GCSE Biology A (Gateway)

J247/01 B1-B3 and B7 Foundation (Foundation Tier)

Question Set 16

1

Students investigate how to extract DNA from peas.

Stage 1:

- Chill 10 cm^3 of ethanol. Keep it on ice throughout the method for use in stage 2.
- Make a thick 'soup' by blending 100 cm^3 of peas with salt and cold water. Blend for 15 seconds in an electric blender.
- Strain the 'soup' through a mesh strainer and collect the liquid part in a beaker.
- Add 30 cm^3 of washing-up liquid and swirl to mix.
- Let the mixture settle for 5–10 minutes in a water bath at 60 °C.

(a) One group of students made a water bath using a beaker of water, thermometer and Bunsen burner. Another group used an electric water bath. Write down **two** advantages of using an electric water bath.

1 Easier to control temperature.

2 There is a limited fire risk.

[2]

(b) Low temperatures protect DNA by slowing down the activity of enzymes that destroy DNA. High temperatures break down membranes in the cell.

To extract DNA, some methods use a water bath at 60 °C but other methods do not use an increased temperature.

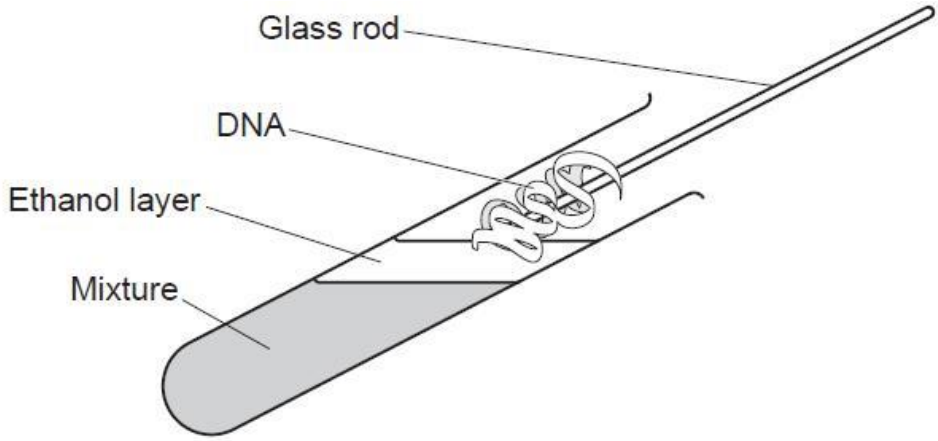
Suggest **two** reasons for the different methods.

[2]

Reason for using 60°C and other higher temperatures is that the membrane breaks down releasing more DNA so DNA is extracted easily.

Reason against 60°C and higher temperatures is the increased risk of DNA breaking down. So more DNA is lost at 60°C and other high temperatures.

Stage 2 isolates the DNA.



- Pour the mixture collected from stage **1** into a test tube until a third full. Add protease enzymes to the test tube.
- Slowly pour cold ethanol at an angle of 45° into the tube. Ethanol will float on top.
- DNA is soluble in water, but salted DNA does not dissolve in ethanol and will form white clumps where the water and ethanol layers meet.
- Twirl a glass rod and the DNA will collect on the rod.
- Dry the sample on a pre-weighed filter paper and measure the mass of product.

(c)

Suggest **two** safety precautions which should be taken at stage **2**.

Explain why each safety precaution is needed.

1 Safety precaution: Wear goggles

Explanation: To prevent chemicals entering eyes.

2 Safety precaution: Wear gloves

Explanation: To prevent chemicals touching skin.

[2]

(d) Look at the table. It shows the results from the two groups of students in the investigation.

Type of water bath used	Mass of DNA collected (mg)			
	Test 1	Test 2	Test 3	Mean
Beaker of water and Bunsen burner				22.9
Electric	33.6	32.3	33.3	.....

(i) Calculate the mean mass collected in the investigation using the electric water bath.

Give your answer to **1** decimal place.

$\frac{33.6 + 32.3 + 33.3}{3} = 33.1$

Answer = 33.1 mg **[2]**

(d) (ii) The range of the three test readings for the beaker of water and Bunsen burner was 3.4.

Does the evidence support using an electric water bath instead of a beaker of water and Bunsen burner?

Explain your answer. **[2]**

Yes because a greater yield of DNA was produced and there is less variation in the results.

Total Marks for Question Set 16: 10