



A-Level Biology

Y13 Practical Questions

Question Paper

Time available: 84 minutes

Marks available: 68 marks

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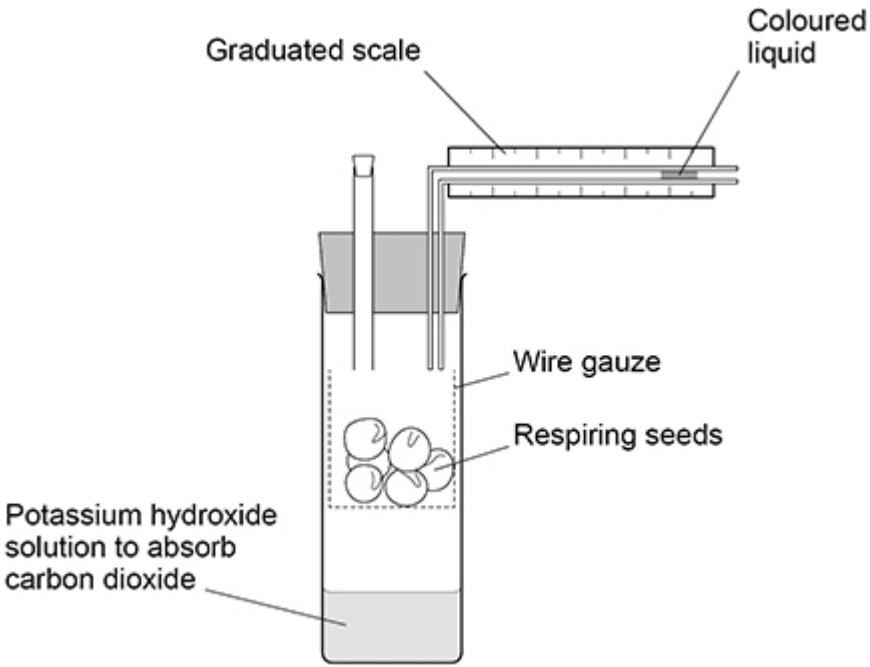
2.

(a) Put a Tick (✓) in the box next to the process that occurs in anaerobic respiration but does **not** occur in aerobic respiration.

- Phosphorylation of glucose
- Reduction of NAD
- Reduction of pyruvate
- Substrate-level phosphorylation

(1)

A student used the apparatus shown in the diagram below to measure the rate of aerobic respiration of seeds for 48 hours.



(b) During the 48 hours, the coloured liquid moved to the left.

Explain why.

(3)

(c) Apart from time, give **two** measurements the student would have to make to determine the rate of aerobic respiration of these seeds in $\text{cm}^3 \text{ hour}^{-1}$

1 _____

2 _____

(2)

- (d) The student used the same apparatus to determine the volume of carbon dioxide the seeds produced during 48 hours.

Give the change the student would need to make to the contents of the apparatus **and** describe how he could calculate the volume of carbon dioxide produced.

(3)

- (e) The student calculated that during the 48 hours, $6.2 \times 10^{-4} \text{ cm}^3$ of oxygen was absorbed by 40 g of seeds.

Calculate the oxygen uptake in $\text{cm}^3 \text{ g}^{-1} \text{ hour}^{-1}$

Answer _____ $\text{cm}^3 \text{ g}^{-1} \text{ hour}^{-1}$

(1)

(Total 10 marks)

3.

A student isolated chloroplasts from spinach leaves into a solution to form a chloroplast suspension. He used the chloroplast suspension and DCPIP solution to investigate the light-dependent reaction of photosynthesis. DCPIP solution is blue when oxidised and colourless when reduced.

The student set up three test tubes as follows:

- **Tube 1** – 1 cm³ of solution without chloroplasts and 9 cm³ of DCPIP solution in light.
- **Tube 2** – 1 cm³ of chloroplast suspension and 9 cm³ of DCPIP solution in darkness.
- **Tube 3** – 1 cm³ of chloroplast suspension and 9 cm³ of DCPIP solution in light.

The student recorded the colour of the DCPIP in each of the tubes at the start and after the tubes had been left at 20 °C for 30 minutes.

His results are shown in the table.

Tube	Colour of DCPIP in tube	
	At start	After 30 minutes
1	blue	blue
2	blue	blue
3	blue	colourless

- (a) The solution that the student used to produce the chloroplast suspension had the same water potential as the chloroplasts.

Explain why it was important that these water potentials were the same.

(2)

- (b) Explain why the student set up **Tube 1**.

(2)

(c) Explain the results in **Tube 3**.

(2)

(d) The student evaluated the effectiveness of different chemicals as weed-killers by assessing their ability to prevent the decolourisation of DCPIP in chloroplast suspensions.

