

Paper Reference(s) 4BI1 / 2BR

Pearson Edexcel International GCSE (9–1)

Biology

Unit: 4BI1

Paper: 2BR

Friday 7 June 2019 – Afternoon

**Time: 1 hour 15 minutes plus your additional
time allowance**

INSTRUCTIONS TO CANDIDATES

**Write your centre number, candidate number,
surname, other names and your signature in
the boxes below. Check that you have the
correct question paper.**

Centre No.					
Candidate No.					
Surname					
Other names					
Signature					
Paper Reference	4	B	I	1	/ 2 B R



- Use **BLACK** ink or ball-point pen.
- Answer **ALL** questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- Show all the steps in any calculations and state the units.
- 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 ☐.

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Nil

INFORMATION FOR CANDIDATES

- The total mark for this paper is 70.
- The marks for **EACH** question are shown in brackets – use this as a guide as to how much time to spend on each question.

(Instructions continue on next page)

(Turn over)

ADVICE TO CANDIDATES

- **Read each question carefully before you start to answer it.**
- **Write your answers neatly and in good English.**
- **Try to answer every question.**
- **Check your answers if you have time at the end.**

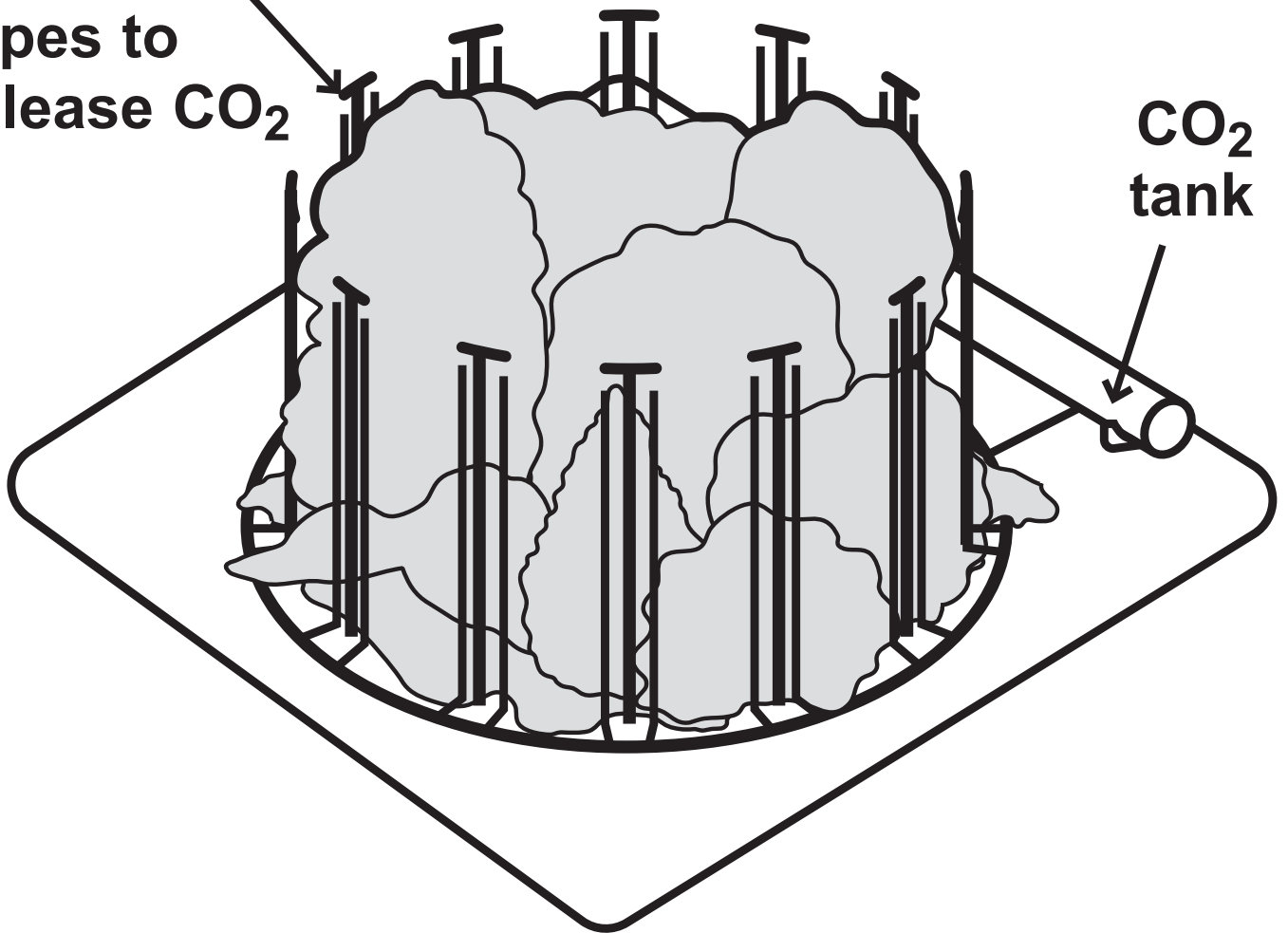
Answer ALL questions.

