Food Tests, Membranes, Enzymes and DNA (Specified Practicals): Eduqas A Level Biology Exam Questions

22 questions · 43 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

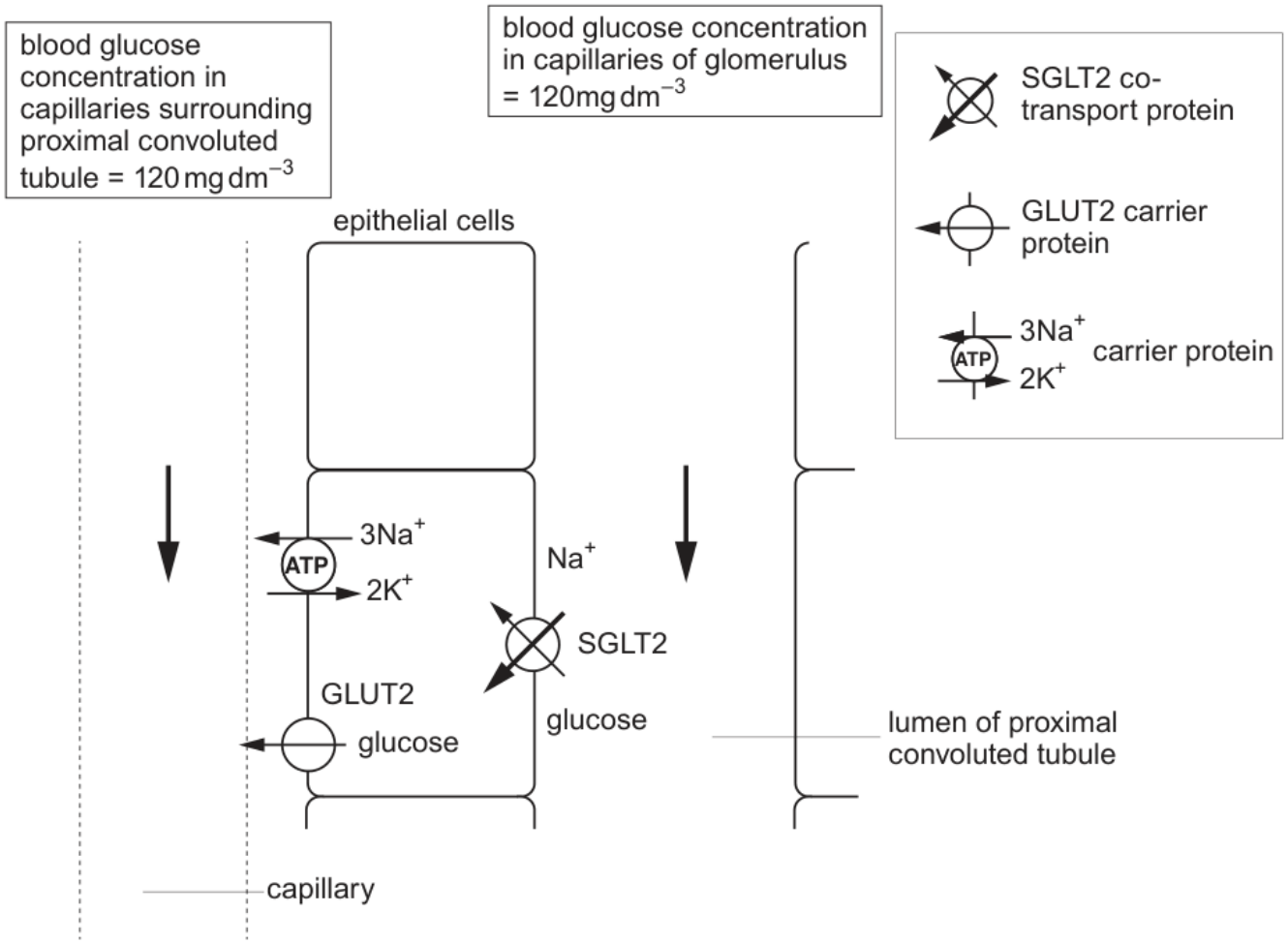
Question 1 · A level Component 3 · Autumn 2020 · Q5(a)(ii) · 3 marks

