IB Biology HL - Prediction Exams
May 2025 - Paper 1

Paper 1

44 questions | 120 mins | 75 marks

Filters | Go to Question

Question Type: All | Difficulty: Easy | Medium | Hard

Section A

Question 1

Easy

Which substance is insoluble in water and suitable for energy storage in animals?

A. Starch

B. Glucose

C. Ribose

D. Glycogen

Revisit | Complete

Mark Scheme

Video Solutions 1

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Question 2

Easy

Which statement explains why DNA is evidence of common ancestry?

A. All organisms have an identical DNA base sequence.

B. All organisms contain DNA.

C. Closely related species contain the same alleles.

D. More recently evolved species have more similar DNA.

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 3

Medium

Which property of ribozymes is believed to have identified RNA as the first genetic material, ahead of DNA?

A. Structural

B. Synthetic

C. Catalytic

D. Physical

Revisit | Complete

Mark Scheme

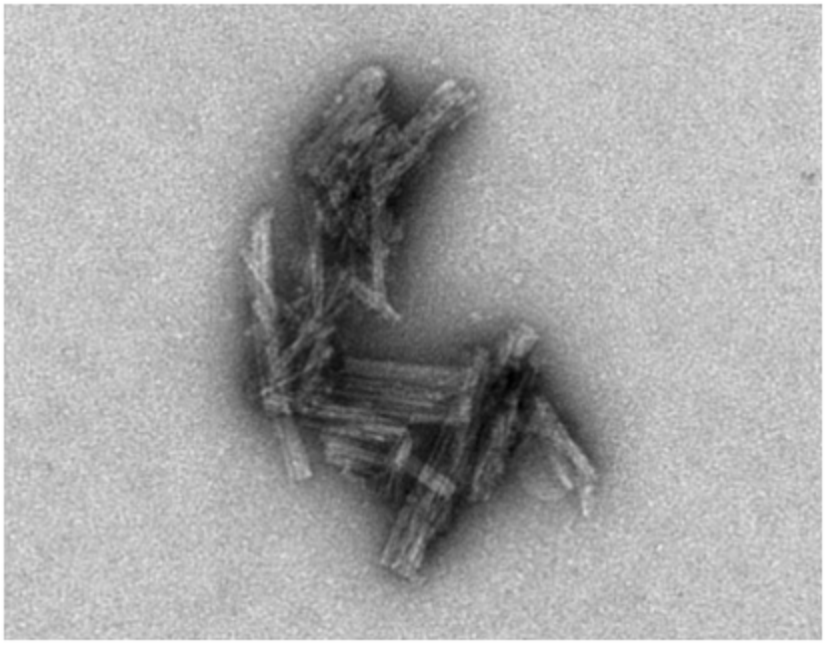
Video Solutions 1

Newton AI

Question 4

Medium

Electron microscopes allow the ultrastructure of cells and molecules to be viewed.



[Source: National Institute of Allergy and Infectious Diseases (NIAID)/NIH (2019, January 4). *Electron micrograph of tau clusters (46603522841).jpg*. Wikimedia. Retrieved December 27, 2024, from https://commons.wikimedia.org/wiki/File: Electron_micrograph_of_tau_clusters_(46603522841).jpg. Public Domain]

Which of these methods is used to analyse protein structure?

A. Freeze-fracture electron microscopy

B. Fluorescent staining

C. Cryogenic electron microscopy

D. Immunofluorescence

Question 5

Medium

Which gives the best summary of the action of reverse transcriptase?

A. viral DNA → viral RNA

B. viral RNA → viral DNA

C. viral RNA → host cell RNA

D. viral RNA → host cell DNA

Revisit | Complete

Mark Scheme

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Question 6

Easy

When constructing a dichotomous key for classifying bird species, which characteristic would be most appropriate for the first division in the key?

A. Colour of feathers

B. Habitat (forest, grassland, urban)

C. Presence or absence of webbed feet

D. Diet (carnivorous, herbivorous, omnivorous)

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 7

Hard

Which feature of Archaea helped biologists to classify them in a separate domain from other prokaryotes?

A. The presence of a cell wall

B. The frequency of introns in the genome

C. The presence of linear chromosomes

D. The difference in structure of membrane phospholipids

Revisit | Complete

Mark Scheme

Video Solutions 1

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Question 8

Hard

Which of the following is **NOT** a true statement of allopolyploidy in plants?

A. It results in an increased chance of hybrid vigour.

B. Plant breeders can select varieties that are best suited to local conditions.

C. It results in the duplication of chromosomes within a single species.

D. It results in an Increased ability of plants to colonise new habitats.

Revisit | Complete

Mark Scheme

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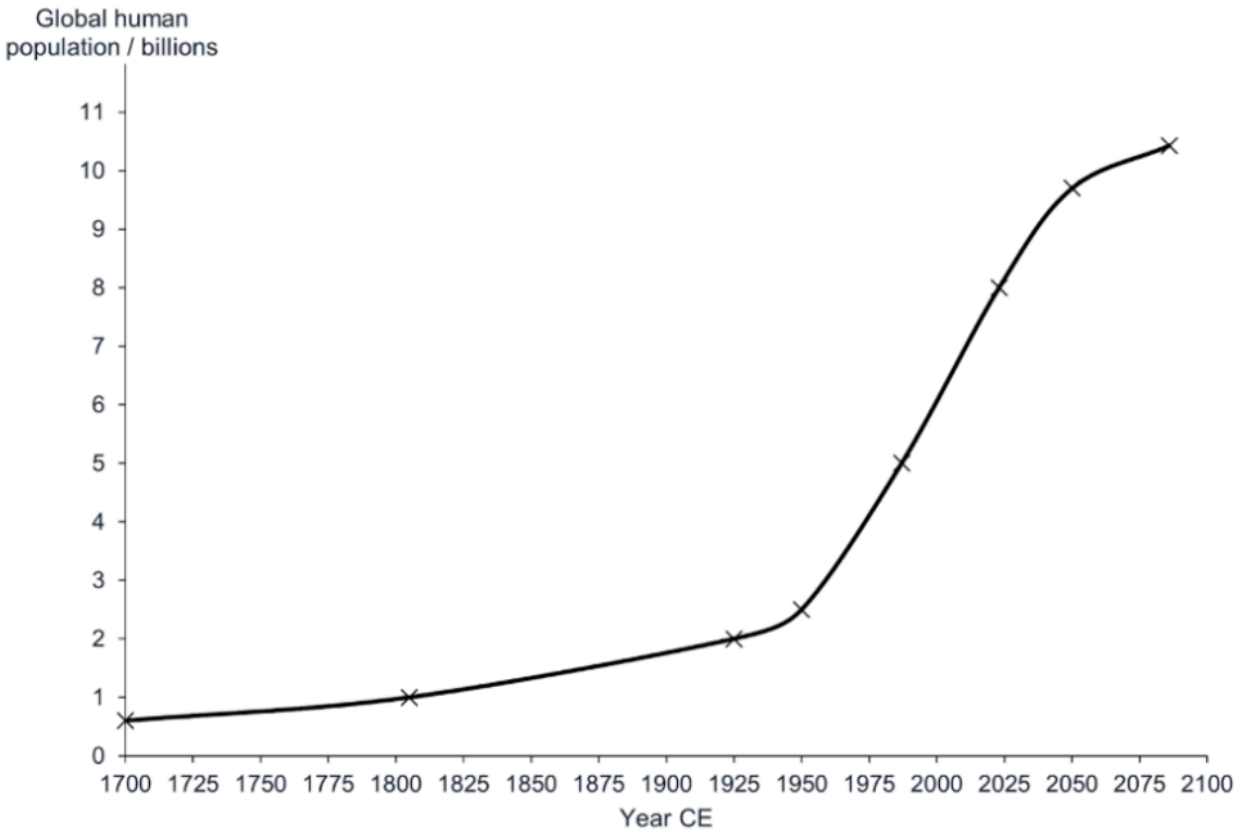
Question 9

