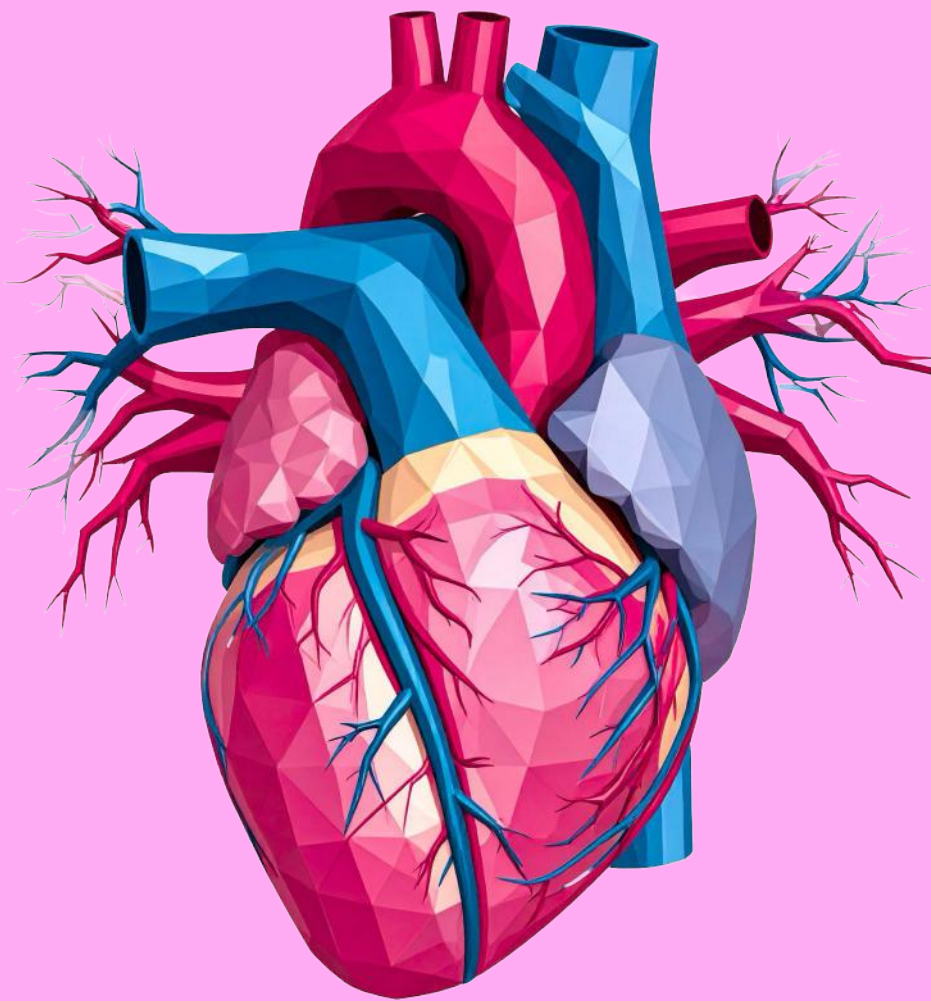


edexcel 

**AS**

**Biology**



**Unit 3**  
**Topical Questions**

# Edexcel IAL Biology - Unit 3 (WBI13/01)

## Past-Paper QUESTIONS by Topic

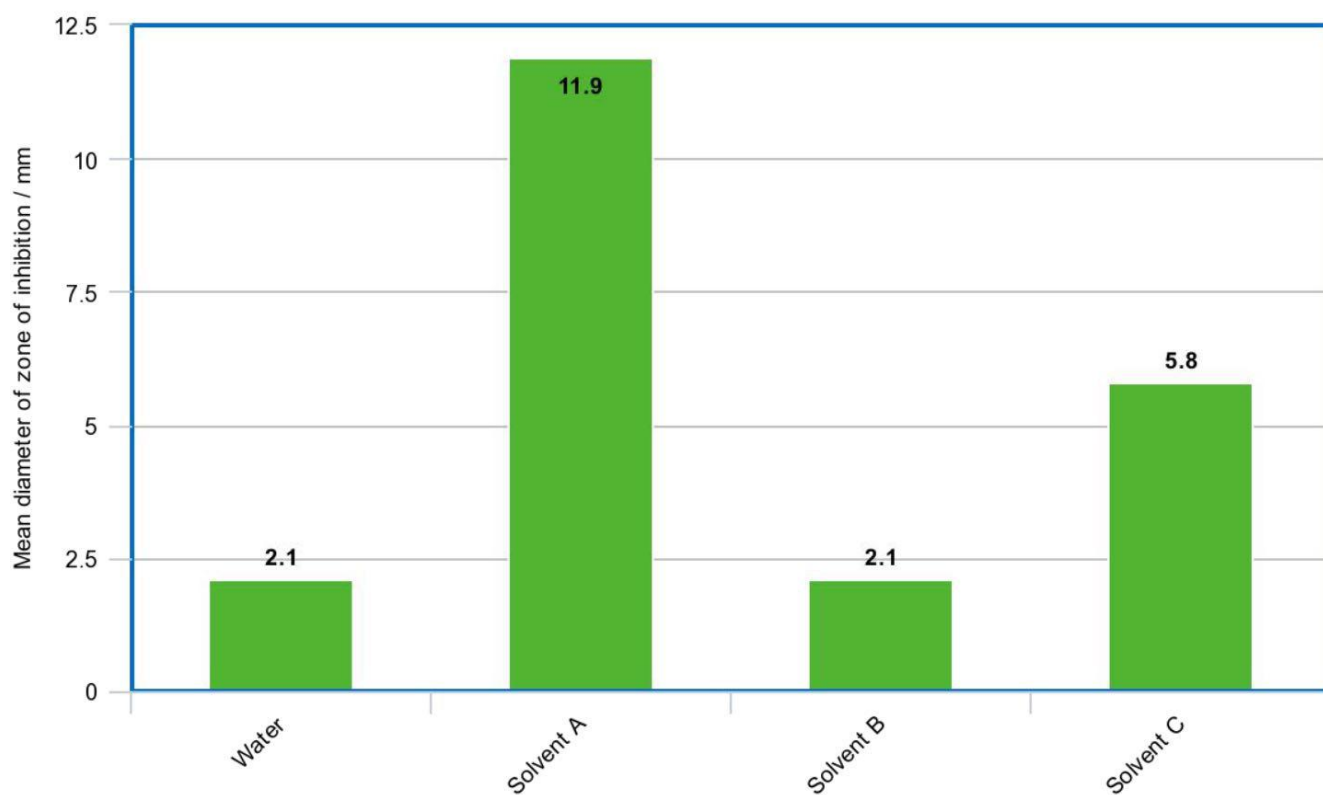
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| 5. Animal-cell microscopy             | 3 questions  |
| 6. Root-tip squash                    | 5 questions  |
| 7. Plant-tissue microscopy            | 2 questions  |
| 8. Plant-fibre tensile strength       | 4 questions  |
| 9. Antimicrobial properties of plants | 6 questions  |
| 10. Other practicals                  | 16 questions |

- (i) Plot the information about the solvent used to prepare the extract and the mean diameter of the zone of inhibition in a suitable graphical form.

(4)



**Examiner's insight**

Cover both variables - higher temperature and longer time both lower the protein, but use your gradient to note the 5-day line falls more steeply, and that at 37 °C the two times converge.

**● 3 (b)(iv)**

Devise · [6 marks]

The process preserves the feed because it kills bacteria (via heating time, temperature and added acid). Devise a procedure to safely compare the effect of acid on bacteria.