He added different concentrations of each chemical to illuminated chloroplast suspensions containing DCPIP. He then determined the IC_{50} for each chemical. The IC_{50} is the concentration of chemical which inhibits the decolourisation of DCPIP by 50%.

Explain the advantage of the student using the IC_{50} in this investigation.

(1)

(e) Explain how chemicals which inhibit the decolourisation of DCPIP could slow the growth of weeds.

(2)

(Total 9 marks)

4.

The diagram below shows the banding pattern of a single sarcomere.



(a) Explain the banding pattern shown in the diagram above.

(3)

Creatinine is produced in muscle tissues. Creatinine diffuses into the blood. The kidneys then excrete creatinine.

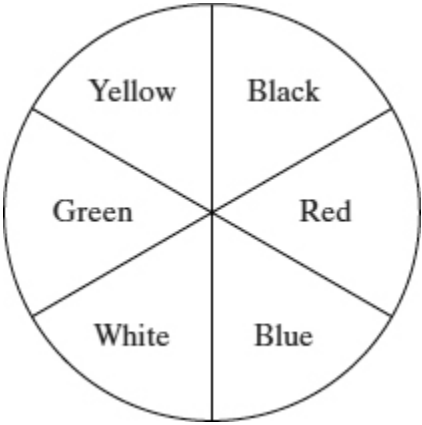
A calibration curve can be used to determine the concentration of creatinine in urine. One method of producing a calibration curve needs:

- creatinine solution of known concentration
- distilled water
- creatinine-detecting solution
- a colorimeter.

Creatinine-detecting solution reacts with creatinine to produce an orange colour.

5.

In an investigation by a student into the responses of maggots, the bottom of a large box was marked with six coloured segments, as shown in the diagram.



30 maggots were placed on each segment in the box. A transparent cover was put on the box and light bulbs were positioned so that the segments were evenly illuminated. The positions of the maggots were recorded after one hour. The intensity of the light reflected by each segment was measured.

The experiment was repeated three more times. The total number of maggots in each segment from the four experiments is shown in the table.

Colour of segment	Intensity of reflected light / arbitrary units	Total number of maggots
Black	4	154
Red	25	229
Blue	10	178
White	44	47
Green	25	48
Yellow	40	64

(a) Give **one** conclusion about the responses of maggots which is supported by these results.

Give the evidence from the table for your conclusion.

(2)

- (b) The chi-squared test was used to analyse the data. For the results obtained, suggest **one** null hypothesis which might be analysed by a chi-squared test.

(1)

- (c) It was suggested that the movement of the maggots might have been influenced by the Earth's magnetic field. Suggest **one** simple way of repeating the investigation which would avoid this possibility.

(1)

(Total 4 marks)

6.

- (a) Explain the meaning of these ecological terms.

Population _____

Community _____

(2)

- (b) Some students used the mark-release-recapture technique to estimate the size of a population of woodlice. They collected 77 woodlice and marked them before releasing them back into the same area. Later they collected 96 woodlice, 11 of which were marked.

- (i) Give **two** conditions necessary for results from mark-release-recapture investigations to be valid.

1. _____

2. _____

(2)

(ii) Calculate the number of woodlice in the area under investigation. Show your working.