Hard

The graph shows the global human population since 1700 CE, with a projection made to 2086.



According to the projection, what will be the percentage population increase between 2000 and 2050 CE?

A. 37%

B. 38%

C. 62%

D. 88%

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 10

Medium

Which characteristics of triglycerides make them suitable for functions in organisms?

	Energy per gram	Solubility in water	Heat conduction
A.	Half compared to carbohydrates	Yes	High
B.	Twice compared to carbohydrates	Yes	Low
C.	Half compared to carbohydrates	No	High
D.	Twice compared to carbohydrates	No	Low

Revisit | Complete

Mark Scheme

Video Solutions 1

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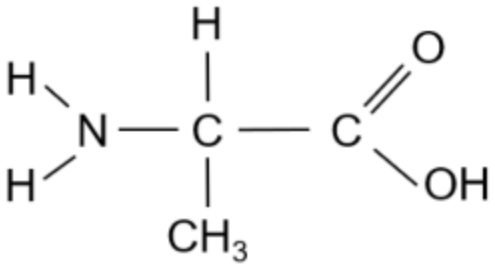
Question 11

Hard

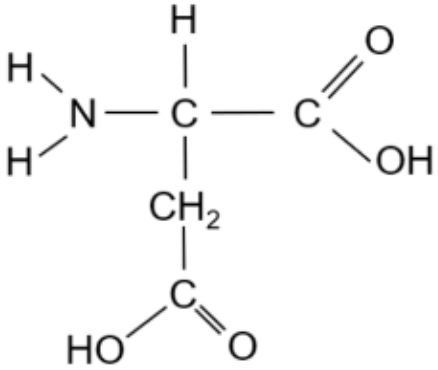
Which amino acid in a membrane protein is likely to be oriented close to the centre of the membrane bilayer?

A.

B.

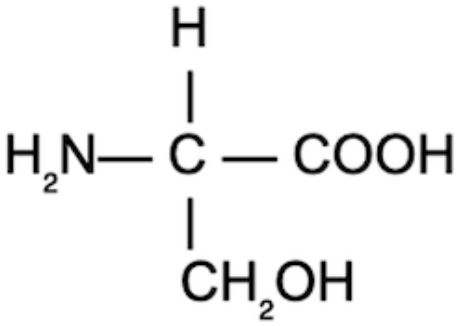


alanine



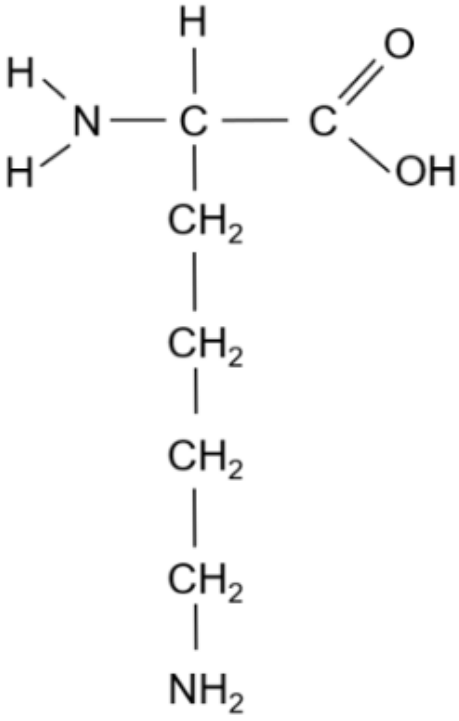
aspartic acid

C.



serine

D.



lysine

Question 12

Easy

In neonatal mammals, intestinal epithelial cells absorb maternal antibodies from milk by forming vesicles that engulf extracellular fluid.
Which term best describes this process?

A. Phagocytosis

B. Endocytosis

C. Pinocytosis

D. Exocytosis

Revisit | Complete

Mark Scheme

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Question 13

Easy

Which organelle requires compartmentalisation to concentrate enzymes and prevent damage to the contents of cells?

