Vitamin C and Membrane Permeability (Core Practicals 2 and 3): Edexcel SNAB A Level Biology Exam Questions

15 questions · 48 marks · about 58 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 1 · June 2022 · Q2(b)(i) · 2 marks

(b) (i) Complete the table to show the details of a reagent that could be used to show if vitamin C was present.

(2)

Reagent name	Colour change observed if vitamin C present
	from ..... to .....

Question 2 · information from earlier in the question

2 Vitamin C can be found in fruits and vegetables.

The vitamin C content of four fruits was sampled on the day of picking and one week after picking.

The results are shown in the table.

Fruit	Vitamin C / mg per 100 g of fruit	
	Day of picking	One week after picking
Apple	27	7
Guava	70	53
Pineapple	53	28
Orange	75	52

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Question 2 · AS Paper 1 · June 2022 · Q2(b)(ii) · 2 marks

(ii) State and justify **one** variable that should have been controlled when the fruits were stored after picking.

(2)

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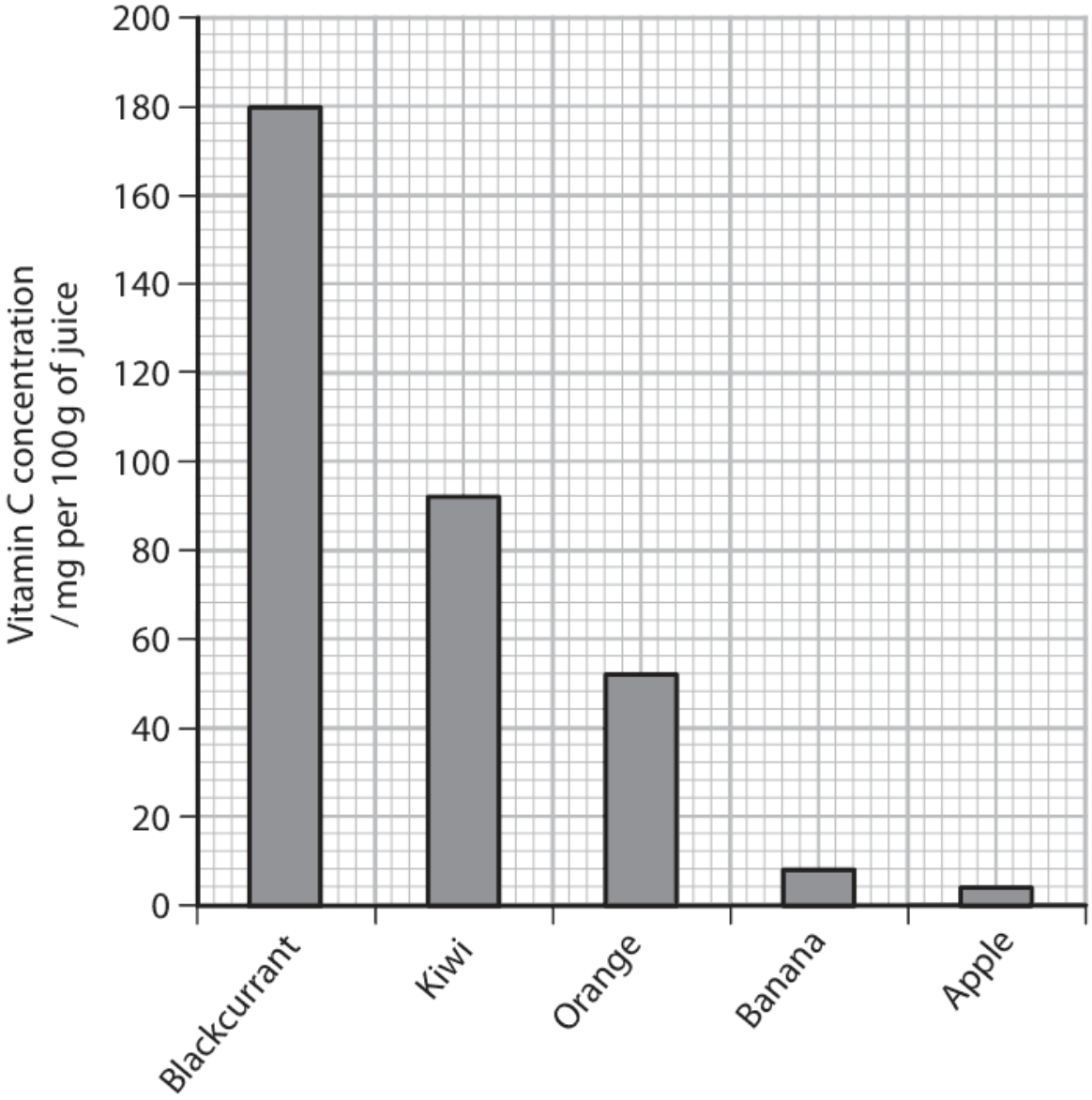
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3 Fruit juices contain various concentrations of vitamin C.