(ii) The fluid collected contains sucrose. Describe a chemical test that the scientist could use to confirm that it was **sucrose** present in the fluid collected from the phloem and **not glucose**. [3]

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4. Type 2 diabetes affects nearly three million adults in the UK and is particularly prevalent in obese people. Under normal conditions, almost all of the filtered glucose is reabsorbed and returned to the circulation in the proximal convoluted tubule of the nephron but in people with type 2 diabetes, glucose starts to appear in the urine when blood glucose concentration exceeds 180 – 200 mg dm^{-3}.

The diagram below shows how glucose is reabsorbed in the first part of the proximal convoluted tubule.



(a) (i) Describe a biochemical test that could demonstrate the presence of glucose in urine and explain why this test can only provide semi-quantitative results. [3]

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Question 3 · A level Component 2 · June 2024 · Q5(a)(ii) · 1 mark

(ii) Describe a chemical test to show the presence of protein in the elaiosome. [1]

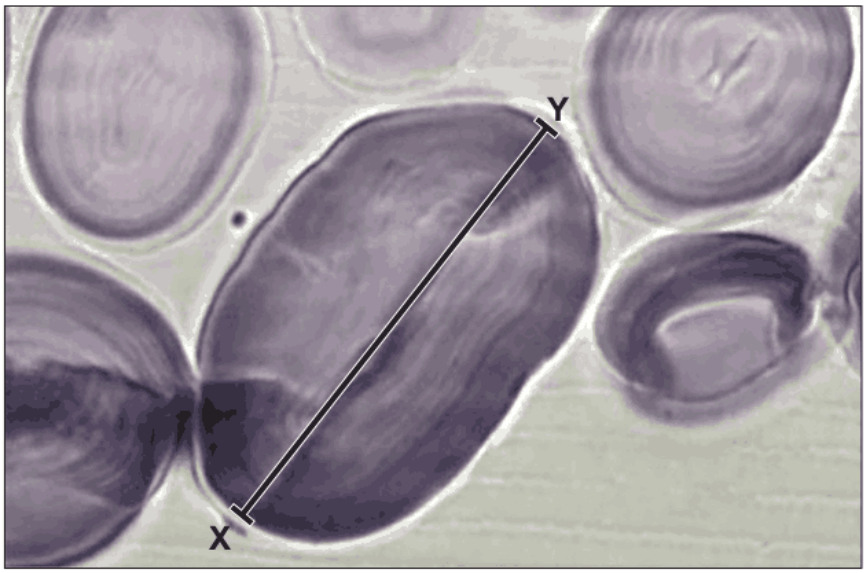
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Question 4 · A level Component 3 · Autumn 2021 · Q1(c)(ii) · 1 mark

Image 1.3 shows starch grains in a plant cell.

Image 1.3



(ii) Starch grains are normally transparent, but can be treated to become visible under the microscope. Suggest why these starch grains appear to be blue. [1]

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Question 5 · AS Component 1 · Autumn 2020 · Q1(a)(iv) · 2 marks

(iv) Describe a test which could be performed to detect the presence of triglyceride in a sample. [2]

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Question 6 · AS Component 1 · June 2022 · Q2(a)(i) · 2 marks

2. An investigation was carried out to determine the water potential of potato tissue using the following method.

1. Cut four cylinders of potato tissue, each approximately 50 mm long.
2. Place 30 cm^3 distilled water and three different concentrations of sodium chloride (NaCl) solution into four different boiling tubes.
3. Record the mass of each cylinder to the nearest 0.1 g.
4. Place one cylinder into each boiling tube.
5. Leave at room temperature for 45 minutes.
6. Gently blot and re-weigh the cylinders.