A. Lysosome

B. Chloroplast

C. Mitochondrion

D. Contractile vacuole

Revisit | Complete

Mark Scheme

Video Solutions 1

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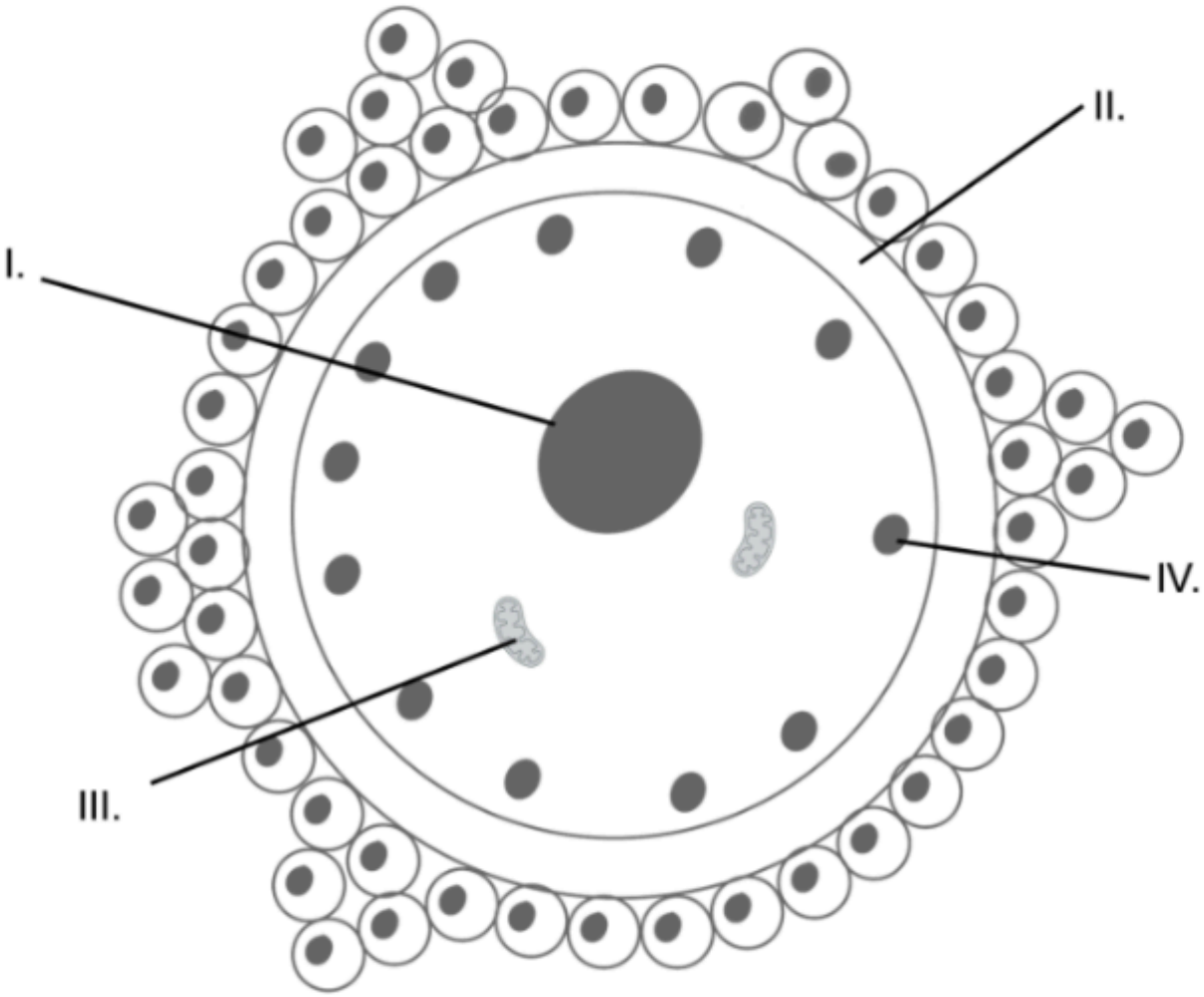
Question 14

Medium

The diagram shows a simplified view of a human ovum (egg cell).



Which structures play a role in preventing polyspermy?

A. II and IV only

B. I, II and III only

C. III and IV only

D. I, II, III and IV

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 15

Medium

Which of the following is an **inaccurate** statement about leaves?

A. Spongy mesophyll cells increase the surface area available for evaporation of water.

B. Stomata change their cell contents to allow opening and closing.

C. The waxy cuticle prevents excessive water loss from the leaf by evaporation.

D. Carbon dioxide absorption is maximised when the rate of photosynthesis is at its peak.

Revisit | Complete

Mark Scheme

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Question 16

Hard

Which row of the table contains **three** correct statements about the circulatory systems of bony fish, amphibians and mammals?

	Bony fish	Amphibians	Mammals
A.	open circulation	oxygen absorbed via capillaries in the lungs and skin	oxygen absorbed via capillaries in the lungs and skin
B.	double loop	double loop	four-chambered heart
C.	single loop	three-chambered heart	pulmonary circulation
D.	closed circulation	four-chambered heart	double loop

Revisit | Complete

Mark Scheme

Video Solutions 1

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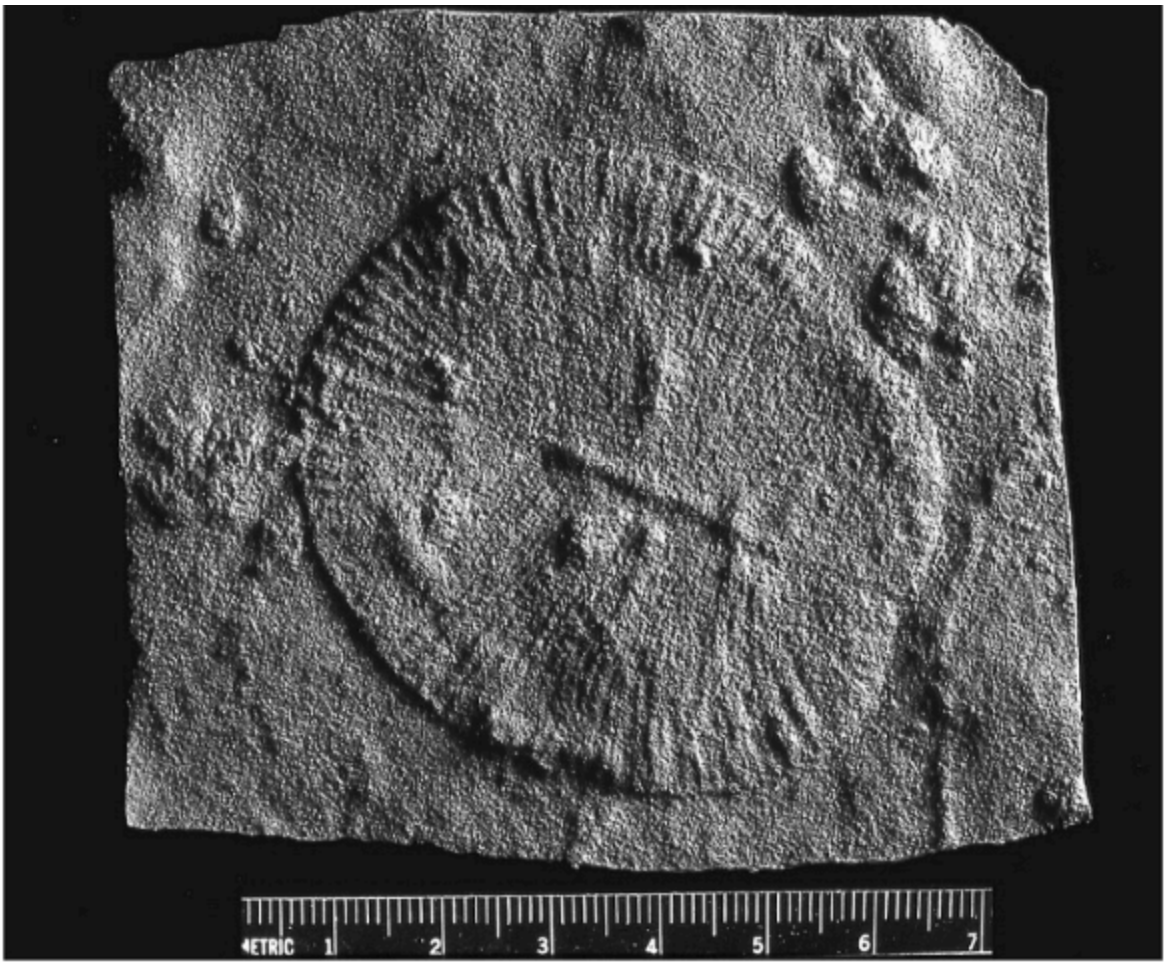
Question 17

Hard

The extinct early animal genus *Dickinsonia* included large, flat organisms that fed on microbial mats on the sea bed. The image shows an example of the species *Dickinsonia minima* from a fossil find.