- 1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.**

The FACE Programme

towers that
contain
pipes to
release CO₂

CO₂
tank



(Continues on next page)

(Turn over)

5 The global concentration of carbon dioxide (CO₂) in the atmosphere has risen by 35% since 1800. It is higher now than at any time in the past 25 million years and is predicted to increase further by 2050.

10 Free air carbon dioxide enrichment (FACE) is when scientists increase the concentration of CO₂ in the air surrounding crop plants. A typical FACE plot is circular and surrounded by a ring of pipes. These pipes release CO₂ at the base of the plant and all the way to the top of the plant.

15 Wind direction, wind speed and CO₂ concentration are measured at the centre of each plot. A computer uses this information to maintain a high concentration of CO₂.

20 Plants do not just respond to increasing CO₂ in the atmosphere. They can also change the

(Continues on next page)

(Turn over)

concentration of CO₂ by increasing the amount they absorb. Much of
25 what we used to know about plant responses to rising CO₂ came from studies in glasshouses. However, in FACE experiments the effect of increasing CO₂ can be studied in a
30 natural environment. This should provide a better idea of how plants and ecosystems will respond to higher global concentrations of CO₂.

One of the effects of higher
35 concentrations of CO₂ is an increase in the rate of photosynthesis. FACE experiments were done in various parts of the world using different plant species. In these experiments,
40 raised CO₂ concentrations increased the rate of photosynthesis by about 40%. CO₂ concentrations also affect how open stomata are. Open stomata allow CO₂ to diffuse into leaves for
45 photosynthesis, but also allow water

(Continues on next page)

(Turn over)

to escape from leaves. Plants respond by changing how open their stomata are as a compromise. As CO₂ concentrations increase, plants can
50 maintain a high rate of photosynthesis with a lower rate of transpiration. Growth with raised CO₂ decreases water loss by about 22%. This can
55 have consequences for the water cycle of entire ecosystems.

In FACE experiments, dry mass production increased by about 30%. This increased growth leads to a
60 greater yield in crops such as wheat, rice and soybean.

(Question continues on next page)

(Turn over)

- (a) Explain why the carbon dioxide concentration is predicted to increase further by 2050 (lines 5 to 6). (2 marks)**

(Question continues on next page)

(Turn over)

(b) Suggest why wind direction and speed are measured in FACE plots (lines 15 to 17). (1 mark)

(Question continues on next page)

(Turn over)

(c) Scientists conclude that FACE experiments are more useful than experiments in glasshouses (lines 24 to 33).

Evaluate this conclusion. (3 marks)

(Continue your answer on next page)
(Turn over)

(Question continues on next page)

(Turn over)

- (d) Explain why an increase in carbon dioxide concentration would lead to an increase in the rate of photosynthesis (lines 34 to 36). (2 marks)**

(Question continues on next page)

(Turn over)

- (e) Describe an experiment to estimate the rate of water loss from a plant. (4 marks)**

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

(Turn over)

- (f) Plants respond by changing how open their stomata are as a compromise (lines 46 to 48).**

Explain the compromise that plants must make. (2 marks)

(Question continues on next page)

(Turn over)

(g) An increased concentration of carbon dioxide in the atmosphere is causing climate change.

Scientists hope that an increase in the rate of photosynthesis may limit climate change.