The results of the investigation are shown in **Table 2.1**.

Table 2.1

Concentration of NaCl / mol dm^{-3}	Initial mass of cylinder / g	Final mass of cylinder / g	Change in mass / g	Percentage change in mass
0.0	4.2	4.5	0.3	7.14
0.2	4.1	4.2	0.1	2.44
0.6	4.4	3.9	–0.5	–11.36
0.8	4.2	3.5	–0.7	.....

(a) (i) Calculate the percentage change in mass of the potato cylinder in the 0.8 mol dm^{-3} sodium chloride solution. **Write your answer in the table. Give your answer to two decimal places.** [2]

Question 7 · AS Component 1 · June 2022 · Q2(a)(iii) · 4 marks

(iii) **Use the results from Table 2.1 to plot a graph** showing how the percentage change in mass is affected by the concentration of sodium chloride solution. [4]

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Question 8 · AS Component 1 · June 2022 · Q2(a)(vi) · 2 marks

(vi) With reference to the method given, suggest and explain how confidence in the data collected could be improved. [2]

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Question 9 · AS Component 1 · June 2019 · Q6(b)(i) · 1 mark

(b) Water passes from one plant cell to another down a water potential gradient.
Water potential is affected by two opposing forces, pressure potential (ψ_p) and solute potential (ψ_s).

$$\psi_{cell} = \psi_p + \psi_s$$

A practical was carried out to determine the water potential of red onion cells by placing red onion tissue in different concentrations of sucrose solution and observing them under a microscope. The total number of cells in the field of view was counted together with the number of plasmolysed cells. The percentage of plasmolysed cells was then calculated for each concentration of sucrose solution.

The results are shown in the table.

Concentration of sucrose solution / mol dm^{-3}	Solute potential / kPa	Plasmolysed cells / %
0.1	−269	2
0.2	−526	12
0.3	−790	18
0.4	−1052	36
0.5	−1322	56
0.6	−1596	70
0.7	−1882	81
0.8	−2180	98
0.9	−2580	100

(i) Explain why the water potential of the cell can be assumed to be equal to the solute potential of the solution that causes 50 % plasmolysis. [1]

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Question 10 · AS Component 1 · June 2019 · Q6(b)(ii) · 1 mark

(ii) Use the results in the table to estimate a value for the water potential of the onion tissue. [1]

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Question 11 · AS Component 1 · June 2019 · Q6(b)(iii) · 2 marks

(iii) Outline how the data in the table could be used to determine a more accurate estimate of the onion tissue water potential. [2]

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Question 12 · AS Component 1 · June 2023 · Q3(d)(ii) · 1 mark

The results of the investigation are shown in **Table 3.6**.

Table 3.6

NaCl concentration /%	Absorbance of betalain solution / au			
	Trial 1	Trial 2	Trial 3	Mean
0.1	0.49	0.52	0.48	0.50
0.2	0.26	0.26	0.27	0.26
0.3	0.14	0.20	0.15	.....
0.4	0.09	0.10	0.08	0.09
0.5	0.03	0.01	0.03	0.02

(ii) Calculate the mean absorbance for 0.3% NaCl solution. **Write your answer in Table 3.6**. [1]

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Question 13 · information from earlier in the question

(d) The effect of sodium chloride concentration on membrane structure was studied using beetroot cells. Beetroot cells contain a red pigment called betalain which is released when the membrane structure is disrupted. A temperature of 30 °C disrupts the membrane structure and allows the pigment to escape from the cell.

The method used to study the membrane structure is shown below:

Method

- Samples of beetroot were added to test tubes containing a range of sodium chloride solutions.
- They were left for five minutes at 30 °C.
- A sample of the liquid was then placed in a cuvette.
- The absorbance of light was recorded using a colorimeter.