[© Susan H. Butts, CC0, via Wikimedia Commons https://commons.wikimedia.org/wiki/File:Dickinsonia_minima_(YPM_IP_035468).jpg Retrieved January 2025, Copyright free]

Early species of *Dickinsonia* were sessile, based on this kind of single imprint found in fossils. However, later species appeared to be motile, based on multiple overlapping trace imprints being found in fossil samples. No discernible sense organs have been found in the *Dickinsonia* genus.
What does the fossil record show as an evolutionary advantage that motile species would have had over sessile ones?

A. A more varied diet

B. The ability to escape from predators

C. The ability to hunt for new food sources

D. Greater access to new food sources through random movement

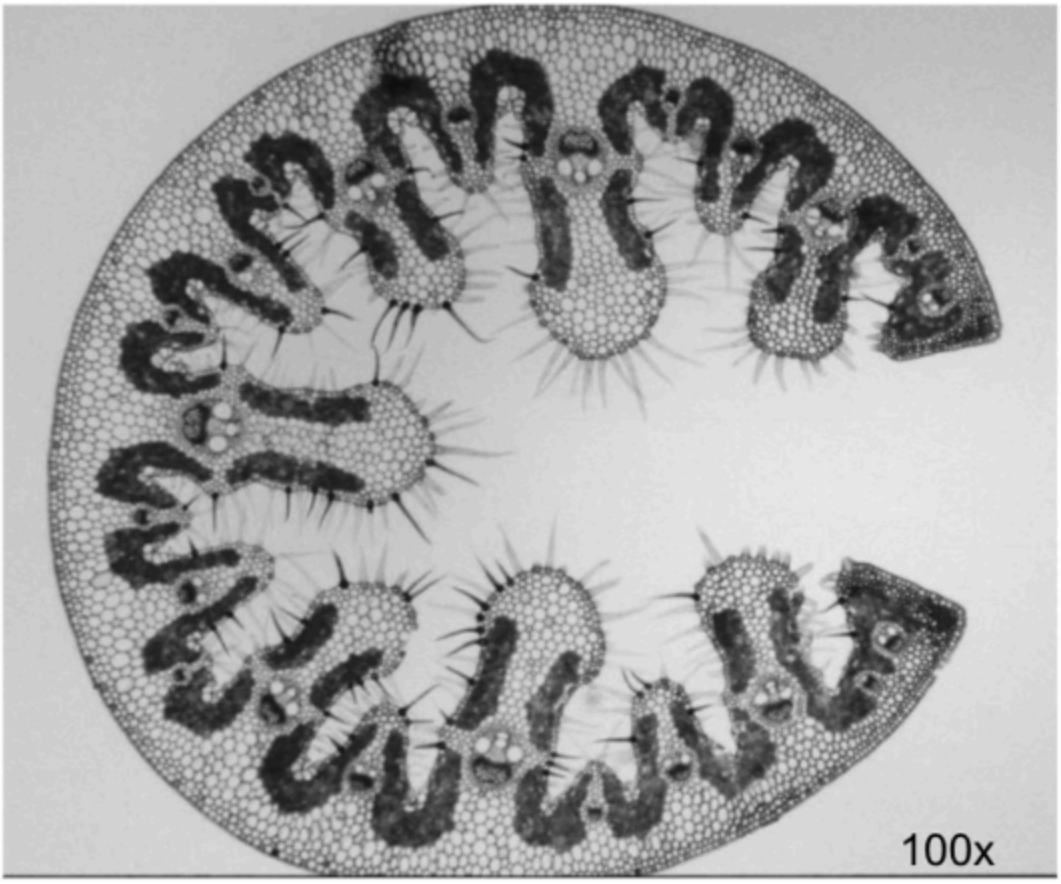
Video Solutions 1

Newton AI

Question 18

Medium

The micrograph shows a cross-section of a marram grass leaf (*Ammophila arenaria*), a xerophyte often found on sand dunes.



[Source: Adapted from Schools, S. and P. for. (2012, May 2). *Marram Grass*. Flickr. Retrieved 8 September, 2024 from https://www.flickr.com/photos/71183136@N08/6989003016. Copyright by CC 2.0]

Which row in the table correctly describes how this species is adapted to its environment?

	Adaptation	Purpose
A.	Thick, waxy cuticle on inside of rolled leaf	To prevent water loss
B.	Rolled leaf traps moisture, providing humid microclimate	To create a humid microclimate near the surface of the leaf
C.	Rolled leaf structure	To allow the wind to remove sand from stomata on the outer surface of the leaf
D.	Bumpy inner surface of rolled leaf	To increase the surface area of the leaf for photosynthesis

Revisit Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 19

Hard

Which statement is correct for adaptations of herbivores for feeding on plants?

A. Chewing mouthparts help insects to prevent damage from spines and thorns.

B. Chewing mouthparts allow insects to directly access vascular tissues.

C. Piercing-sucking mouthparts allow insects to feed directly on cell contents.

D. Piercing-sucking mouthparts allow direct feeding from the phloem sap.

Revisit Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 20

Medium

Which of the following does penicillin inhibit the formation of?

A. Short cross-linking peptides between peptidoglycan polymers

B. Transpeptidases

C. Glycosidic bonds within peptidoglycan

D. Enzyme-antibiotic complexes

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 21

Easy

Which term best describes the chemical conversion step undergone by pyruvate prior to the Krebs cycle?

A. Reductive carboxylation

B. Reductive decarboxylation

C. Oxidative carboxylation

D. Oxidative decarboxylation

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 22

Medium

Which of the following are the advantages of photosynthetic pigments being held in photosystems within the thylakoid membrane?

I. More electrons are available for excitation.

II. Light energy can be captured from a wide variety of wavelengths of the visible spectrum.

III. Spatial channelling of excited electrons towards the reaction centre can be achieved.

A. I and II only

B. II only

C. II and III only

D. I, II and III

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 23

Medium

What is the likely time taken for an adrenergic neurotransmitter to perform its function in chemical signalling?

