

1)

Many drugs used in medicine are developed from plants. These drugs have to be tested before they are used.

- (a) In 1775, William Withering published details of testing digitalis soup on patients with dropsy.
Compare this historic drug testing with contemporary drug testing protocols.

Give **one** similarity and **two** differences, other than the use of a **placebo**, between these two protocols.

(3)

Similarity

Difference 1

Difference 2

- (b) One of the stages in a drug trial may use a placebo.

In a drug trial, people with schizophrenia were given one of four treatments. The table below shows the recorded improvement in people with schizophrenia for each of the four treatments.

Treatment	Concentration of drug / mg	Recorded improvement / arbitrary units
1 (placebo)		18.8
2	400	24.8
3	600	30.9
4	800	31.3

- (i) Complete the table to give the concentration of the drug in treatment 1 (placebo).

(1)

- (ii) Suggest why there was a recorded improvement when the placebo was used. (1)

- (iii) To calculate the actual improvement due to the drug, the effect of the placebo must be considered. This can be done by subtracting the recorded improvement for treatment 1 from each of the other treatments.

Complete the table below by filling in the actual improvements for treatments 2, 3 and 4.

(1)

Treatment	Concentration of drug / mg	Actual improvement / arbitrary units
2	400	
3	600	
4	800	

- (iv) Use the information in this table to describe the relationship between the concentration of the drug used and the actual improvement in people with schizophrenia.

(2)

2)

There are now over 1400 seedbanks in the world and they store plant seeds to maintain genetic diversity. Plant seeds are carefully selected and processed so they can be stored for years in a seedbank.

- (a) Give **two** differences between genetic diversity and species richness.

(2)

- (b) (i) Suggest **two** reasons why it is better to store seeds rather than to store whole plants.

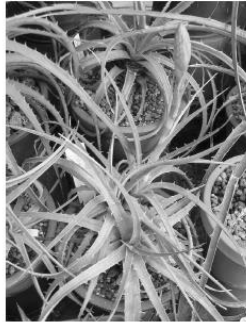
(2)

- (ii) Suggest why it is better to store seeds from several individual plants of one species rather than seeds from one individual plant.

(2)

- (c) Seeds that are selected for storage are usually dried to remove most of the water before they are placed in a seedbank.

An investigation was carried out to study the effect of drying on the germination success of seeds from *Encholirium* plants, shown in the photograph below.



Magnification $\times 0.2$

One hundred seeds were collected from each of four species of *Encholirium*. The seeds from each species were separated into two groups, each containing 50 seeds.

One group of 50 seeds was planted immediately after collection. The other group of 50 seeds was dried after collection and then planted. Germination success was measured as the number of seeds that germinated out of the 50 seeds planted.

This was repeated several times and the mean germination success was calculated. The results are shown in the table below.

<i>Encholirium</i> species	Mean germination success for 50 seeds	
	Planted immediately	Planted after drying
A	48	45
B	40	23
C	45	45
D	48	37

- (i) Use the data in the table to calculate, for *Encholirium* species A, the percentage decrease in mean germination success for dried seeds compared with seeds planted immediately. Show your working.

(2)

Answer %

- (ii) Using the data in the table, suggest which of the four species is **least** likely to survive storage in a seedbank. Give reasons for your answer.

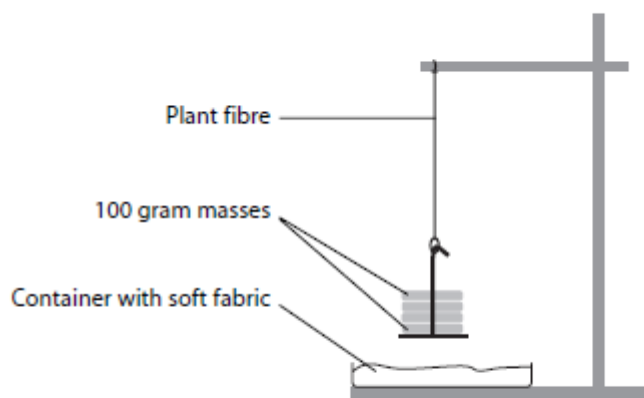
(3)

- (iii) Suggest how seeds from these *Encholirium* species may need to be treated to ensure their long term survival in a seedbank.