**Model answer**

✓ Grow a named, non-pathogenic bacterium on nutrient agar (or in broth). ✓ Add the acid over a range of pH values - e.g. on filter-paper discs, in wells, or added to the broth - with a water / neutral pH control. ✓ Incubate all plates at the same suitable temperature for the same set time. ✓ Assess bacterial growth in a measurable way - e.g. measure the zone of inhibition or the turbidity. ✓ Work aseptically for safety - flame the loop, lift the lid only partially, disinfect the bench. ✓ Wear gloves and goggles because of the acid, and incubate at a safe temperature.

**Mark scheme** any six · 6 marks

- ✓ make a (nutrient) agar plate / broth with the bacterium (1)
- ✓ use a named / non-pathogenic bacterium (1)
- ✓ describe how the acid is applied (disc / well / broth) (1)
- ✓ use a water control / a range of pH (1)
- ✓ incubate at the same suitable temperature (1)
- ✓ incubate for the same suitable time (1)
- ✓ a method of assessing bacterial growth (zone of inhibition / turbidity) (1)
- ✓ an example of aseptic technique + safety with the acid (gloves / goggles / safe incubation temperature) (1)

**Examiner's insight**

A full aseptic plan worth six marks - a safe named bacterium, a pH range with a control, matched incubation temperature and time, a measurable growth outcome, and aseptic technique plus acid safety.

**June 2025 · Question 3 · Starch testing in cassava****● 3 (a)(i)**

Describe · [3 marks]

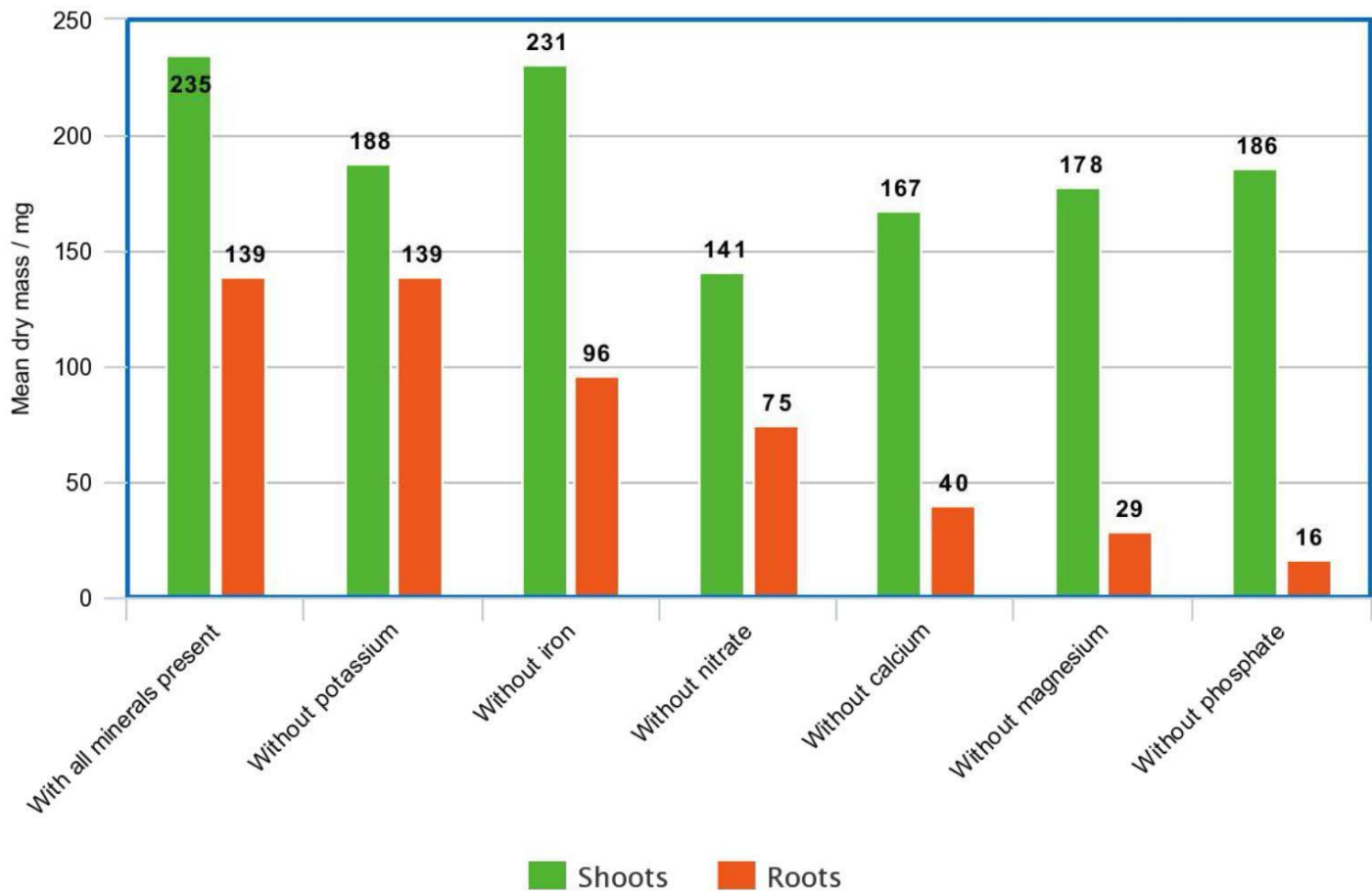
Cassava roots have a high starch content. Describe the structure of starch.