A. 60s

B. 1s

C. 1ms

D. $1\mu s$

Revisit | Complete

Mark Scheme

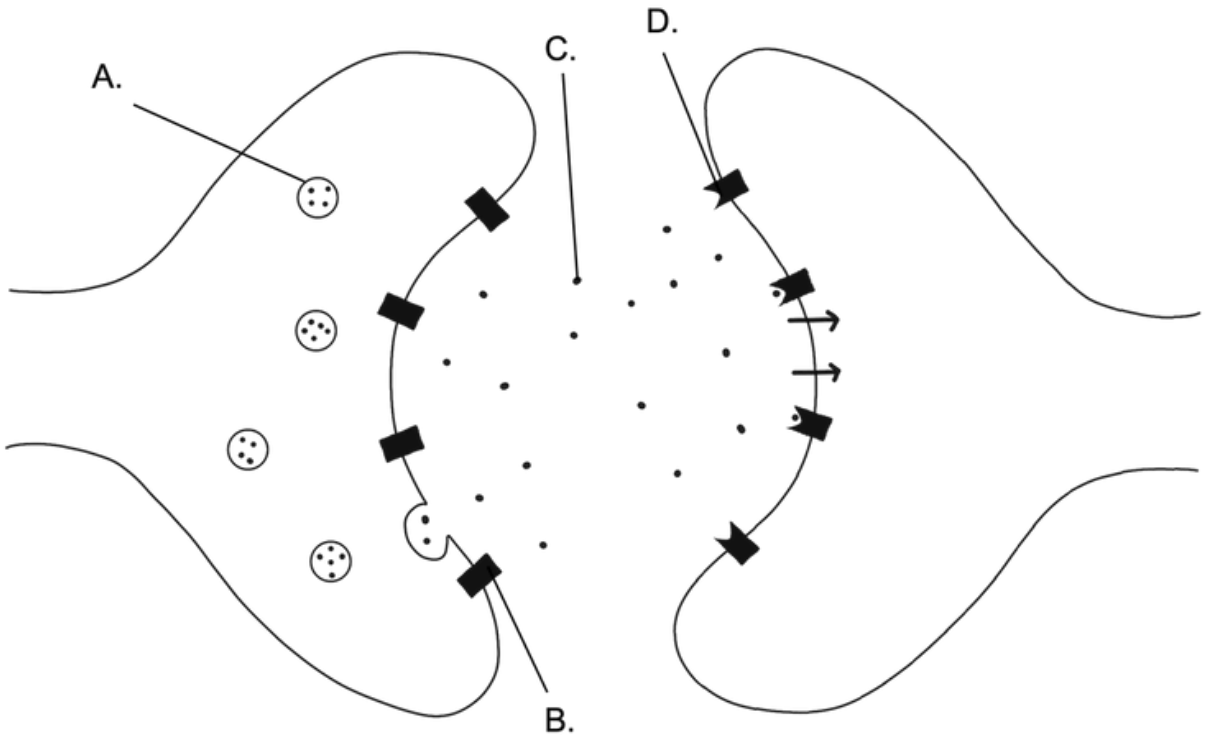
Video Solutions 1

Newton AI

Question 24

Medium

A teacher drew the following unlabelled diagram of a synapse to illustrate the mode of action of cocaine.



Which label (**A - D**) shows the site of action of cocaine in the teacher's drawing?

Revisit | Complete

Mark Scheme

Video Solutions 1

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Question 25

Easy

Chemoreceptors in the body detect and monitor various blood variables to regulate ventilation rate. Which of the following is the factor that most directly drives changes in ventilation rate under normal conditions?

A. Blood oxygen concentration

B. Blood pH

C. Blood carbon dioxide concentration

D. Blood osmolarity

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 26

Hard

The World Health Organisation has identified 95% vaccination coverage as the threshold for herd immunity for measles. Which statement best describes the consequence of 95% measles vaccination coverage?

A. Reduces the need for measles vaccination programs in the future

B. Eradicates measles in the population

C. Protects individuals who cannot be vaccinated and significantly reduces transmission of measles

D. Protects all vaccinated individuals from measles

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 27

Hard

A typical adult male has 6 dm^3 of blood. The blood passes through the kidneys 300 times per day. The volume of urine produced is 3 dm^3. What proportion of the kidneys' input is excreted as urine?

A. 50%

B. 1.7%

C. 1%

D. 0.17%

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 28

Easy

Which term describes biomass, peat, coal, oil and natural gas before combustion?

A. Trophic level

B. Carbon flux

C. Carbon source

D. Carbon sink

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 29

Easy

Which of these is responsible for the semi-conservative replication of DNA?

A. Action of DNA polymerase

B. Complementary base pairing

C. Action of DNA helicase

D. Hydrogen bonding

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 30

Easy

Which of the following allows a eukaryotic gene to code for multiple polypeptides?

A. Accurate A-T and C-G base pairing

B. The presence of introns

C. The degenerate code

D. Alternative splicing

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 31

Medium

The diagram shows a section of one DNA strand before and after a mutation. Which term(s) describe this mutation?

Before mutation :	GTC GAG TCT AGC GCT ATC GCT
After mutation :	GTC GAG TCT AAG CGC TAT CGC T

I. Frameshift
II. Deletion
III. Insertion

A. I only

B. II only

C. I and III only

D. I, II and III

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 32

Easy

Which of these is an example of unequal cytokinesis?

A. Mitosis in root tips

B. Spermatogenesis in testes

C. Binary fission in bacteria

D. Budding in yeast

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 33

Medium

Which of the following describes the *lac* operon, as found in *Escherichia coli (E. coli)*?

A. Lactose interacts with a regulator protein, preventing it from binding with the promoter region of the gene.

B. The *lac* operon is activated in the presence or absence of lactose.

C. The *lac* operon operates by controlling the level of translation of mRNA.

D. The *lac* operon is also present in mammals to aid the digestion of lactose in milk.

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 34

Medium

Which mechanism can be used by both unicellular and multicellular organisms to regulate water movement via active transport?

I. Control ion concentration of tissues
II. Use aquaporins to increase water movement
III. Use contractile vacuoles to release water
IV. Use membrane proteins to control ion movement

A. I and II only

B. II and III only

C. IV only

D. I, II and IV only

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 35

Medium

Which row of the table contains **three** correct statements about the transport of substances across the mammalian placenta?