The graph shows the vitamin C concentration of five fruit juices.



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Question 3 · AS Paper 1 · June 2018 · Q3(b) · 5 marks

(b) Devise an investigation that can be used to collect these data.

(5)

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Question 4 · AS Paper 1 · June 2019 · Q4(b) · 4 marks

(b) Milk at the start of a feed does not contain any vitamin C. Milk at the end of a feed can contain 10 mg of vitamin C per 100 cm^3 of milk.

Milk samples were taken at different times during the course of one feed.

Devise a method to measure how the concentration of vitamin C changes during the course of a feed.

(4)

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Question 5 · A level Paper 1 · June 2019 · Q4(b) · 4 marks

(b) Devise a procedure that can be used to investigate the effect of cooking on the vitamin C content of cauliflower.

(4)

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Question 6 · AS Paper 1 · June 2025 · Q4(b) · 5 marks

(b) The photograph shows green broccoli being cooked in a steamer.



(Source: © Art Directors & TRIP / Alamy Stock Photo)

Broccoli can also be cooked by boiling in water.

A student investigated the following hypothesis:

'The broccoli will lose less vitamin C if it is steamed than if it is boiled'.

Devise an investigation the student could use to test this hypothesis and collect valid data.

(5)

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Question 7 · A level Paper 2 · June 2024 · Q2(c) · 4 marks

(c) Many mammals such as cows can synthesise vitamin C from glucose in the liver.

Vitamin C solutions can be prepared from fresh or frozen cow liver.

Devise an investigation to compare the vitamin C content of these solutions.

(4)

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Question 8 · A level Paper 2 · June 2022 · Q8(d) · 3 marks

(d) Beetroot cells contain the pigment betalain.

When beetroot cells are placed in alcohol, the concentration of betalain in the cells changes.

Explain why alcohol affects the concentration of betalain in these cells.

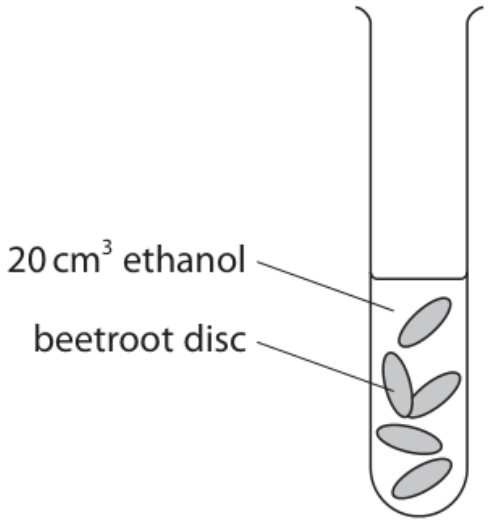
(3)

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(c) Beetroot cell vacuoles contain a red pigment called betalain.

A student investigated the effect of ethanol on the permeability of beetroot membranes.

Test tubes were set up as shown in the diagram, each with a different concentration of ethanol.