(Question continues on next page)

Describe three other methods of reducing climate change. (3 marks)

1 _____

2 _____

3 _____

(TOTAL FOR QUESTION 1 = 17 MARKS)

(Questions continue on next page)

(Turn over)

2 Ecology is the study of organisms in their environment.

(a) (i) State what is meant by the term POPULATION. (1 mark)

(ii) State what is meant by the term COMMUNITY. (1 mark)

(Question continues on next page)

(Turn over)

(iii) State what is meant by the term ECOSYSTEM. (1 mark)

**(b) Which of these is an abiotic factor?
(1 mark)**

- ☐ **A availability of mates**
- ☐ **B number of pathogens**
- ☐ **C number of predators**
- ☐ **D acidity of soil**

(Question continues on next page)

(Turn over)

(c) Which apparatus would be suitable for estimating the population size of a woodland plant? (1 mark)

- ☐ **A potometer**
- ☐ **B quadrat**
- ☐ **C spotting tile**
- ☐ **D sweep net**

(Question continues on next page)

(Turn over)

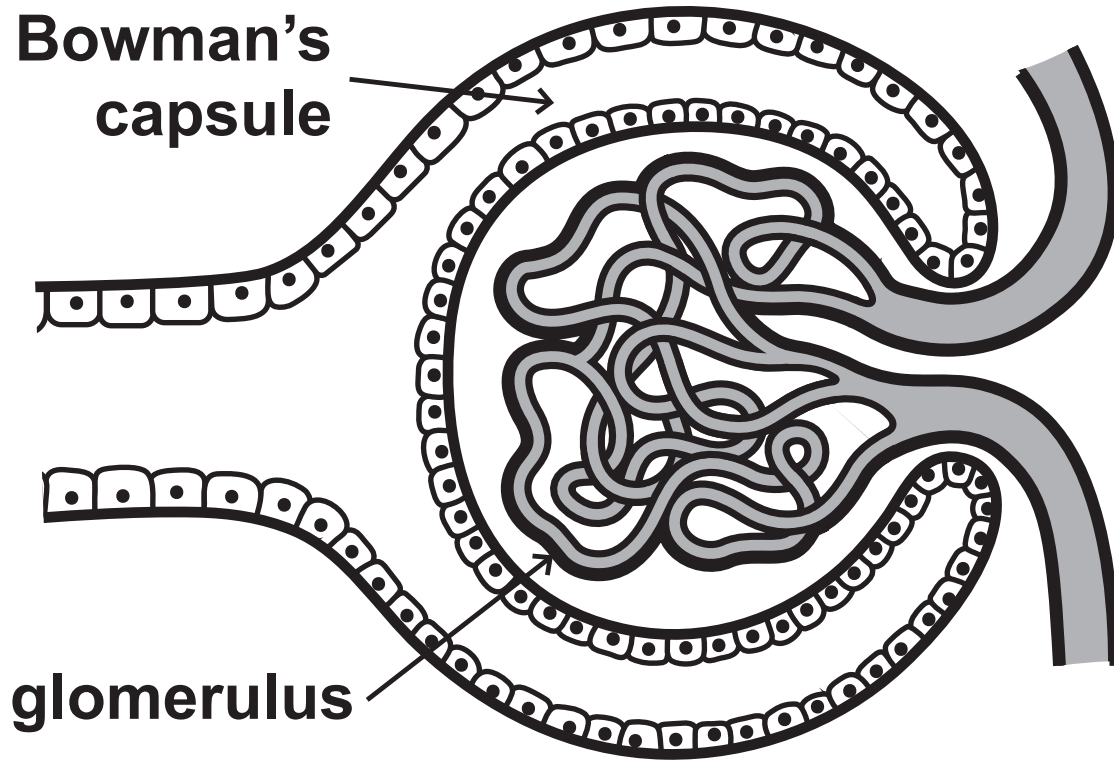
(d) Describe how the biodiversity of a woodland differs from the biodiversity of a farmed field of wheat plants. (2 marks)

(TOTAL FOR QUESTION 2 = 7 MARKS)

(Questions continue on next page)

(Turn over)

- 3 The diagram shows part of a kidney nephron.