	Simple diffusion	Facilitated diffusion	Active transport
A.	carbon dioxide	mineral ions	fatty acids
B.	oxygen	glucose	amino acids
C.	water	amino acids	mineral ions
D.	antibodies	amino acids	glucose

Revisit | Complete

Mark Scheme

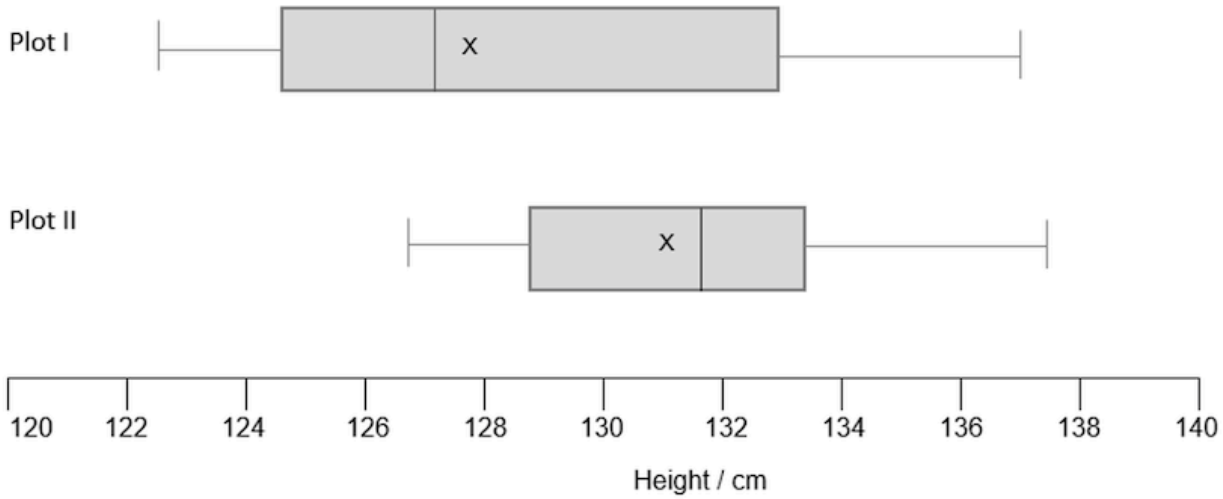
Video Solutions 1

Newton AI

Question 36

Hard

Box-and-whisker plots can be used to represent continuous data. The box-and-whisker plots below show data for heights of two groups of people.



Which statement is correct for one of these box-and-whisker plots?

A. Mean has the same value as the median and the lower quartile is 124 cm.

B. Mean has a lower value than the median and the lower quartile is 128 cm.

C. Mean has a higher value than the median and the upper quartile is 133 cm.

D. Mean has a lower value than the median and the interquartile range is the larger of the two plots.

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 37

Medium

Which row is correct for uncoupled respiration in brown adipose tissue?

A. ATP is produced, used to generate heat, and is more common in adulthood.

B. ATP is produced, used to generate heat, and is more common in childhood.

C. No ATP is produced, and is more common in adulthood.

D. No ATP is produced, and is more common in childhood.

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 38

Medium

Which of the following characteristics would not be subject to selective breeding by farmers?

A. Size of wheat kernels

B. Muscle bulk in beef cattle

C. Longevity of sheep

D. Wool yield from alpacas

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 39

Medium

Which of the following events could lead to the process of ecological succession?

I. A nuclear accident that destroys plant and animal life within a 20 km radius.
II. The dumping of spoil from shale oil mining in large heaps that resemble hills.
III. Any human intervention on an ecosystem, followed by human abandonment.

A. II only
B. I and II only
C. III only
D. I, II and III

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Question 40

Medium

Which of the following is/are possible consequences of a climate change-induced temporal shift in the reproduction cycle of the great tit (*Parus major*)?

I. Earlier hatching and fledging of great tit chicks.
II. Change of food sources sought by great tit parents to feed their young.
III. Extinction.

A. I only
B. I and III only
C. III only
D. I, II and III

Revisit | Complete

Mark Scheme

Video Solutions 1

Newton AI

Section B

Question 41

Medium

[Maximum mark: 5]

The beach strawberry (*Fragaria chiloensis*) and yellow sand verbena (*Abronia latifolia*) are two plant species found in the coastal region of Oregon, USA. Some students decided to record the presence and absence of the two

species in 200 quadrats and use the chi-squared test to examine whether their distributions were associated with each other. The table below shows the observed results obtained.

		Beach strawberry		
		Present	Absent	Total Rows
Yellow sand verbena	Present	90	44	134
	Absent	30	36	66
	Total columns	120	80	200

[© Revision Village 2025]

The expected results and chi-square values were calculated:

Species absent / present	**Expected value**	**Chi-square value**
Yellow sand verbena present Beach strawberry present(A)	80	1.25
Yellow sand verbena present Beach strawberry absent	54	1.85
Yellow sand verbena absent Beach strawberry present	40	2.50
Yellow sand verbena absent Beach strawberry absent	26	

[© Revision Village 2025]

(a) Calculate the chi-square value for the final quadrant using the formula $\chi^2 = \Sigma\frac{(O-E)^2}{E}$. [1]

Degrees of freedom	**Critical value for p=0.05**
1	3.84
2	5.99
3	7.81
4	9.49

(b) Using the **total** chi-squared value, explain the conclusion that can be drawn from the calculated and critical values obtained from the data. [4]

Revisit | Complete

Mark Scheme

Video Solutions 2

Newton AI

Question 42

Medium

[Maximum mark: 10]

Monozygotic twin studies have been used to investigate the effect of environmental factors on epigenetic tags.

The table below summarises data from three twin studies.

Twin study	Gene affected	Environmental condition	Methylation
1	NR3C1	High stress	25% higher than low-stress environment
		Low stress	
2	PPAR-y	Regular exercise	
		Low exercise level	10% less than regular exercise
3	AHRR	Exposure to high air pollution	15% less than low exposure
		Little exposure to air pollution	

(a) Define the term epigenesis. [1]

(b) Explain why monozygotic twins are suitable to investigate the effect of the environment on methylation patterns. [3]

(c) Describe how methylation affects gene expression. [2]

(d) Evaluate the validity of the following statement: “Stress has the most significant impact on methylation in humans.” [4]