Question 13 · AS Component 1 · June 2023 · Q3(d)(v) · 2 marks

(v) Suggest how the method could be modified to investigate the effect of temperature on membrane stability. [2]

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3. Some bacteria produce a protease which breaks down milk protein. When the enzyme is added to milk the milk gradually becomes clear as the protein in milk is broken down.
A student investigated the effect of temperature on this protease using the following method.

- Set up five water baths in beakers using ice, hot and cold water at the following approximate temperatures; 10 °C, 20 °C, 30 °C, 40 °C, 50 °C.
- Record the actual temperature of the water baths.
- Add 10 cm^3 of milk to one test tube.
- Add 1 cm^3 of protease at pH 7 to a separate test tube.
- Place both test tubes in the first water bath for five minutes.
- Pour the milk into the protease.
- Record the time taken for the milk to become clear.
- Repeat for the other temperatures.

The results the student obtained are shown in **table 3.1**.

Table 3.1

Actual temperature of water bath / °C	Time taken for the milk to become clear / seconds			
	Trial 1	Trial 2	Trial 3	Mean
8	56	49	54	53
18	31	34	28	31
32	28	34	27	30
42	21	17	21	20
54	45	36	34	38

(a) (i) State **two** *other* variables that should have been controlled during this investigation. [2]

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Question 15 · AS Component 1 · Autumn 2020 · Q3(a)(ii) · 4 marks

(ii) Identify **two** sources of inaccuracy in this experimental method **and** describe how accuracy could be improved in each case. [4]

Question 16 · information from earlier in the question

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Question 16 · AS Component 1 · Autumn 2020 · Q3(b)(ii) · 4 marks

(ii) Describe and explain the results of the experiment. [4]

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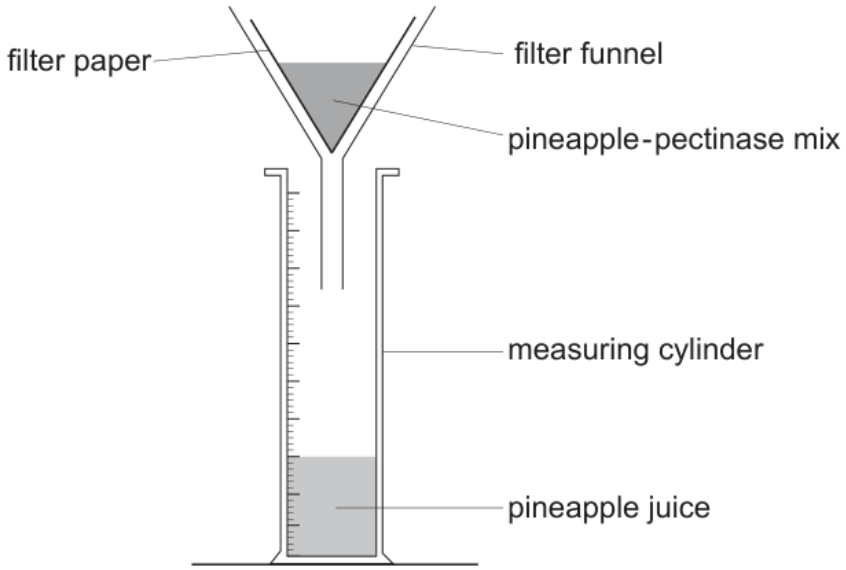
Question 17 · AS Component 1 · June 2024 · Q3(b)(i) · 1 mark

(b) In the production of pineapple juice, pineapple pulp can be treated with pectinase, an enzyme which breaks down pectin in the cell wall. This releases more juice from the cells.

An investigation was carried out to show the effect of the concentration of pectinase on the breakdown of pectin. A brief method is given below. Some of the apparatus is shown in **Image 3.2**.

- Pineapple tissue was mashed to form a pulp.
- 5 cm^3 of 0.2% pectinase was added to the pulp and stirred for 10 seconds.
- The pineapple-pectinase mix was placed in a water bath at 25 °C for 1 hour.
- The mixture was then filtered and the volume of juice recorded.
- The experiment was repeated with a range of pectinase concentrations.