**Model answer**

✓ Starch is a polymer of alpha-glucose molecules joined by glycosidic bonds. ✓ It is a

- (a) (i) Plot the data from the table, in a suitable graphical form, to compare the mean dry masses of shoots and roots in each of the solutions.

(4)

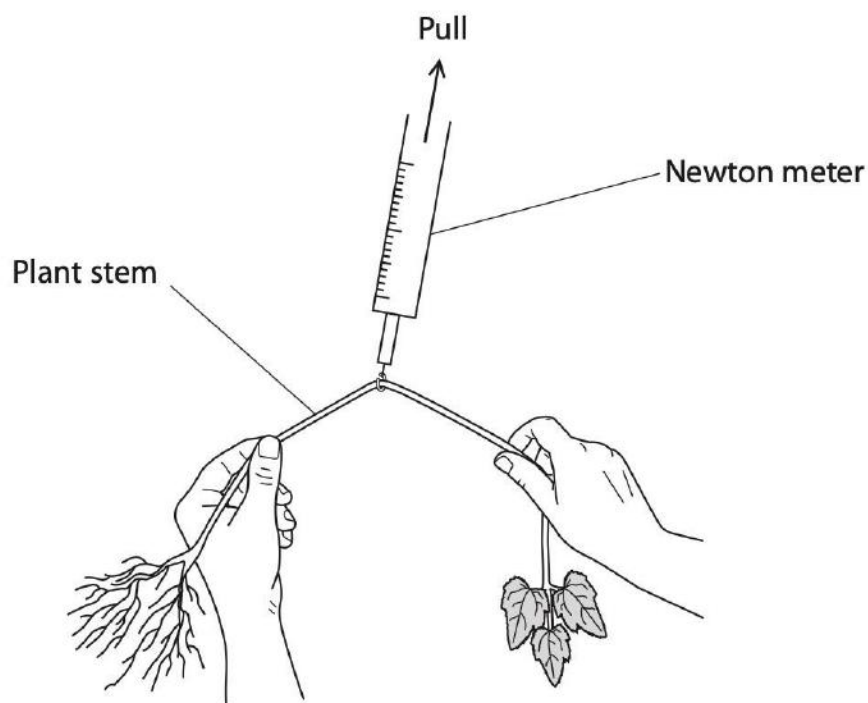


- 4 Plants living in rivers and lakes experience pulling forces from water currents and waves. These forces may damage or destroy the plants and it is important to know what forces they can withstand.