Revisit Complete

Mark Scheme

Video Solutions 4

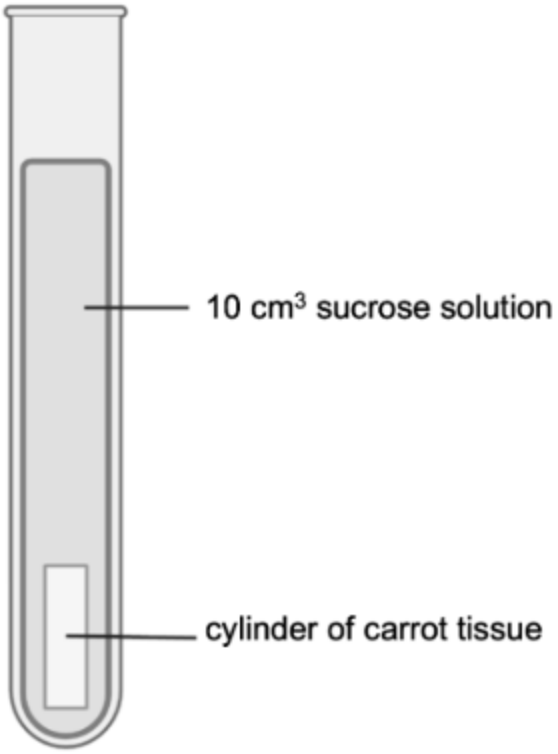
Newton AI

Question 43

Medium

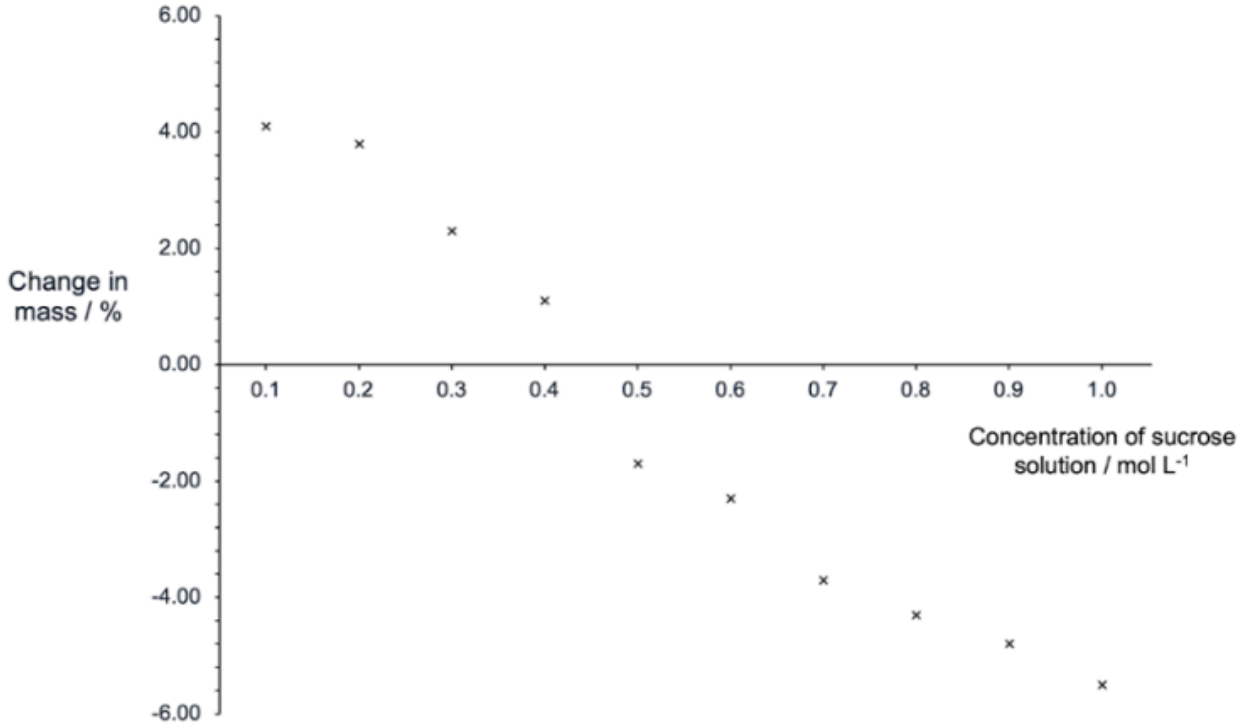
[Maximum mark: 10]

A group of students was investigating the water potential of carrot cells. They cut ten cylinders of tissue from the same carrot, all the same diameter and length. They recorded the mass of each carrot cylinder and then placed each one into different solutions, with varying sucrose concentrations, as shown below.



[© Revision Village 2025. Created in BioRender.com]

After 1 hr, each carrot cylinder was removed from its solution, dried, and its final mass recorded. The students then calculated the percentage change in mass and recorded this in the graph shown.



[© Revision Village 2025]

(a) Draw a line of best fit onto the graph provided. [1]

(b) Use the graph and the conversion table below to estimate the water potential of the carrot cells (ψ_{cell}). Show your working. [3]

mol L^{-1} to solute potential conversion table

Sucrose concentration / mol L^{-1}	**Solute potential / kPA**
0.1	-248.44
0.2	-496.86
0.3	-745.30
0.4	-993.74
0.5	-1242.11
0.6	-1490.62
0.7	-1739.06
0.8	-1987.50
0.9	-2235.94
1.0	-2484.38

(c) Explain what happens inside the carrot cells, in terms of pressure, osmotic and water potentials, when immersed in sucrose concentrations lower than 0.4 mol L^{-1} (hypotonic solutions). [3]

The students repeated the experiment using turnip tissue. The solute potential (ψ_{s}) of the turnip cell contents was given as -1550.40 kPa.

$$\psi_{\text{cell}} = \psi_{\text{s}} + \psi_{\text{p}}$$

(d) Use the equation and 'mol L^{-1} to water potential conversion table' provided to calculate the pressure potential (ψ_p) of the turnip cells when they reached equilibrium in a 0.5 mol L^{-1} sucrose solution. [1]

(e) The students studied the carrot cells under a light microscope after immersing them in the 1.0 mol L^{-1} sucrose solution for one hour. Describe what the students would have observed about the carrot cells. [2]

Revisit | Complete

Mark Scheme

Video Solutions 5

Newton AI

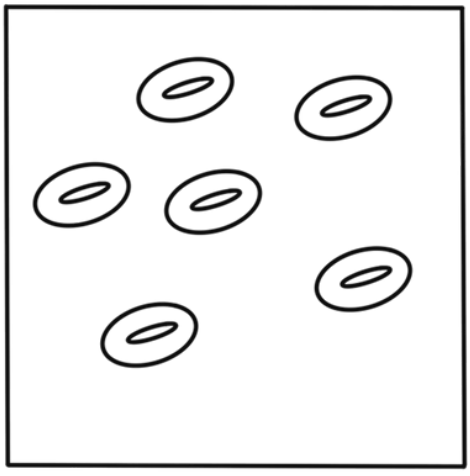
Question 44

Medium

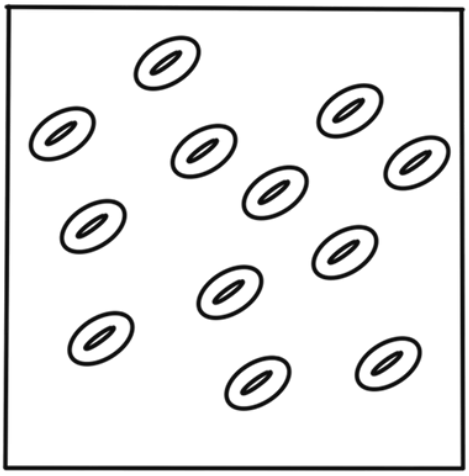
[Maximum mark: 10]

A student wanted to compare the stomatal density on the leaves of two different species of tree. They took impressions of the lower surface of the leaves using clear nail varnish. Below are the student's diagrams of two of the impressions, examined at a magnification of x400.