(a) Where is this part of a kidney nephron located? (1 mark)

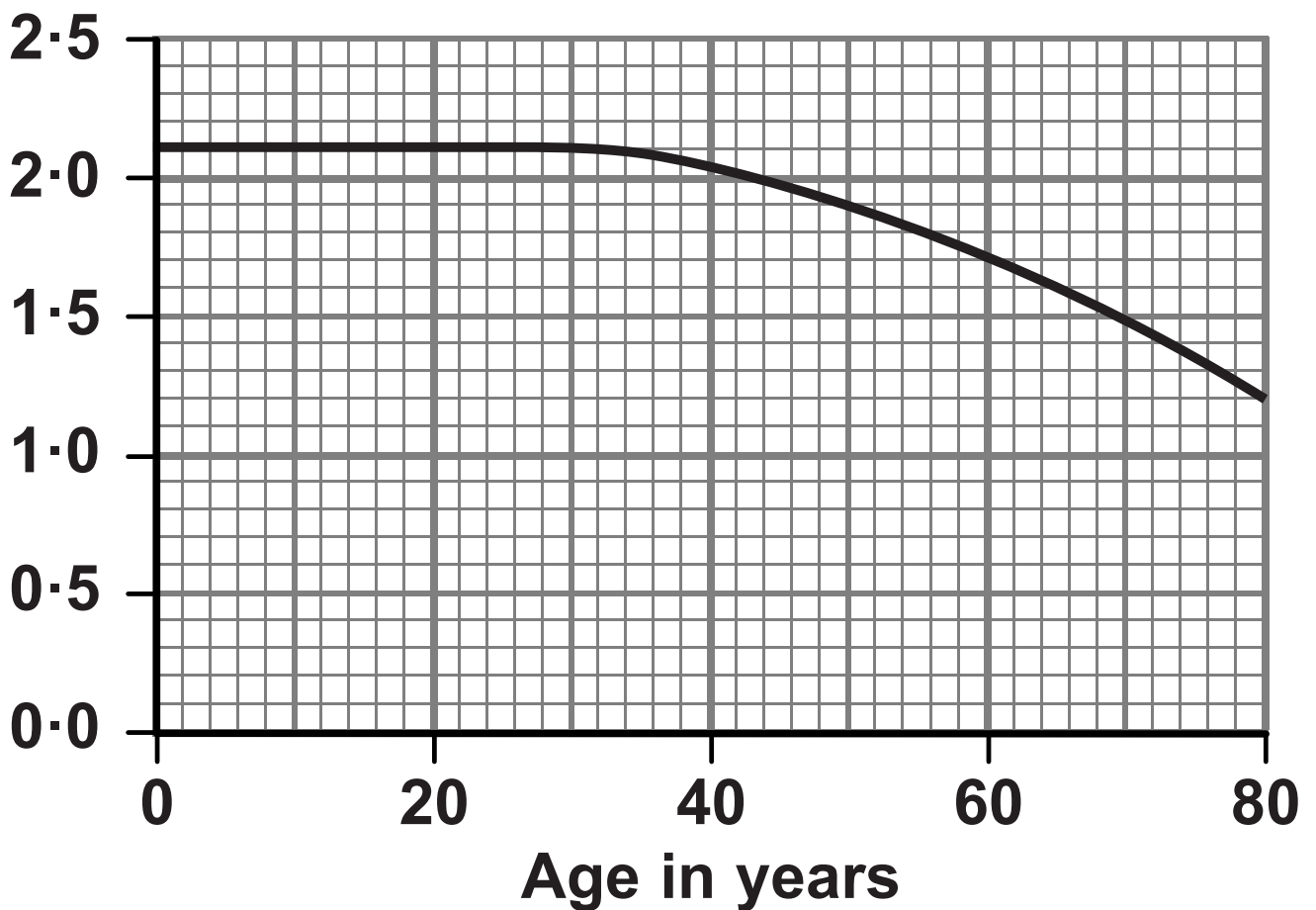
- ☐ A in the cortex
- ☐ B in the collecting duct
- ☐ C in the loop of Henle
- ☐ D in the medulla

(Question continues on next page)

(Turn over)

(b) The graph shows the effect of age on the number of glomeruli in the kidneys.

Number of
glomeruli $\times 10^6$



Using the graph, determine the age of a person with 1 600 000 glomeruli in their kidneys. (1 mark)

age = _____ years

(Question continues on next page)

(Turn over)

(c) The table lists three molecules. It also gives their concentrations in the glomerulus, the Bowman's capsule and the bladder.

Molecule	Concentration in glomerulus (%)	Concentration in Bowman's capsule (%)	Concentration in bladder (%)
protein	8.00	0.00	0.00
glucose	0.10	0.10	0.00
urea	0.03	0.03	2.00

(Question continues on next page)

**Explain the difference between the concentration of each substance in the glomerulus and in the bladder.
(4 marks)**

**(Continue your answer on next page)
(Turn over)**

(TOTAL FOR QUESTION 3 = 6 MARKS)

(Questions continue on next page)

(Turn over)

- 4 Chocolate contains small amounts of a substance called theobromine.**

In high amounts, theobromine is poisonous to animals.