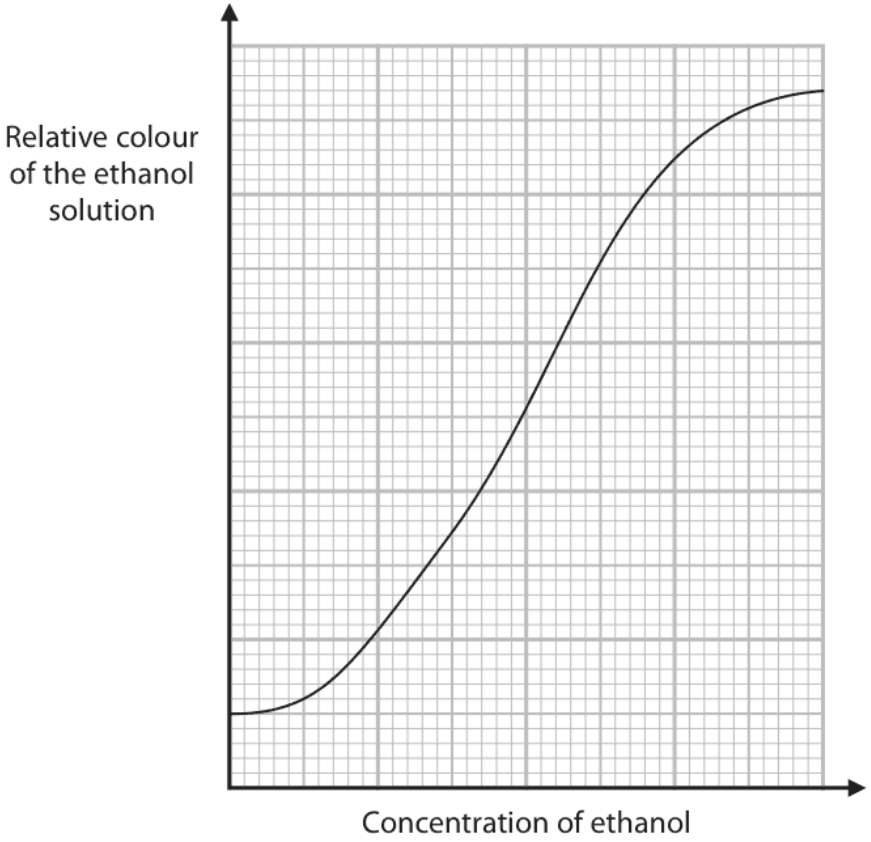
The test tubes were placed in a thermostatically controlled water bath at 25 °C for 30 minutes.

The beetroot discs were removed from the ethanol.

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Question 9 · AS Paper 1 · June 2023 · Q8(c)(ii) · 2 marks

(ii) The relative colour of the ethanol after 30 minutes was measured using a colorimeter. The results of the investigation are shown in the graph.



Explain the results of this investigation.

(2)

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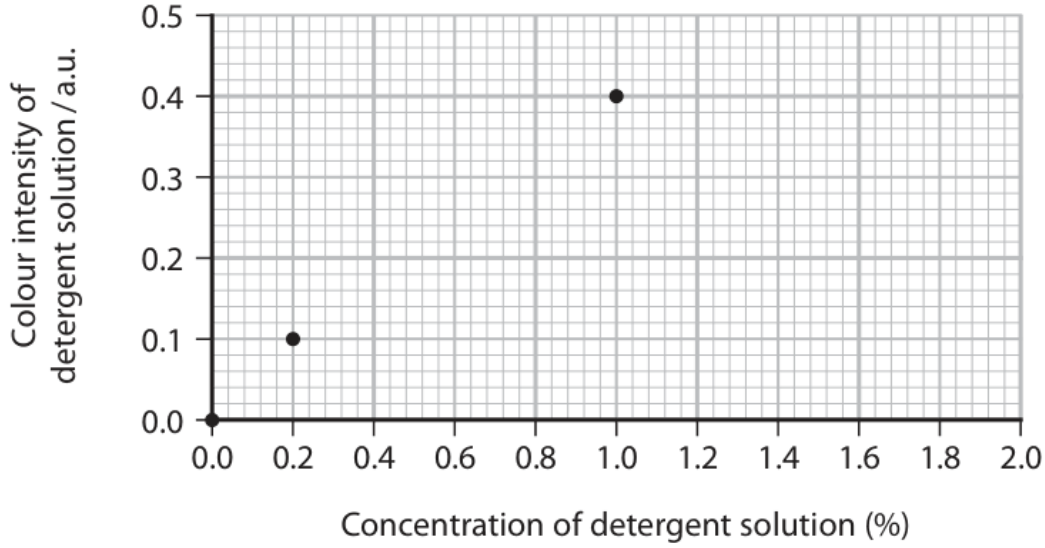
(c) Some chemicals affect the permeability of cell membranes.