Scientists investigated the force needed to break a plant stem. This force is called the breaking strength.

In one series of experiments, they investigated the relationship between the cross-sectional area of stems and the forces needed to break them.

These forces were measured with a newton meter, as shown in the diagram below. The meter was pulled until each stem broke and the forces were recorded.



- (a) (i) Name the dependent variable in this experiment.

(1)

**breaking strength**

- (ii) Assuming that the stem is circular, suggest how stem cross-sectional area could be determined accurately.

(2)

- 1. measure diameter with a micrometer**
- 2. calculate the surface area:  $\pi r^2$**

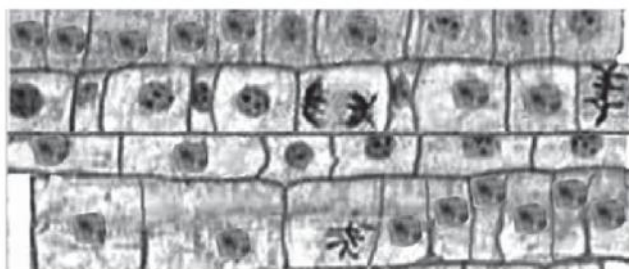
**Examiner's insight**

Keep the units in the heading, not the table body, and read each pH/mitotic-index pair carefully from the graph.

**● 2 (c)(ii)**

Calculate · [3 marks]

The photograph shows 35 cells from a root tip at one of the pH values investigated. Calculate the mitotic index of this root tip, and use the graph to determine the pH at which it was grown.

**Model answer**

✓ Count the cells in **mitosis** in the photograph: 3 out of the 35 cells. ✓ Mitotic index =  $(3 \div 35) \times 100 = 8.6\%$  (8.57%). ✓ Reading this value off the graph gives pH ~ 5.7 (or 6.9 - the curve reaches 8.6% at two pH values).

**Mark scheme** 3 marks

- ✓ number of cells in mitosis identified (1)
- ✓ mitotic index calculated  $(3 \div 35 \times 100 = 8.6\%)$  (1)
- ✓ corresponding pH read from the graph (5.7 and/or 6.9) (1)

**Ignore:** a correct answer with no working gains two marks; pH  $\pm 0.05$ ; a correct reading of any MI answer

**Examiner's insight**

Count the dividing cells, work out the index, then read the pH back off your graph - either 5.7 or 6.9 is accepted.

**● 2 (c)(iii)**

Explain · [4 marks]

Explain why the mitotic index is affected by pH, as shown by the graph.

**Model answer**

✓ The reactions of the **cell cycle** are controlled by enzymes, which are proteins. ✓ pH 6.2 is the optimum for these enzymes, giving the highest mitotic index. ✓ Above or below the optimum the active site changes shape (the enzyme begins to denature as the bonds holding its shape are disrupted), ✓ so fewer enzyme-substrate complexes form and the mitotic index falls.

**Mark scheme** any four · 4 marks

- (iii) Give **two** variables to be controlled in this investigation. Describe how they could be controlled.

(4)

Variable 1 **length of fibre** **Humidity** **Temperature**

How it could be controlled **using an accurate ruler**

**a closed chamber with a baker containing 25 cm<sup>3</sup> of water**

**thermostatically controlled chamber**

Variable 2 **Cross-sectional area** **soaking time** **same species / age**

How it could be controlled **using a micrometer**

**use a stopclock to ensure that fibres are soaked for the same time**

**obtain all fibres from the same plant**

- (b) (i) The results of an investigation using sisal fibres are shown in the table below  
(1 MPa = 1 million pascals).

| <b>Sodium hydroxide concentration (%)</b> | <b>Mean tensile strength / MPa</b> |
|-------------------------------------------|------------------------------------|
| 0.00                                      | 395                                |
| 0.04                                      | 425                                |
| 0.08                                      | 540                                |
| 0.16                                      | 820                                |
| 0.24                                      | 590                                |
| 0.32                                      | 620                                |

Fig. 1.2 is a photomicrograph showing part of an organ from a plant of a different species.