The table shows the mass of theobromine per kg of body mass that is poisonous for five different species.

Species	Mass of theobromine per kg of body mass in mg
cat	200
dog	300
mouse	837
human	1000
rat	1265

(Question continues on next page)

(Turn over)

- (a) (i) The mass of theobromine per kg that is poisonous differs between species. Compare the poisonous effect in cats and rats. (2 marks)**

(Question continues on next page)

(Turn over)

- (ii) A small bar of chocolate contains 200 mg of theobromine.

Explain why eating chocolate bars is unlikely to poison a man of mass 70 kg.

Include a calculation in your answer. (2 marks)

(Question continues on next page)

(Turn over)

(b) Theobromine prevents the release of ADH.

**Explain why preventing the release of ADH can be harmful to humans.
(4 marks)**

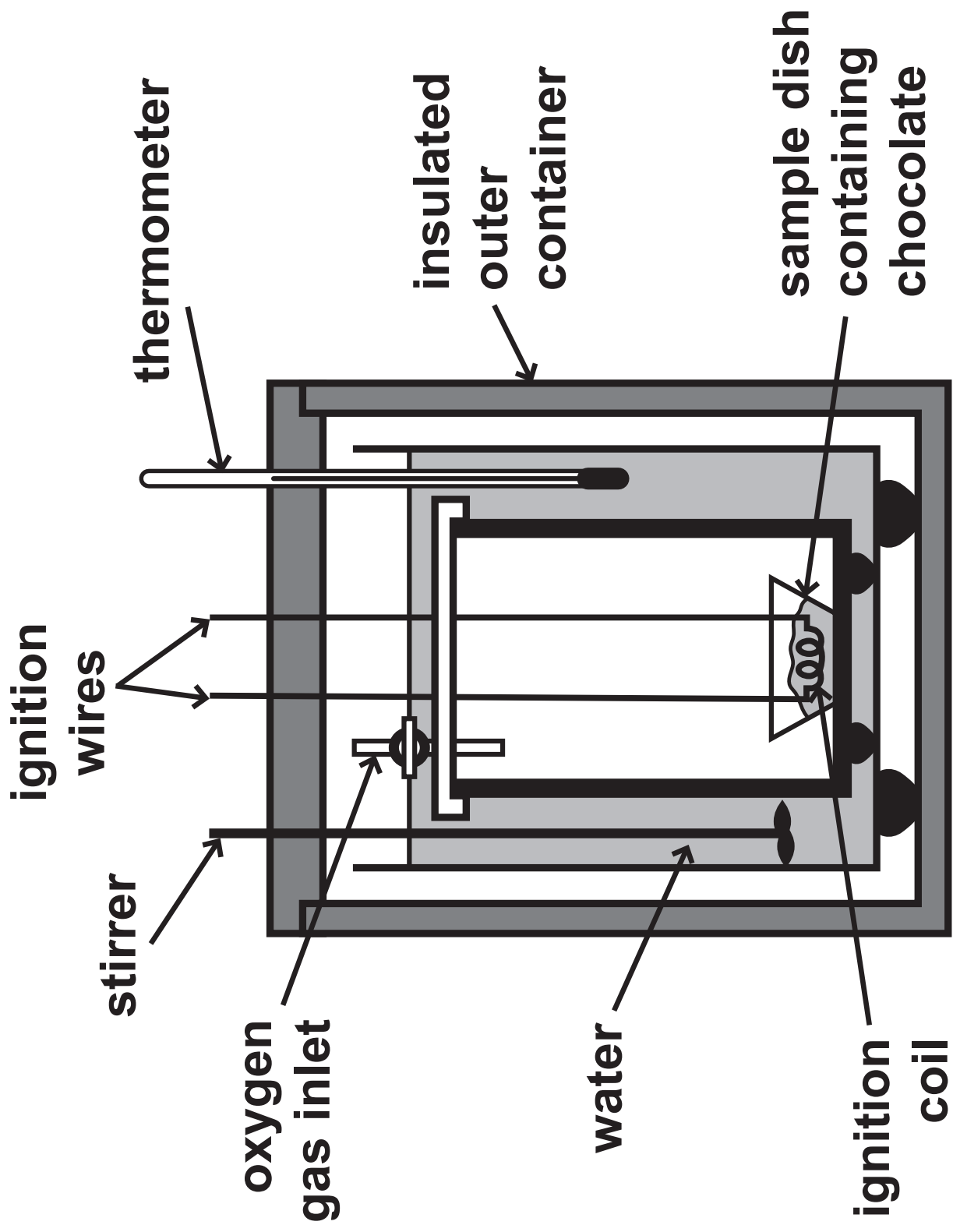
(Continue your answer on next page)