The effect of detergent on the permeability of beetroot cell membranes was investigated.

Sections of beetroot were placed in test tubes containing detergent solution.

The colour of the detergent solution at the end of the investigation was measured.

The graph shows the results of this investigation.



(i) The colour of the 0.5% detergent solution was 0.25 a.u.

Plot this result on the graph.

(1)

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(c) Haemolysis is the breaking open of a red blood cell, causing the release of haemoglobin.

The effect of concentration of three different alcohols on the haemolysis of red blood cells was investigated.

Samples of red blood cells were treated with different concentrations of three alcohols.

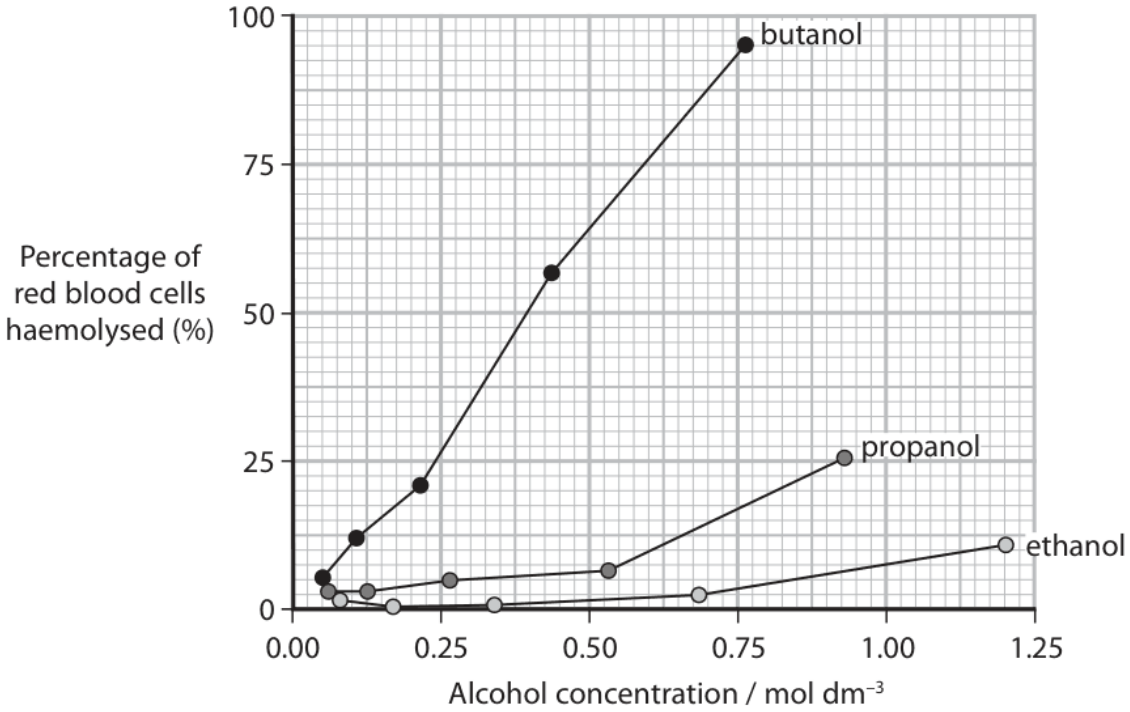
The table shows the formulae of the alcohols.

Alcohol	Formula
Ethanol	CH_3CH_2OH
Propanol	$CH_3CH_2CH_2OH$
Butanol	$CH_3CH_2CH_2CH_2OH$

A microscope was used to count the number of intact red blood cells.

The investigation was repeated twice.

The mean percentage of red blood cells that had haemolysed was calculated, and the results are shown in the graph.



(i) State and justify a suitable control for this investigation.

(2)

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Question 12 · AS Paper 1 · June 2024 · Q4(c)(ii) · 4 marks

(ii) Evaluate the effect of concentration of the three alcohols on the haemolysis of red blood cells.

(4)

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4 Brilliant cresyl blue (BCB) can be used to stain red blood cells. When red blood cells are immersed in a solution of BCB, they take up all the stain and leave the surrounding solution colourless.