(2)

3)

The diagram below shows a technique used by a student to investigate the mass needed to break dry plant fibres. In this investigation, 100 gram masses were added until the fibre broke.



(a) The student carried out the investigation four times to achieve reliable results.

(i) Suggest **three** factors that would need to be kept constant in this investigation.

(3)

(ii) Describe how the results obtained would be processed to produce a mean.

(2)

(b) Suggest why increasing the mass by 50 grams each time, rather than 100 grams, could increase the accuracy of the student's results.

(1)

(c) The diagram shows a container with soft fabric in it. Suggest the safety role of this container.

(1)

(d) This student also investigated the mass required to break four samples of an oil-based plastic fibre.

The table below shows the data the student collected for the plastic fibre.

Sample	Mass required to break the plastic fibre / g
1	13 300
2	2 300
3	13 600
4	13 600
Mean	13 500

- (i) The student calculated the mean using only three of the results from the table.
Explain why the mean for the plastic fibre was calculated using only these three results.

(1)

- (ii) Suggest why the use of oil-based plastic fibres such as nylon, rather than plant fibres, does not contribute to sustainability.

(2)

4)

- i) Various internal and external factors can affect the phenotype of humans.

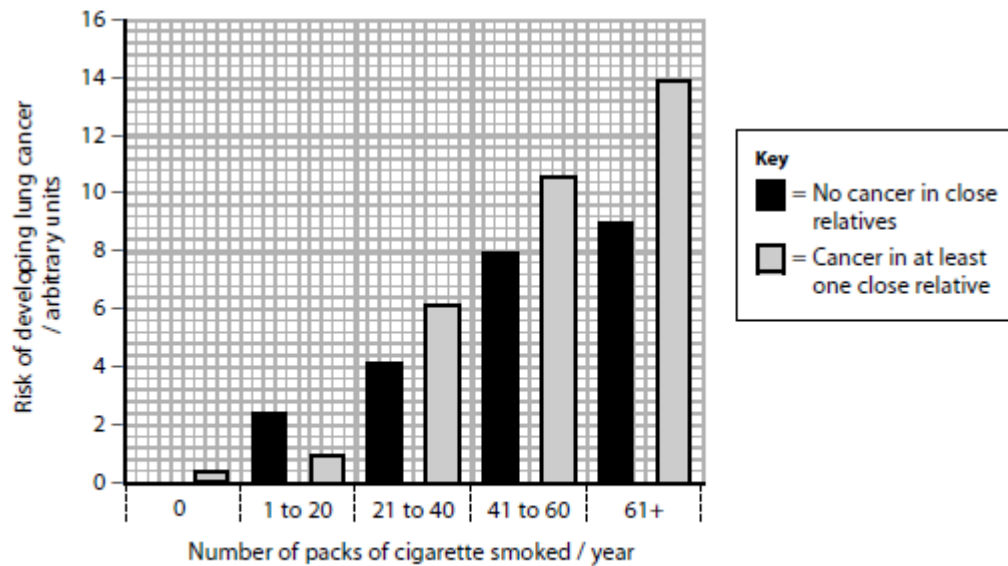
- (a) Explain what is meant by the term **phenotype**.

(2)

- (b) A survey was carried out to investigate the factors affecting the risk of developing lung cancer. In this survey, people were asked how many packs of cigarettes they smoked per year. They were also asked whether a close relative (a brother, sister or parent) had developed some form of cancer.

The results of the survey are shown in the graph below.

A risk of developing lung cancer of 0 arbitrary units means that there is no increased risk.