Image 3.2



(i) State the independent and dependent variables in this experiment. [1]

Independent variable: .....

Dependent variable: .....

Question 18 · AS Component 1 · June 2024 · Q3(b)(ii) · 2 marks

(ii) Suggest **two** variables which were **not** controlled. [2]

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Question 19 · information from earlier in the question

3. Many plants, especially those which have been selectively bred to produce food for humans are polyploid, with several complete sets of chromosomes. For example, wild strawberries, are 2n = 14 but those grown commercially are octoploid, with eight sets of chromosomes.

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 19 · A level Component 2 · Autumn 2020 · Q3(b)(i) · 1 mark

Strawberries are often used as a source of DNA for extraction in a school laboratory. The following method was used to extract DNA from a strawberry.

1. Place a strawberry in a sealable plastic bag and crush.
2. Add 10 cm^3 of a mixture containing 1 cm^3 of detergent (pH 9), 0.1 g of salt and 10 cm^3 of water to the bag and mix thoroughly with the crushed strawberry.
3. Place the bag containing the strawberry mixture in a water bath at 60 °C for 15 minutes.
4. Cool the contents by placing the bag in a water bath of iced water.
5. Filter the mixture through a coffee filter paper into a clean beaker. Keep the filtrate.
6. Place 10 cm^3 of the filtrate in a boiling tube and add 2–3 drops of a protease enzyme and mix. Leave for 2 minutes.
7. Carefully pour ice-cold ethanol down the side of the tube to form a layer 1 cm deep on top of the filtrate. Let it stand for 3–4 minutes.
8. DNA precipitates into the ethanol. It should look cloudy. Using a glass rod, gently lift out some of the DNA.

(b) (i) Using **only** the information given, suggest why strawberries are often used as a source of DNA for extraction in a school setting. [1]

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Question 20 · A level Component 2 · Autumn 2020 · Q3(b)(ii) · 1 mark

(ii) Coffee filter paper has a pore size of approximately 20 µm. Suggest why coffee filter paper is used rather than Grade 1 laboratory filter paper with a pore size of 11 µm. [1]

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Question 21 · information from earlier in the question

2. Students carried out an investigation to determine how amylase activity in barley seeds changes during germination. The method followed is outlined below.

1. 100 barley seeds were soaked in 50 cm^3 of distilled water for 24 hours. They were then removed from the water and allowed to germinate.
2. After one day of germination, 10 of the barley seeds were homogenised in 5 cm^3 of distilled water.
3. Three discs of filter paper were soaked in the barley seed extract and placed on the surface of a starch agar plate.
4. The plate was incubated for 24 hours at 25 °C.
5. The paper discs were removed and the surface of the agar covered with iodine / potassium iodide solution.
6. The maximum diameter of the clear area around each disc was measured and the mean diameter calculated.
7. Steps 2 to 6 were repeated for barley seeds after 2, 4, 5, 8, 9 and 10 days of germination.

Question 21 · A level Component 2 · June 2022 · Q2(a)(ii) · 2 marks

(ii) Explain why it was important that the same concentration of agar and the same concentration of starch were used in all Petri dishes. [2]

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(b) A scientist investigated the germination of barley grains.

The scientist used three barley grains. The grains were treated in one of three ways.