(Turn over)

(c) The diagram on page 32 shows a calorimeter, which is used to measure the energy content of a food sample.

(Question continues on next page)

(Turn over)



(Question continues on next page)

(Turn over)

**Explain the measurements and the calculations you would use to compare the energy content of milk chocolate and dark chocolate.
(4 marks)**

(Continue your answer on next page)

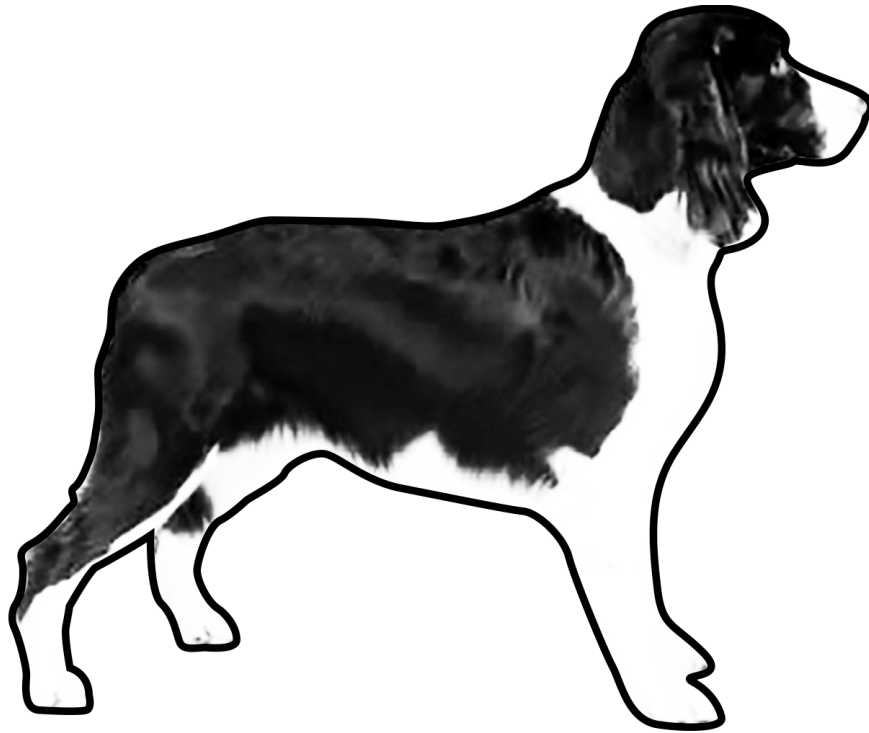
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(TOTAL FOR QUESTION 4 = 12 MARKS)

(Questions continue on next page)

(Turn over)

- 5 The photograph shows a breed of dog called an English Springer Spaniel.**



Phosphofructokinase deficiency (PFK) is an inherited disease in this breed of dog.

The disease causes red blood cells to burst.

(Question continues on next page)

(Turn over)

(a) Explain why dogs with PFK find it difficult to exercise. (2 marks)

(Question continues on next page)

(Turn over)

(b) PFK is caused by a recessive allele.

The table lists the genotypes of some parents.

Complete the table by giving the percentage of offspring likely to have PFK for each set of parents.

**The first one has been done for you.
(2 marks)**

Genotype of parents	Percentage of offspring likely to have PFK
both homozygous dominant	0
heterozygous x heterozygous	
heterozygous x homozygous recessive	

(Question continues on next page)

(Turn over)

(c) A dog breeder is someone who breeds dogs and sells the offspring.

Explain the advantage for the dog breeder of using homozygous dominant dogs as parents. (2 marks)

(Question continues on next page)

(Turn over)

(d) A dog breeder buys a healthy dog.