- (i) Identify the control group in this survey and suggest why they were included. (2)
- (ii) State the phenotype being investigated. (1)
- (iii) Describe the effect of smoking on the increased risk of developing lung cancer, for the people who had close relatives who developed cancer. (2)
- (iv) Use evidence from the graph to support the suggestion that genetic factors may influence the risk of developing lung cancer. (2)
- (v) Give **one** piece of evidence from the graph which suggests that genetic factors may **not** influence the risk of developing lung cancer. (1)
- (vi) Give **one** piece of evidence from the graph which suggests that external factors may influence the risk of developing lung cancer. (1)

5)

Organisms are adapted to their environment which increases their chances of survival.

- (a) Read through the following passage about adaptations to the environment. Write on the dotted lines the most appropriate word or words to complete the passage. (3)

The process of selection can lead to adaptation, survival and

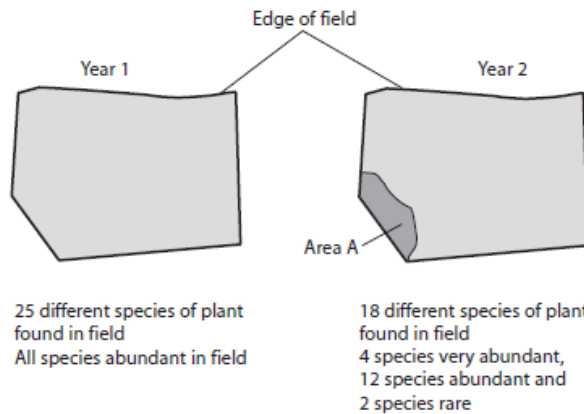
There are three types of adaptations to the environment: physiological, anatomical and

- (b) The table below describes some adaptations in humans. Complete the table by stating whether the adaptation is physiological or anatomical. (3)

Description	Adaptation
Hearing becoming temporarily less sensitive after listening to loud music for a few hours	
Heart beats faster when the hormone adrenaline is released	
People living in a cold climate have a shorter neck than people living in a hot, dry climate	

6)

A student studied one field in two different years.
She recorded some information, shown in the diagram below.



(a) Using the information in the diagram, suggest in which year the species richness was greater. Give a reason for your answer.

(2)

(ii) The genetic diversity of buttercup plants in the field is low.
Describe and explain why asexual reproduction results in low genetic diversity.

(2)

* (c) Another student noted that several species of plant did not grow as well in area A as they did in the rest of the field. He suggested this was due to a shortage of nitrate ions in the soil in this area.

The effect of varying nitrate ion concentration on the growth of one plant species can be investigated in a laboratory.

Describe how this investigation can be carried out to produce **reliable** results.

(5)

7)

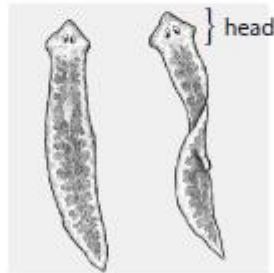
(a) Read through the following passage on the blood clotting process, then write on the dotted lines the most appropriate word or words to complete the passage.

(5)

The blood clotting process starts when cell fragments called
release molecules of These molecules
are which catalyse the conversion of
into , in the presence of calcium ions. As a result, fibrinogen
is converted into fibrin and blood cells are trapped to form the clot.

8)

Some species of flatworm are found in freshwater streams. Flatworms obtain oxygen from the water through the surface of their bodies. The diagram below shows the structure of flatworms.



Flatworms

Magnification $\times 10$

(a) Using the diagram and your knowledge of gas exchange surfaces, explain how the structure of a flatworm is adapted to obtain oxygen from the water.

(2)

(b) The table below shows the relationship between the temperature of water and the solubility of oxygen in water.

Temperature of water / °C	Solubility of oxygen in water / mg dm ⁻³
0	14.6
5	12.8
10	11.3
15	10.2
20	9.2
25	8.6
30	7.5
35	6.9
40	6.4

(i) Describe the relationship between the temperature of the water and the solubility of oxygen in water.

(2)

(ii) Using the information in the table and your knowledge of gas exchange and enzymes, suggest why flatworms are often found in water at a temperature of about 15 °C .

(3)

(c) Flatworms do not have a heart or a circulatory system.

Explain why many animals need a heart and a circulatory system.

(4)