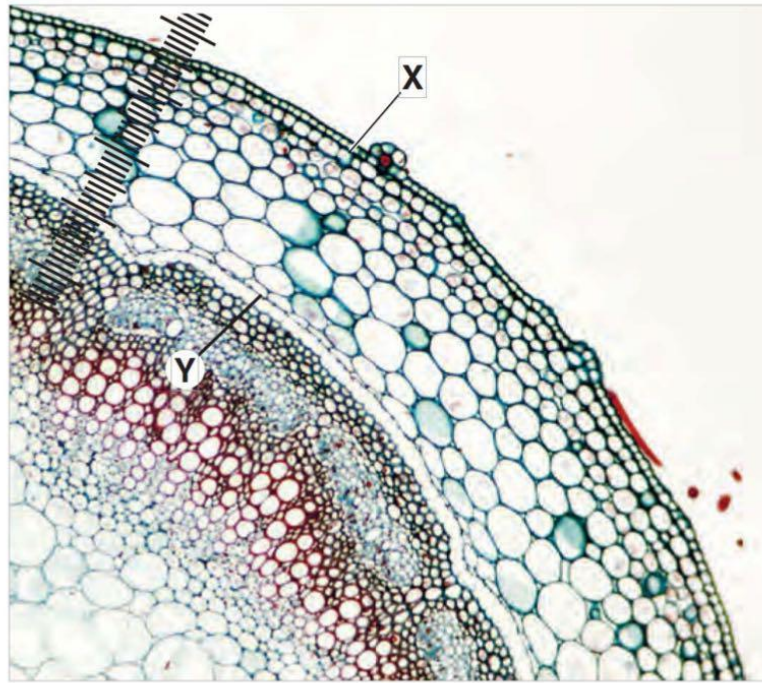


**Fig. 1.2**

- (ii) Fig. 1.2 shows a photomicrograph taken using the same microscope with the same lenses as Fig. 1.2.

Use the calibration of the eyepiece graticule unit from (b)(i) and Fig. 1.2 to calculate the actual length of the plant tissue from X to Y.

**22 / 23 / 24 unit**

**24 x 12.5**

**300  $\mu\text{m}$**

| Variety of potato | Mass of resistant starch in 100 g of potato after cooking / g |               |               |               |
|-------------------|---------------------------------------------------------------|---------------|---------------|---------------|
|                   | Baked                                                         |               | Fried         |               |
|                   | Hot                                                           | Cold          | Hot           | Cold          |
| Red Norland       | $3.8 \pm 0.6$                                                 | $4.8 \pm 0.7$ | $2.5 \pm 0.6$ | $3.1 \pm 0.2$ |
| Russet Burbank    | $3.5 \pm 0.2$                                                 | $4.7 \pm 0.5$ | $2.6 \pm 0.4$ | $3.8 \pm 0.2$ |
| Yukon Gold        | $3.5 \pm 0.4$                                                 | $5.4 \pm 0.5$ | $2.3 \pm 0.8$ | $3.9 \pm 0.3$ |

Justify **two** conclusions that can be made from the results shown in this table.

(4)

Conclusion 1

Model answer

✓ **Conclusion 1:** baking gives significantly more resistant starch than frying - justified because the standard deviations do not overlap in any of the cases. ✓ **Conclusion 2:** potatoes served cold have significantly more resistant starch than those served hot - justified because their standard deviations do not overlap (in all but one case). ✓ (There is no significant difference between the three varieties, because their standard deviations overlap in every case.)