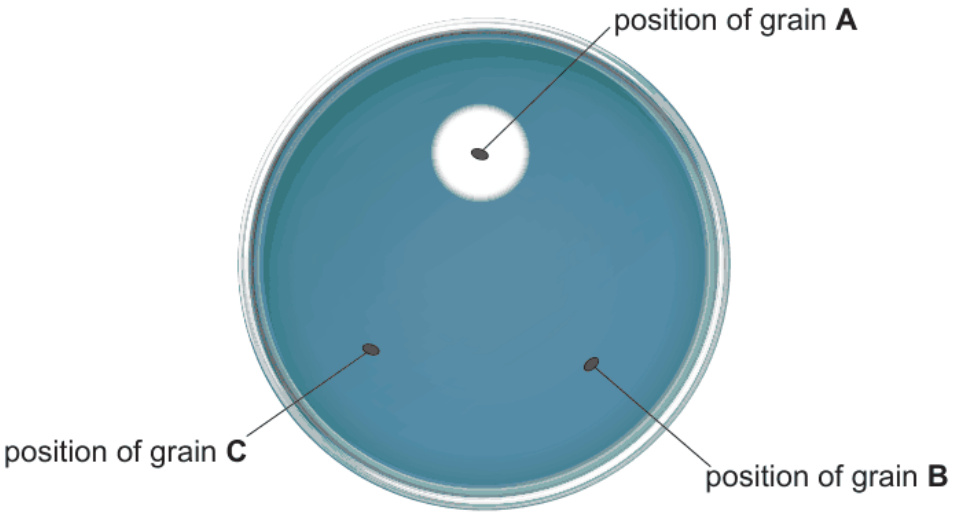
Grain A was soaked in water at 20 °C for 24 hours.

Grain B was boiled for 10 minutes and soaked in water at 20 °C for 24 hours.

Grain C was left dry.

The grains were then cut in half and placed cut surface downwards onto a starch agar medium in a Petri dish. The grains were left for 12 hours and removed. The dish was then flooded with iodine solution. The results are shown in **Image 4.2**.

Image 4.2



(i) A sharp scalpel was used to cut the grains in half. There is a risk of cutting fingers when using a scalpel to cut the grains.

State **one** way of reducing the risk when carrying out this procedure. [1]

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Mark schemes

Question 1 · A level Component 3 · Autumn 2020 · Q5(a)(ii) · 3 marks

(ii)	Benedict's test is negative (1) then add acid, heat then add alkali then Benedict's (1) turns from blue to orange/ brick red (1)	3	3	3

Question 2 · A level Component 3 · June 2017 · Q4(a)(i) · 3 marks

4	(a)	(i)	• add Benedict's and{boil / heat (to a high temperature)} / use {Clinistix/ test stick} (1) • colour change (from blue) to {green / brick red} demonstrates presence of glucose /suitable description of use of colour change chart for Clinistix (1) • colour change {indicates approximate values of glucose in urine only/ is subjective} (1)	2	1	3	3

Question 3 · A level Component 2 · June 2024 · Q5(a)(ii) · 1 mark

(ii)	Add Biuret AND turns (from blue to) {violet / purple / lilac} Accept copper sulfate + sodium hydroxide Reject heat	1		1	1

Question 4 · A level Component 3 · Autumn 2021 · Q1(c)(ii) · 1 mark

(ii)	Iodine (solution has been added)	1	1	1

Question 5 · AS Component 1 · Autumn 2020 · Q1(a)(iv) · 2 marks

(iv)	Mix sample with ethanol and water (1) If triglyceride is present a {milky/ white} {precipitate emulsion} will form (1) Accept Sudan III/ alternative	2	2	2

Question 6 · AS Component 1 · June 2022 · Q2(a)(i) · 2 marks

2	(a)	(i)	-16.67 or 16.66' **2 marks** Award 1 mark for -16.66666667 16.67 -0.7/4.2 x 100	2	2	2

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Question 7 · AS Component 1 · June 2022 · Q2(a)(iii) · 4 marks

(iii)		• Correct axes with appropriate linear scale using at least 6 large squares (1) • Fully labelled axes (NaCl concentration /mol dm^{-3} on x axis and Percentage change in mass / % on y axis) (1) • Correct plots (1) ±½ small square • Suitable Line – accept line of best fit (1)	4	4	4		