The effect of temperature on the uptake of BCB by red blood cells was investigated.

The table shows the results of the investigation.

Temperature / °C	Percentage of stained cells (%)	Colour of solution surrounding red blood cells
10	100	colourless
20	100	colourless
30	100	colourless
40	97	colourless
50	81	pale blue
60	17	blue

It was concluded that the cells were taking up the BCB stain by active transport.

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Question 13 · AS Paper 1 · June 2017 · Q4(c) · 2 marks

(c) Explain **one** way in which this investigation could be improved.

(2)

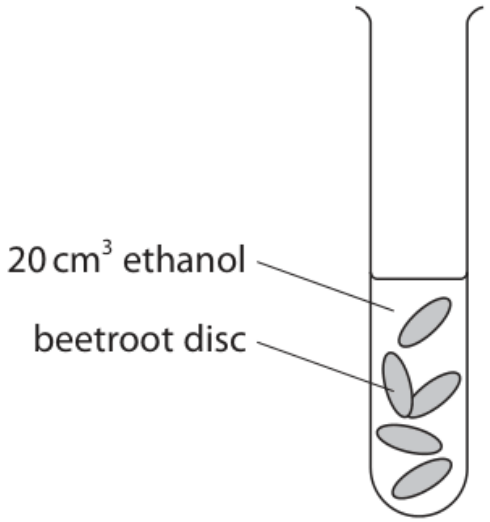
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Question 14 · information from earlier in the question

(c) Beetroot cell vacuoles contain a red pigment called betalain.

A student investigated the effect of ethanol on the permeability of beetroot membranes.

Test tubes were set up as shown in the diagram, each with a different concentration of ethanol.



The test tubes were placed in a thermostatically controlled water bath at 25 °C for 30 minutes.

The beetroot discs were removed from the ethanol.

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Question 14 · AS Paper 1 · June 2023 · Q8(c)(iii) · 4 marks

(iii) Devise a **valid** investigation to compare the effects of ethanol and propanol on the permeability of beetroot membranes.

(4)

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Question 15 · AS Paper 1 · June 2016 · Q3(b) · 4 marks

(b) Anthocyanins are purple pigments found in the cells of red cabbage leaves.

A student investigated the following hypothesis:

'The permeability of cell membranes in a red cabbage leaf is affected by the age of the plant.'

Devise an investigation the student could use to test this hypothesis and collect valid data.

(4)

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Mark schemes

Question 1 · AS Paper 1 · June 2022 · Q2(b)(i) · 2 marks

Question Number	Answer
2(b)(i)	• correct named reagent (1) • correct colour change (1)

Additional Guidance		Mark
Reagent name	colour change observed if vitamin C present	
DCPIP	blue to colourless	
starch/iodide solution	yellow-brown to blue-black	(2)

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Question 2 · AS Paper 1 · June 2022 · Q2(b)(ii) · 2 marks

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	An answer that makes reference to the following: • suitable variable to control (1) • correct justification (1)	e.g. temperature e.g. description of {effect on vitamin C content / how it would increase the validity of the data} e.g. temperature is a factor that can {increase / decrease} percentage of vitamin C	(2)

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Question 3 · AS Paper 1 · June 2018 · Q3(b) · 5 marks

Question Number	Answer	Additional Guidance	Mark
3(b)	An answer that makes reference to five of the following: • titration using DCPIP (1) • (using) {known/ same} volume of {fruit juice / DCPIP} (1) • method for controlling another relevant variable (1) • method for determining a suitable end point (1) • determine concentration of vitamin C (1) • calculation of vitamin C per 100g from concentration determined (1)	ALLOW description of titration e.g. concentration of DCPIP, age of fruit juice e.g. DCPIP changing from blue to colourless e.g. use of calibration curve / compare result with standardised vitamin C solution	(5)

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Question 4 · AS Paper 1 · June 2019 · Q4(b) · 4 marks

Question Number	Answer
4(b)	An answer that makes reference to four of the following: • five samples of breast milk tested from different points of feed (1) • description of titration of breast milk using DCPIP (1) • standardisation of titration technique (1) • use of a calibration curve to determine the vitamin C content in each breast milk sample (1) • repeat titration to achieve concordant results (for each time) (1)