**Mark scheme** any two conclusions with justifications · 4 marks

- ✓ variety: no significant difference between varieties - because the SDs overlap (1)
- ✓ cooking: baking gives significantly more resistant starch than frying - because the SDs do not overlap (1)
- ✓ temperature: served cold gives significantly more than served hot - because the SDs do not overlap (1)

**Ignore:** explanations speculating about the cooking chemistry (not supported by the data)

**Examiner's insight**

Justify each conclusion using the standard deviations (do they overlap or not?), not by speculating about what heating does - that was the mark most people missed.

### ● 2 (c)(i)

Describe · [3 marks]

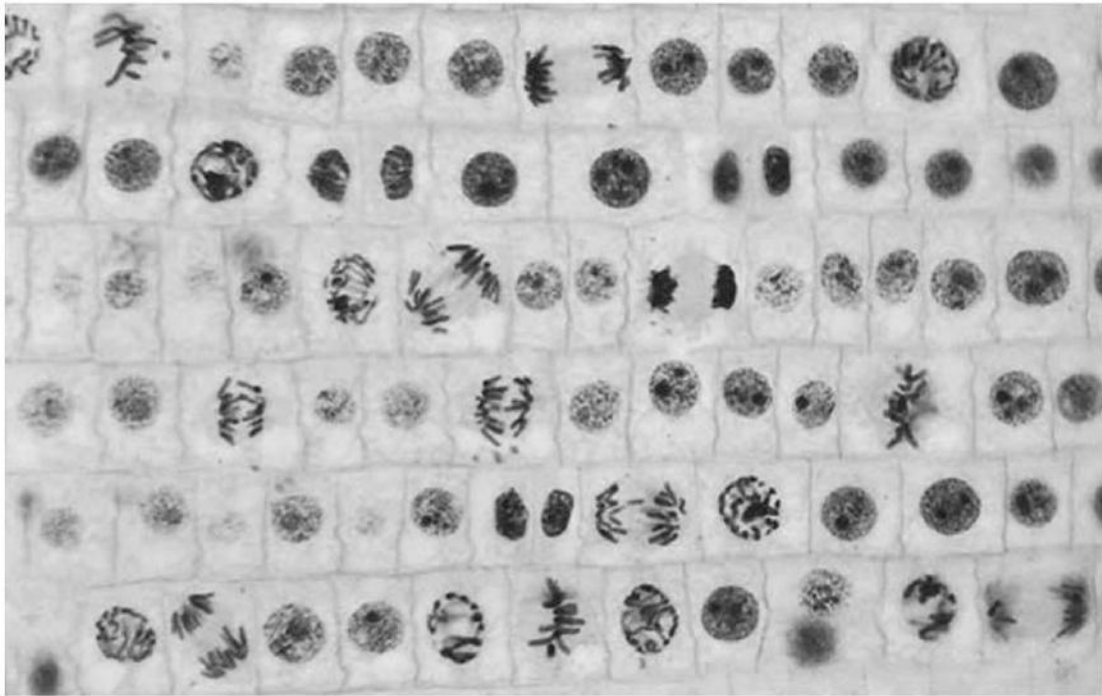
Fats contain triglyceride molecules. Describe how a triglyceride molecule is made from its component molecules.

Model answer

✓ Three fatty acids join to one glycerol molecule, ✓ by **condensation** reactions, ✓ forming three ester bonds (and releasing water).

**Mark scheme** 3 marks

**10** The photomicrograph below shows a stained squash preparation of an onion root tip.



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(a) Describe how you would prepare a root tip squash to observe the stages of mitosis under the light microscope.

(4)

**Treat roots with HCl to break cell wall**

**Remove 2mm of the tip and place on a slide**

**Add acetic orcein and heat gently**

**Then add cover slip and press firmly and vertically**

- (ii) Use the information in the table to calculate the mean rate of decrease of vitamin C per day during storage.

Show your working.

(3)

$$\text{Mean decrease: } 14.3 - 7.7 = 6.6$$

$$\text{Number of days: } 7 \times 8 = 56$$

$$6.6 / 56$$

Answer  $0.12 / 0.118 / 0.1179$  mg per 100g per day

- (iii) The fresh pineapple contained 24.8 mg of vitamin C per 100 g.