Species A



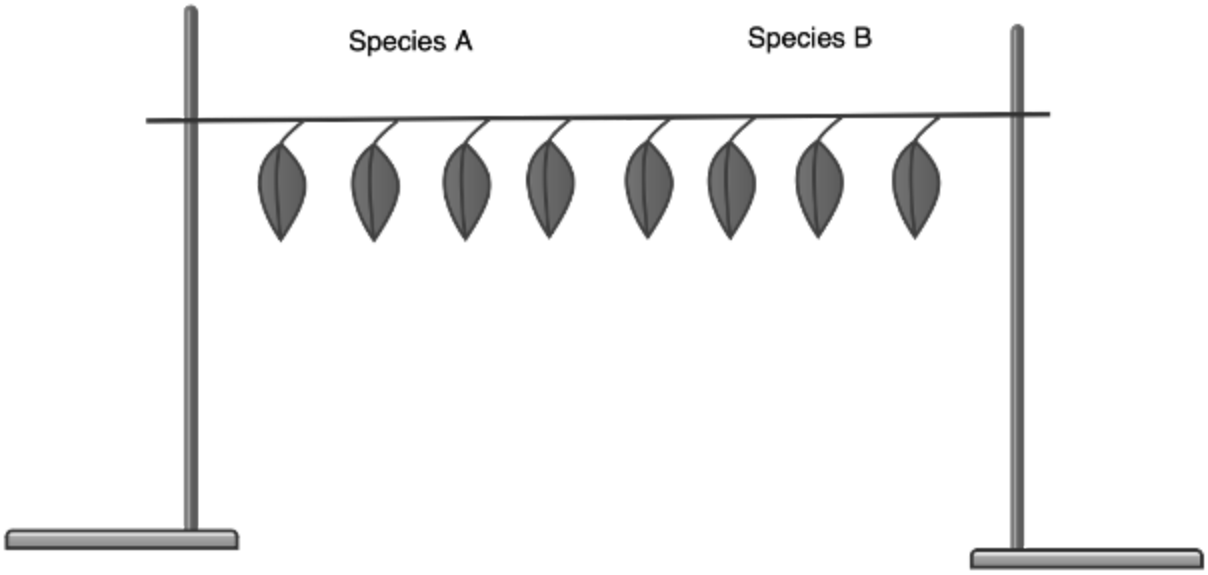
Species B



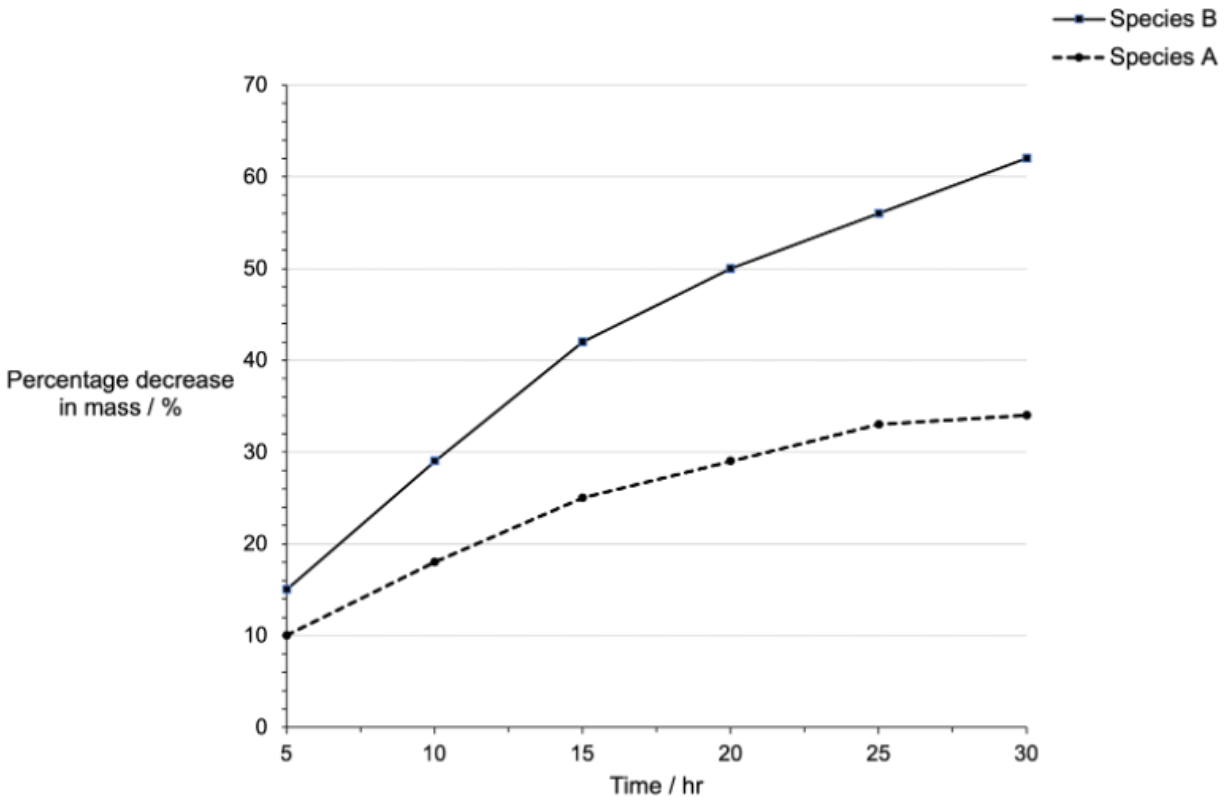
The length of each side of the fields of view shown above is 250μm.

(a) For species B calculate the number of stomata per mm^2 and show your working. [2]

The student then removed four more leaves from each tree and spread a waterproofing agent onto the top surface of each leaf. The leaves were then hung from a piece of string tied between two clamp stands as shown below.



The leaves were then weighed at regular intervals, and their masses were recorded. The percentage change in mass of each leaf was calculated. The mean results for each species are shown below.



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(b) Explain why the percentage change in mass was recorded rather than just the change in mass. [2]

(c) Identify **one** factor, not already mentioned that would need to be controlled in this experiment. [1]

(d) Calculate the difference in percentage change in mass between species A and species B after 30 hours. [1]

(e) Explain why the greater stomatal density of species B leads to the results shown in the graph. [1]

(f) Suggest one reason why the rate of mass lost decreases towards the end of the experiment. [1]

(g) When transpiration is not enough to bring about the movement of water through the plant, root pressure is required. Describe how root pressure is generated. [2]

Thank you Revision Village Members

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