question 3 = 9 marks)

4 (a) A student wanted to make a jacket to wear in cold weather.

The student compared the insulation properties of wool as a natural material with polyester as a synthetic material.

Each material was wrapped around a beaker containing hot water as shown in Figure 8.

The temperature was recorded every 2 minutes for 12 minutes.
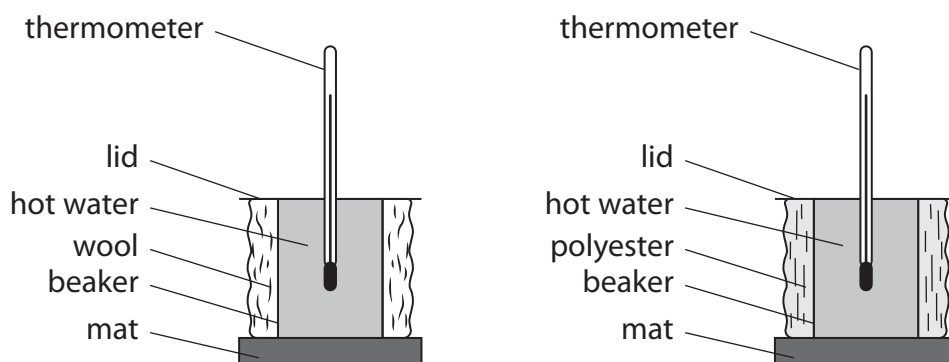
Figure 8

(i) Which part of the body controls the regulation of body temperature?
(1)

☒ **A** kidney

☒ **B** pituitary gland

☒ **C** hypothalamus

☒ **D** pancreas

(ii) State **one** variable that should be controlled in this investigation.
(1)

....

....

(iii) Describe a control that could be used for this investigation.
(2)

....

....

....

....

(b) The results for this investigation are shown in Figure 9.

wool		polyester	
time in minutes	temperature in °C	time in minutes	temperature in °C
0	64	0	82
2	61	2	74
4	56	4	68
6	53	6	63
8	49	8	59
10	45	10	53
12	42	12	48

Figure 9

(i) Compare and contrast the temperature changes for wool and polyester in this investigation.

(2)

....

....

....

....

(ii) State **one** improvement to this investigation that would make the results more comparable.

(1)

....

....

(c) (i) Wearing an insulated jacket may cause a person to sweat.

Explain how sweating helps to regulate temperature in humans.

(2)

....

....

....

....

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

(2)

....

....

....

....

(Total for Question 4 = 11 marks)

5 A student investigated the effect of light intensity on the photosynthesis of pondweed.

A light source was placed at different distances from the pondweed.

The bubbles produced were counted for 2 minutes.

Figure 10 shows the apparatus that was used.
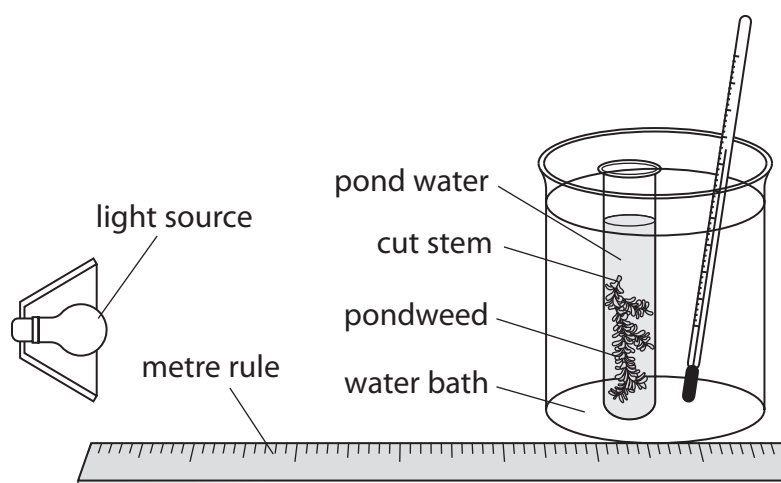
Figure 10

(a) (i) State why the student included a water bath in the apparatus.

(1)

....

....

(ii) State **two** variables that should be controlled when completing this investigation.

(2)

1 ....

....

2 ....

....

(b) Figure 11 shows the results of this investigation.

distance from the lamp in cm	number of bubbles in two minutes	light intensity in arbitrary units
5	62	0.04
10	60	0.01
15	43	0.0044
20	32	0.0025
25	11	?

Figure 11

(i) The light intensity was calculated using the inverse square law for photosynthesis.

Calculate the light intensity at a distance of 25 cm from the lamp.

Include the equation for the inverse square law in your answer.

(3)

.... arbitrary units

(ii) Explain how the student could improve this investigation to get a more accurate measurement of the gas produced.

(2)

....

....

....

....

(c) Devise a plan to show that temperature is a limiting factor in photosynthesis.

Use the apparatus shown in Figure 10.

(3)

....

....