Use the information in the table to calculate the percentage decrease of vitamin C when jam is made.

Show your working.

(3)

$$24.8 - 14.3 = 10.5$$

$$10.5 / 24.8 \times 100 = 42.3$$

Answer  $42.3 / 42$  %

**Examiner's insight**

Most knew the free-radical link. The commonest error was saying vitamin C prevents free radicals from being produced, rather than reducing/neutralising the ones already present.

**1 (b)(i)**

Describe · [5 marks]

The effect of storage time and temperature on the vitamin C content of four foods was investigated. Describe a method to allow a quantitative comparison of the vitamin C content of two of these foods.

**Model answer**

✓ Use equal (controlled) masses of the two foods, and the same extraction method (e.g. macerate with the same volume of distilled water and filter the same way). ✓ Measure out the same volume of DCPIP solution into each tube. ✓ Add the food extract dropwise until the blue DCPIP just goes colourless (the end-point). ✓ Record the volume (or number of drops) of extract needed. ✓ Convert to vitamin C content by calibrating DCPIP against a known vitamin C standard – e.g. vitamin C concentration = (volume of standard vitamin C ÷ volume of food extract added) – so the two foods can be compared quantitatively.

**Mark scheme** 5 marks (6 scoring points, max 5)**accept stated detail e.g. same volume of distilled water / same filtering method**

- ✓ use {equal / controlled} masses of the foods (1)
- ✓ use a {standard / same} extraction method (1)
- ✓ measure out {equal / same} volume of DCPIP solution (1)
- ✓ add food extract dropwise until {no colour remains / blue to colourless} (1)
- ✓ record {volume / number of drops} used (1)
- ✓ explain how to calculate vitamin C content / calibrate DCPIP with a known vitamin C concentration (1)

**Ignore:** ignore colorimeter / colour charts here**Examiner's insight**

A five-mark method needs specific detail at every stage. Because the question asks for a valid COMPARISON, the same mass of food and same volume of water were often missed. Few clearly said how the test results give the actual vitamin C content.

**1 (b)(ii)**

State · [1 mark]

State the independent variable in this investigation.

**Model answer**

✓ The type of food / fruit. (Storage time and storage temperature were also varied.)

**Mark scheme** 1 mark**allow (storage) time / (storage) temperature**

(ii) Suggest how the **dependent** variable could have been measured.

(3)

samples of the liquid around the discs were removed  
Intensity of colour is measured  
using a colorimeter by measuring absorbance / transmission

(iii) The temperature was kept constant throughout this investigation. Suggest a suitable value for this temperature. Give a reason for your answer.

(2)

25 oC

Temperature does affect permeability of biological membranes

(iv) Suggest a suitable control for this investigation.

(2)

Discs put in water (without fenitrothion)  
while keeping all other conditions identical

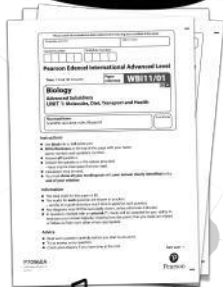
(b) The table below shows the colour of the solution every hour.

| Time<br>/ hours | Colour of the solution<br>/ arbitrary units |
|-----------------|---------------------------------------------|
| 0.0             | 0.00                                        |
| 1.0             | 0.00                                        |
| 2.0             | 0.00                                        |
| 3.0             | 0.03                                        |
| 4.0             | 0.05                                        |
| 5.0             | 0.10                                        |
| 6.0             | 0.12                                        |

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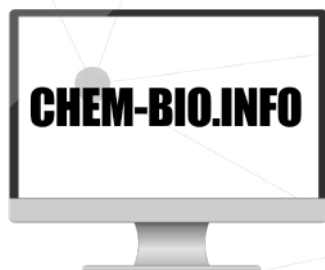


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