Additional Guidance	Mark
e.g. volume of breast milk taken to decolourise the DCPIP ALLOW volume of DCPIP taken to produce a colour change in milk e.g. volume of DCPIP in flask / concentration of DCPIP / standardisation using known concentration of vitamin C ALLOW compare values with known vitamin C concentrations IGNORE to calculate an average	**(4)**

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Question 5 · A level Paper 1 · June 2019 · Q4(b) · 4 marks

Question Number	Answer
4(b)	An answer that makes reference to the following: • cauliflower extract from same mass (of cooked and uncooked cauliflower) (1) • description of titration of cauliflower extract with DCPIP (1) • using same {volume / concentration} of DCPIP (1) • determine the vitamin C content in cooked and uncooked cauliflower by comparing with solution of known vitamin C concentration (1)

Additional guidance	Mark
ALLOW cauliflower extracts of the same concentration produced e.g. volume of cauliflower extract taken to decolourise the DCPIP ALLOW volume of DCPIP added to cauliflower extract until the DCPIP is no longer decolourised e.g. by using a vitamin C calibration curve	**(4)**

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Question 6 · AS Paper 1 · June 2025 · Q4(b) · 5 marks

Question Number	Answer
4(b)	An answer that makes reference to the following: • control of a biotic variable (1) • control of an appropriate abiotic variable (1) • valid method of measuring vitamin C content of {broccoli / water} (1) • performing repeats and calculating mean (1) • compare with vitamin C content of {broccoli / water} before cooking (1)

Additional Guidance	Mark
ignore amount e.g. same age, same type, same mass, same surface area, same broccoli plant e.g. same volume of water, same cooking time, concentration of DCPIP, buffer e.g. use of DCPIP ALLOW correct use of calibration curve to compare with result ALLOW compare with {control / uncooked sample} from **same** plant ignore compare steamed with boiled	**(5)**

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Question 7 · A level Paper 2 · June 2024 · Q2(c) · 4 marks

Question Number	Answer
2(c)	An answer that makes reference to four of the following: • use same volume of solution (for both) / use same { volume / concentration } of DCPIP (for both) (1) • add solution to DCPIP / titration using DCPIP and {vitamin C solution / extract} (1) • until DCPIP {decolourises / changes from blue to colourless } (1) • compare volume of the two solutions needed for the DCPIP to decolourise (1) • quantify the results by titration using a vitamin C standard solution (1)

Additional Guidance	Mark
ALLOW add DCPIP to each solution ALLOW DCPIP becomes colourless in correct context ALLOW DCPIP added to vitamin C solution until {DCPIP colour remains /DCPIP stays blue / solution becomes blue } ALLOW compare volume of DCPIP needed for the two solutions ALLOW correct description of comparison	4

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Question 8 · A level Paper 2 · June 2022 · Q8(d) · 3 marks

Question Number	Answer
8(d)	An explanation that makes reference to three of the following: • decreases betalain concentration (in the cells) (1) • due to betalain {diffusing out / moving down a concentration gradient} (1) • (because) the alcohol increases membrane permeability (1) • membrane {lipids/ phospholipids} dissolve in alcohol (1)

Additional Guidance	Mark
IGNORE reference to cell wall	(3)

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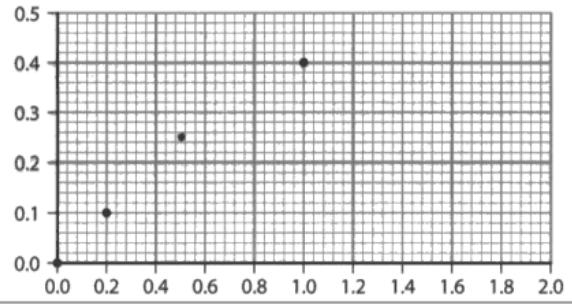
Question 9 · AS Paper 1 · June 2023 · Q8(c)(ii) · 2 marks

Question Number	Answer
8(c)(ii)	An explanation that makes reference to two of the following: • permeability of membrane increases as ethanol increases in concentration (1) • ethanol disrupts membrane (structure) (1) • (therefore) more {betalain / pigment} diffuses through membrane (1) • therefore {increases the absorbance / decreases transmission} of light (in the colorimeter) (1)