....

....

....

....

....

....

(Total for Question 5 = 11 marks)

6 Gas exchange happens in the alveoli in the lungs.

Figure 12 shows an alveolus and a capillary.

alveolar wall

capillary wall

red blood cell
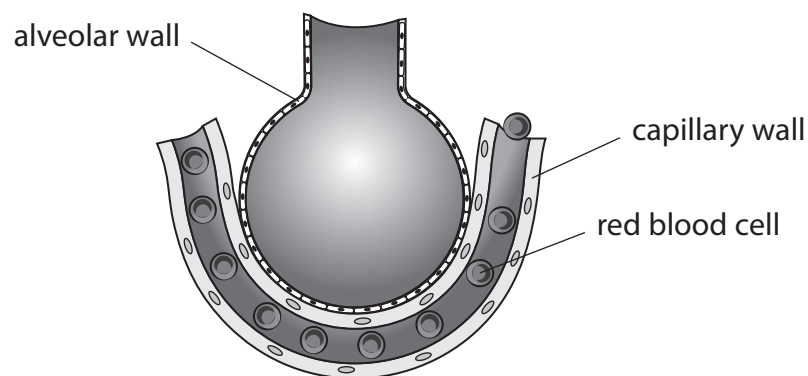
(adapted from : sciencepics/shutterstock)

Figure 12

(a) (i) Name the gas used in respiration that moves from the alveolus into the capillary.

(1)

....

(ii) Name the gas produced by respiration that moves from the capillary into the alveolus.

(1)

....

(iii) The capillary wall is only one cell thick.

Explain how gases move from the alveolus to the capillary.

(3)

....

....

....

....

....

....

....

(iv) Explain the advantages of red blood cells passing one at a time through this narrow capillary.

(3)

....

....

....

....

....

....

(b) The average number of alveoli in each human lung is 280 million.

The surface area of 1 million alveoli is $0.25\,m^2$.

Calculate the total surface area of a human lung.

(2)

....

(Total for Question 6 = 10 marks)

7 Figure 13 shows part of a food web of organisms found in the cold Antarctic Ocean.
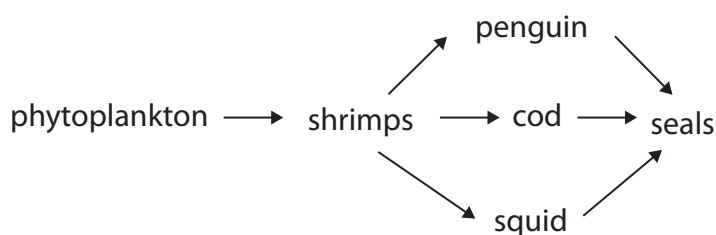
Figure 13

(a) Which term describes phytoplankton in this food web?

(1)

☒ **A** consumer

☒ **B** producer

☒ **C** predator

☒ **D** prey

(b) Humans are removing large numbers of cod from the Antarctic Ocean.

(i) State why the removal of cod could lead to a decrease in the numbers of squid and penguins.

(1)

....

....

(ii) Explain why the removal of cod could lead to an increase in the numbers of squid and penguins.

(2)

....

....

....

....

P72629A01828
P 7 2 6 2 9 A 0 1 8 2 8

(c) Figure 14 shows information about the biomass of some organisms in one part of the Antarctic Ocean.

organism	biomass in tonnes
phytoplankton	200
shrimps	40
cod	10
seals	0.5

Figure 14

(i) Draw and label a pyramid of biomass for this food chain.

(2)

(ii) Seals are mammals.

Explain why the conversion of biomass from phytoplankton to shrimps is more efficient than the conversion of biomass from cod to seals.

(2)

....

....

....

....

(d) Cod are being overfished in the Antarctic Ocean.

Suggest **two** actions that could be taken by humans to increase the number of cod in the Antarctic Ocean.

(2)

1 ....

....

2 ....

....

(Total for Question 7 = 10 marks)