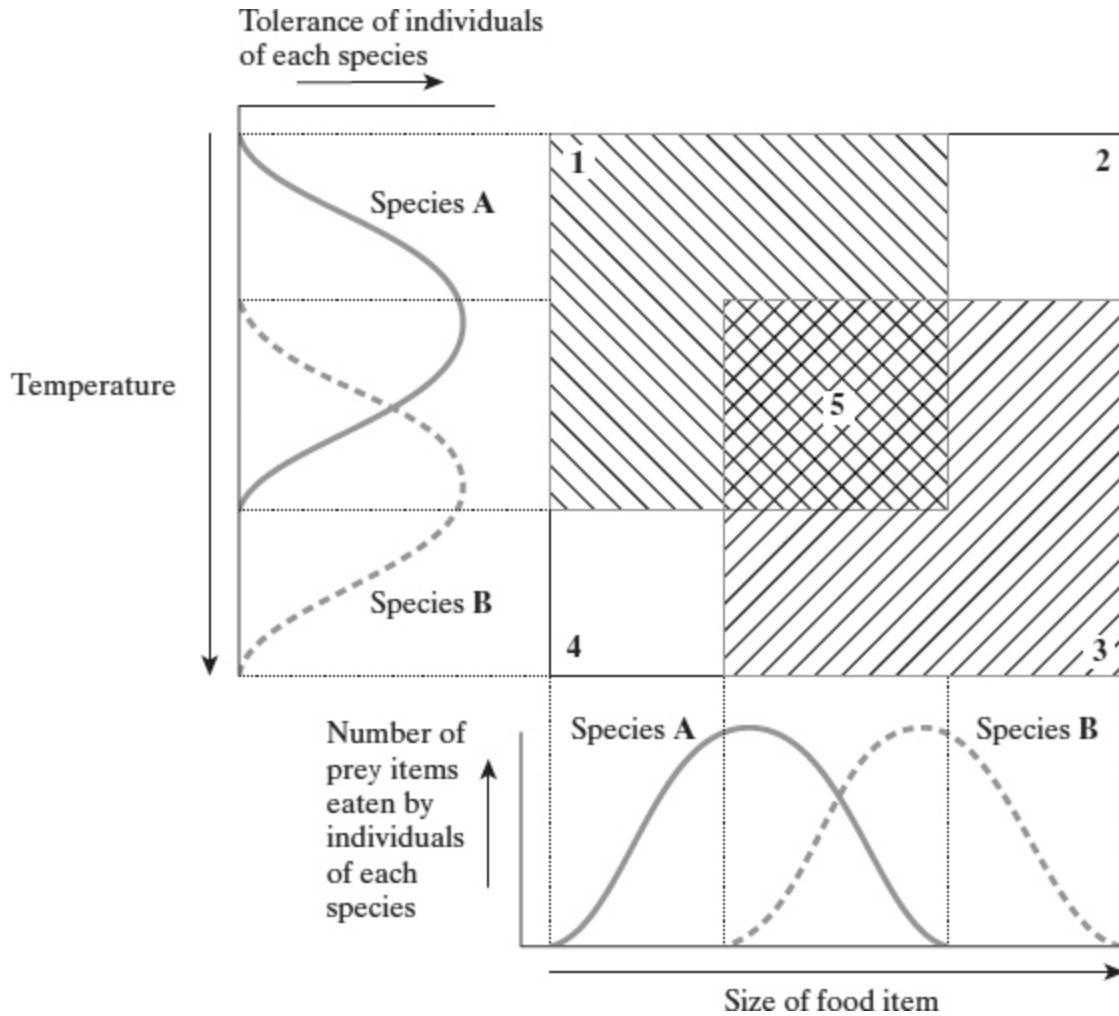
Answer _____

(2)

(c) Explain how you would use a quadrat to estimate the number of dandelion plants in a field measuring 100 m by 150 m.

(3)

- (d) Two similar species of birds (species **A** and species **B**) feed on slightly different sized insects and have slightly different temperature preferences. The diagram represents the response of each species to these factors.



- (i) Which of the numbered boxes describes conditions which represent
- the niche of species **A** _____
- the niche of species **B** _____
- insects too small for species **B** and temperature too warm for species **A**; _____
- insects too large for species **A** and temperature too cool for species **B**? _____

(2)

- (ii) These two species are thought to have evolved as a result of sympatric speciation. Suggest how this might have occurred.

(4)

(Total 15 marks)

7. Scientists investigated the effect of drinking tea and coffee on reducing the risk of developing one type of brain cancer. The investigation involved 410 000 volunteers and was conducted in 10 European countries over a period of 8.5 years.

- (a) (i) Apart from age, suggest **two** factors that the scientists should have considered when selecting volunteers for this trial.

1. _____

2. _____

(2)

- (ii) Give **two** features of the design of this investigation that would ensure the reliability of the results obtained.

1. _____

2. _____

(2)

- (b) The incidence for this type of brain cancer is 6 cases per 100 000 per year. Use this information to calculate the expected number of volunteers developing this cancer during the 8.5 year period of this investigation. Show your working.

Answer _____

(2)

- (c) In analysing the results of this investigation, the scientists took into account the age of the volunteers. Suggest why.

(1)

- (d) During the investigation, the volunteers were asked to estimate the volume of tea and/or coffee that they drank each day. The types of tea and coffee consumed in different countries varied. When the data from all the countries were collected there was a correlation between drinking more than 100 cm³ of tea or coffee each day and a reduced risk of developing this type of brain cancer.

Tea and coffee contain caffeine. A newspaper reported the results of this investigation under the headline 'Caffeine helps cut cancer risk'. Explain why scientists could **not** support this view solely on the basis of this investigation.

(4)

- (e) Another group of scientists investigated the effect of caffeine on blood flow to certain parts of the brain. Volunteers were given different concentrations of caffeine solution to drink. A control group was also set up.

(i) Describe how the control group should have been treated.

(2)

(ii) Volunteers who drank the same concentration of caffeine solution often had different concentrations of caffeine in their blood. Suggest **one** reason for the difference in concentration of caffeine in the blood of volunteers.

(1)

- (iii) The investigation showed that caffeine reduces the blood flow to certain parts of the brain. Suggest **one** way in which this could lead to a reduced risk of brain cancers.

(1)

(Total 15 marks)