**The dog shows no signs of PFK,
but the breeder does not know its
genotype.**

**Explain why the breeder mates this
dog with a dog that has PFK. (2 marks)**

(Question continues on next page)

(Turn over)

(e) Part of the base sequence in the strand of DNA used to make the protein phosphofructokinase is CAGGTATGG.

(i) Which of these shows the base sequence of mRNA produced from this strand of DNA? (1 mark)

☐ **A CAGGTATGG**

☐ **B CAGGUAUGG**

☐ **C GTCCATACC**

☐ **D GUCCAUACC**

(Question continues on next page)

(Turn over)

- (ii) The mutated base sequence for the same strand of DNA is CAGTTATGG.

Explain why the mutated base sequence makes a different protein than the normal DNA.
(3 marks)

(Continue your answer on next page)

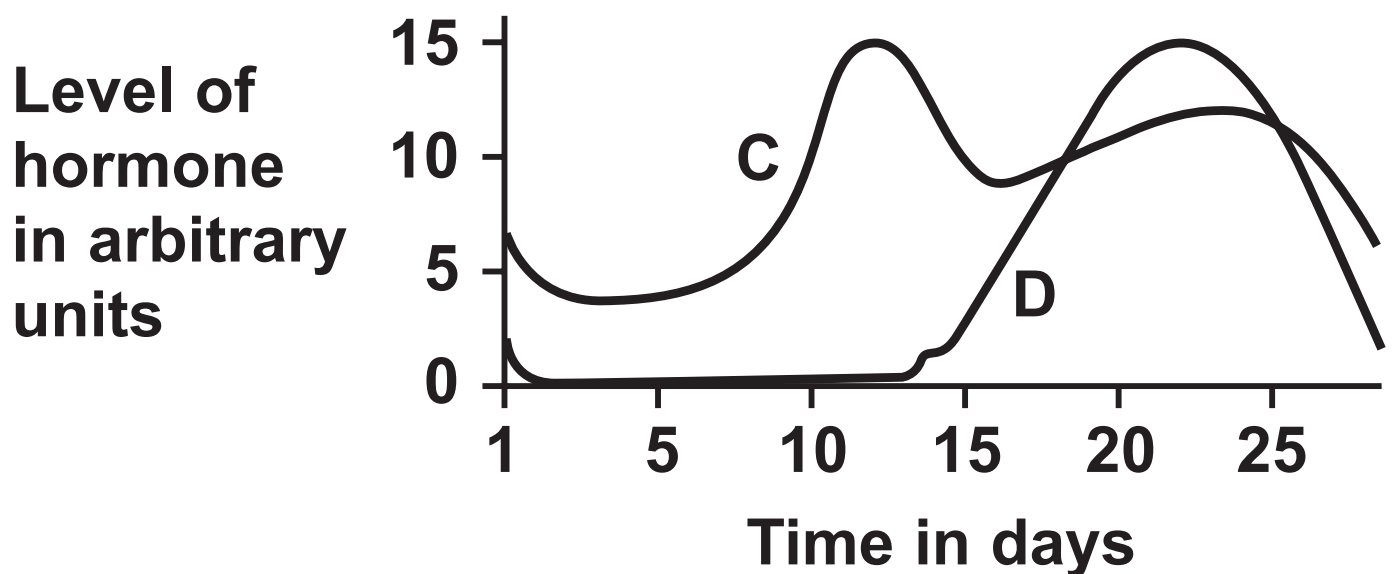
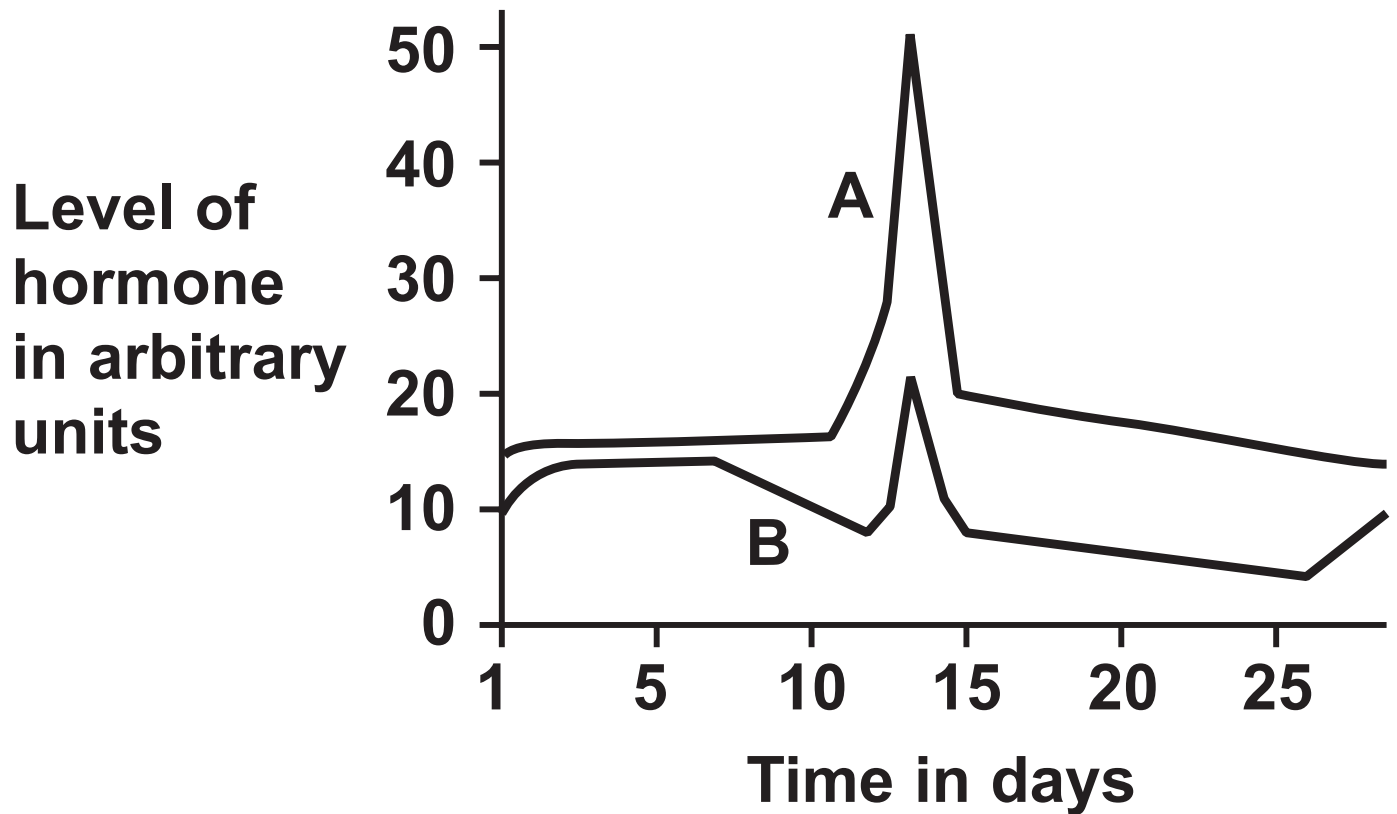
(Turn over)