8 Figure 15 shows the changes in the levels of the hormones of the menstrual cycle.
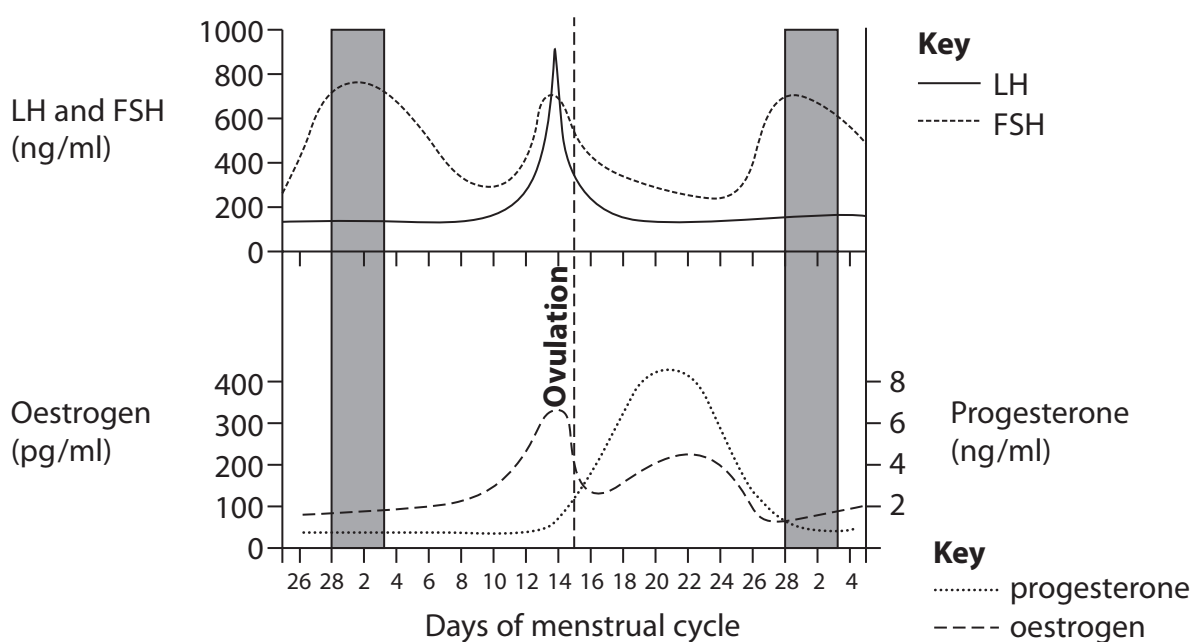
Figure 15

(a) (i) The maximum concentration of oestrogen is just before ovulation.

Which is the maximum concentration of oestrogen?

(1)

☒ **A** 8 ng/ml

☒ **B** 210 pg/ml

☒ **C** 320 pg/ml

☒ **D** 900 ng/ml

(ii) Explain how **two** of the hormones shown in Figure 15 cause ovulation.

(3)

....

....

....

....

....

....

....

(iii) State the number of days for the first menstruation shown in Figure 15.

(1)

....

(iv) Explain how the levels of each hormone in the woman shown in Figure 15
would be different, if she was pregnant.

(4)

....

....

....

....

....

....

....

....

....

(Total for Question 8 = 9 marks)

9 Figure 16 shows a photomicrograph of two stomata in a leaf.
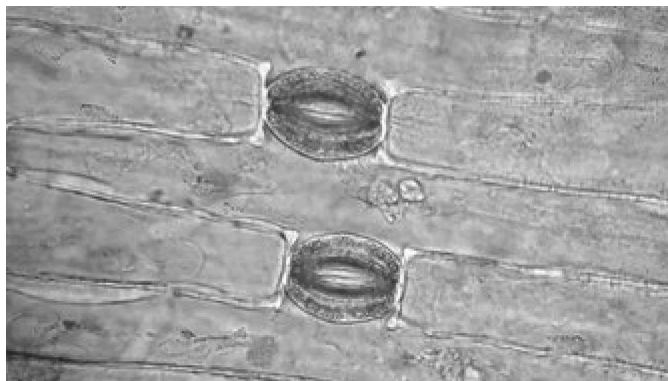
Figure 16

(a) (i) The length of one guard cell in this image is 6 mm.

Convert the length of this guard cell into micrometres (μm).

(1)

....

(ii) The image has been magnified 150×.

Calculate the actual size of the guard cell.

Give your answer in standard form in mm.

(3)

.... mm

(b) Explain the role of denitrifying bacteria in the nitrogen cycle.

(2)

....

....

....

....

....

*(c) Describe how carbon is cycled through the biotic and abiotic components of an ecosystem.

(6)

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(Total for Question 9 = 12 marks)

P 7 2 6 2 9 A 0 2 4 2 8

10 Blood is filtered in the kidney.

Figure 17 shows the diameter of some molecules found in human blood.

molecule	diameter in nanometres (nm)
X	0.6
Y	1.0
Z	15

Figure 17

(a) (i) Which part of the nephron is the site of ultrafiltration?

(1)

☒ **A** distal convoluted tubule

☒ **B** collecting duct

☒ **C** glomerulus

☒ **D** loop of Henle

(ii) Molecule Z is a protein.

Explain why protein is not usually found in urine.

(2)

....

....

....

....

(iii) Haemolytic anaemia is a disease that causes red blood cells to burst.

Haemoglobin is not found in the urine of people who do not have haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nm.

Explain why haemoglobin can be found in the urine of people with haemolytic anaemia.

(3)

....

....

....

....

....

....

....

P 7 2 6 2 9 A 0 2 6 2 8

*(b) Describe how the water content of the blood is controlled in the nephron.

(6)

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(Total for Question 10 = 12 marks)

TOTAL FOR PAPER = 100 MARKS

P 7 2 6 2 9 A 0 2 7 2 8

BLANK PAGE