Additional Guidance	Mark
ALLOW ethanol {dissolves lipids / denatures proteins} in membrane ALLOW ethanol increases membrane fluidity ALLOW more {betalain / pigment} {moves through membrane / enters ethanol / released (into ethanol)}	**(2)**

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Question 10 · AS Paper 1 · November 2021 · Q6(c)(i) · 1 mark

Question Number	Answer	Additional Guidance	Mark
6 (c)(i)	correctly plotted point on graph (1)	Example of plot: 	(1)

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Question 11 · AS Paper 1 · June 2024 · Q4(c)(i) · 2 marks

Question Number	Answer
4(c)(i)	An answer that makes reference to the following: • saline / solution with no alcohol / 0.00% alcohol solution / {solvent / saline} used to dilute alcohol solutions (1) • to calculate percentage of cells which have undergone haemolysis without alcohol being present / to see if cells undergo haemolysis in absence of alcohol (1)

Additional Guidance	Mark
ignore {(distilled) water / no alcohol} unqualified ALLOW baseline value to compare with alcohol solutions	(2)

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Question 12 · AS Paper 1 · June 2024 · Q4(c)(ii) · 4 marks

Question Number	Answer
4(c)(ii)	An answer that makes reference to four of the following: • increasing concentration of alcohol increases the percentage of red blood cells that have haemolysed (1) • {most / largest increase in} haemolysis with butanol / least haemolysis with ethanol (1) • (due to) alcohol {dissolving / disrupting} the {cell membranes / lipids} (1) • correlation between the {size of the alcohol molecules / number of carbon (atoms)} and the percentage of red blood cells that have haemolysed (1) • relevant comment regarding methodology (1)

Additional Guidance	Mark
ALLOW increased number instead of percentage of cells ALLOW positive correlation ALLOW alcohol increases the membrane permeability ALLOW butanol is a more effective solvent for phospholipids / ethanol had least effect on cell membrane structure ALLOW highest level of haemolysis with the longest chain alcohol ALLOW larger chain has more effect on cells e.g. only 2 repeats / were anomalous results identified as some results don't fit pattern / no information regarding controlled variables such as same volume of alcohol	**(4)**

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Question 13 · AS Paper 1 · June 2017 · Q4(c) · 2 marks

Question Number	Answer
4 (c)	An explanation that makes reference to the following: • One for improvement (1) - repeats at each temperature - standardised {BCB concentration / red blood cell count / immersion time} - smaller temperature intervals - use of colorimeter • And one for linked justification (1) - allowing anomalies to be identified / means to be calculated - allowing {repeatability / validity} - to determine the temperature that active transport was affected / solution became coloured - increases accuracy / provides quantitative data

Additional Guidance	Mark
Check that the justification matches the improvement suggested ALLOW not subjective /	**(2)**

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Question 14 · AS Paper 1 · June 2023 · Q8(c)(iii) · 4 marks

Question Number	Answer
8(c)(iii)	An answer that makes reference to the following: • use of {same / 5} concentration(s) for ethanol and propanol (1) • description of how an appropriate variable can be controlled (1) • valid method to measure {absorbance / colour} (1) • repeats in order to calculate {mean / average / SD} (1)

Additional Guidance	Mark
eg use same {beetroot / species / age} / use core borer to get same diameter / use water bath to maintain temperature / use stop clock to measure time / use same stated volume / use measuring cylinder to measure volume ignore same {volume / size / temperature} unqualified e.g. use colorimeter / compare against {colour standards / colour chart}	**(4)**

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Question 15 · AS Paper 1 · June 2016 · Q3(b) · 4 marks

Question Number	Answer
3(b)	An answer that makes reference to four of the following: • (red) cabbages of at least five different ages used (1) • (red) cabbage leaves with same { surface area / mass / source } (1) • description of how another relevant variable is controlled (1) • method for measuring permeability (1) • {replicates / repeats} for each age to allow calculation of mean values (1)

Additional Guidance	Mark
Ignore descriptions of beetroot core practical Allow either growing conditions or experimental conditions relevant variables could include temperature, pH, time, volume of liquid, light intensity e.g. use of colorimeter	(4)

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