(TOTAL FOR QUESTION 5 = 12 MARKS)

(Questions continue on next page)

(Turn over)

- 6 The graphs show changes in the levels of four hormones, A, B, C and D, that control the menstrual cycle.



(Question continues on next page)

(Turn over)

(a) Hormone A stimulates ovulation.

**(i) Give the name of this hormone.
(1 mark)**

**(ii) State what is meant by the term
OVULATION? (1 mark)**

**(b) Give the name of hormone D.
(1 mark)**

(Question continues on next page)

(Turn over)

**(c) State the source of hormones
C and D. (1 mark)**

(TOTAL FOR QUESTION 6 = 4 MARKS)

(Questions continue on next page)

(Turn over)

7 The table shows information about world fish supply from 2009 to 2014.

Source	Fish supply in million tonnes					
	2009	2010	2011	2012	2013	2014
wild	90	89	94	91	93	93
farmed	56	59	62	66	70	74
total	146	148	156	157	163	167

(Question continues on next page)

(Turn over)

- (a) (i) Calculate the difference between the percentage of total fish production that is farmed in 2009 and the percentage of total fish production that is farmed in 2014. (3 marks)**

difference = _____

(Question continues on next page)

(Turn over)

- (ii) Describe the changes in fish supply from 2009 to 2014.
(3 marks)**

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

(Turn over)

(b) Farming large numbers of fish can cause problems for fish farmers.

Discuss how fish farmers solve these problems. (6 marks)

(Continue your answer on next page)

(Turn over)

(Turn over)

(TOTAL FOR QUESTION 7 = 12 MARKS)

TOTAL FOR PAPER = 70 MARKS
END