Question 8 · AS Component 1 · June 2022 · Q2(a)(vi) · 2 marks

(vi)		Repeats + calculate mean/ standard deviation (1) This increases reliability / allows anomalous results to be excluded/ reduces effect of anomalies (1)		2	2		2

Question 9 · AS Component 1 · June 2019 · Q6(b)(i) · 1 mark

(b)	(i)		At incipient plasmolysis pressure potential = 0 because cell membrane is just pulled away from cell wall (1)		1	1		

Question 10 · AS Component 1 · June 2019 · Q6(b)(ii) · 1 mark

(ii)	Between -1 053 and -1 321 (kPa) (1)	1	1	1	1	

Question 11 · AS Component 1 · June 2019 · Q6(b)(iii) · 2 marks

(iii)	plot, percentage plasmolysed against solute potential (of solution) / solute potential on X axis and % plasmolysed on Y axis (1) read down from 50% plasmolysed to solute potential (this is also the water potential) (1)	2	2	2	2	

Question 12 · AS Component 1 · June 2023 · Q3(d)(ii) · 1 mark

(ii)	0.16 (1)	1	1	1		

Question 13 · AS Component 1 · June 2023 · Q3(d)(v) · 2 marks

(v)	Range of temperatures (1) Same NaCl concentration (1) NOT pure water, looking for reference to NaCl concentration e.g. 0% NaCl	2	2		2	

Question 14 · AS Component 1 · Autumn 2020 · Q3(a)(i) · 2 marks

3	(a)	(i)	Same {type of milk used/ pH of milk/ concentration of milk/ protein in milk} (1) Concentration of enzyme / protease (1)	2	2	2	

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Question 15 · AS Component 1 · Autumn 2020 · Q3(a)(ii) · 4 marks

(ii)	Source of inaccuracy: Maintaining a constant temperature (1) + Use thermostatic / constant temperature water baths (1) Difficult to determine exactly when the milk has become clear (1) + Use a colorimeter to determine when the milk has become clear/ colour standard (1)	4	4	4

Question 16 · AS Component 1 · Autumn 2020 · Q3(b)(ii) · 4 marks

(ii)	**Any four (x1) from**: • The mean time taken for the milk to turn clear decreases until 42°C and then increases (1) • Due to increased kinetic energy (1) • Leading to more successful collisions/ owtte (1) • Ref to denaturing at higher temp / owtte (1) • Ref to optimum temperature (1)	4	4	4

Question 17 · AS Component 1 · June 2024 · Q3(b)(i) · 1 mark

(b)	(i)	**Both correct for one mark** Independent: concentration of pectinase (%) Dependent: volume of juice (cm^3)		1	1	1

Question 18 · AS Component 1 · June 2024 · Q3(b)(ii) · 2 marks

(ii)	**Any two (x1) from:** Ripeness / age of the pineapples (1) Variety / species of pineapple (1) Mass of pineapple (1) pH (1) rate of stirring (1)		2	2	2

Question 19 · A level Component 2 · Autumn 2020 · Q3(b)(i) · 1 mark

(b)	(i)	large quantity of DNA/ more DNA easier to see	1	1	1

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Question 20 · A level Component 2 · Autumn 2020 · Q3(b)(ii) · 1 mark

(ii)	DNA too large a molecule to fit through normal filter paper pores/ allows more {DNA/ filtrate} to pass through (1)	1	1	1

Question 21 · A level Component 2 · June 2022 · Q2(a)(ii) · 2 marks

(ii)	**Any two (x1) from** (Agar) no effect on rate of diffusion/ same resistance for amylase to diffuse (1) OWTTE (Starch) same number of molecules to digest / suitable description (1) Both are controlled variables / so the results are due to amylase activity only (1)	2	2	2

Question 22 · A level Component 2 · June 2025 · Q4(b)(i) · 1 mark

(b)	(i)	**Any one (x1) from** Cut away from body (onto a tile) (1) use {forceps / tweezers} to hold grain (1)	1	1	1

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