

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 1: BIOLOGICAL MOLECULES
WATER

SCORE

/25

PERCENTAGE

%

STEMUP

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Q1.

* Acute respiratory distress syndrome (ARDS) is a condition that can occur in babies.

In ARDS, cells in the alveoli do not produce enough of a substance called surfactant.

The alveoli cannot expand sufficiently when the baby inhales.

The diagram shows the alveoli of a baby with ARDS and the alveoli of an unaffected baby.



Alveoli of a baby with ARDS



Alveoli of an unaffected baby

Scientists investigated the effect of two synthetic surfactants, A and B, for treating ARDS.

Four groups of rabbits with ARDS were used.

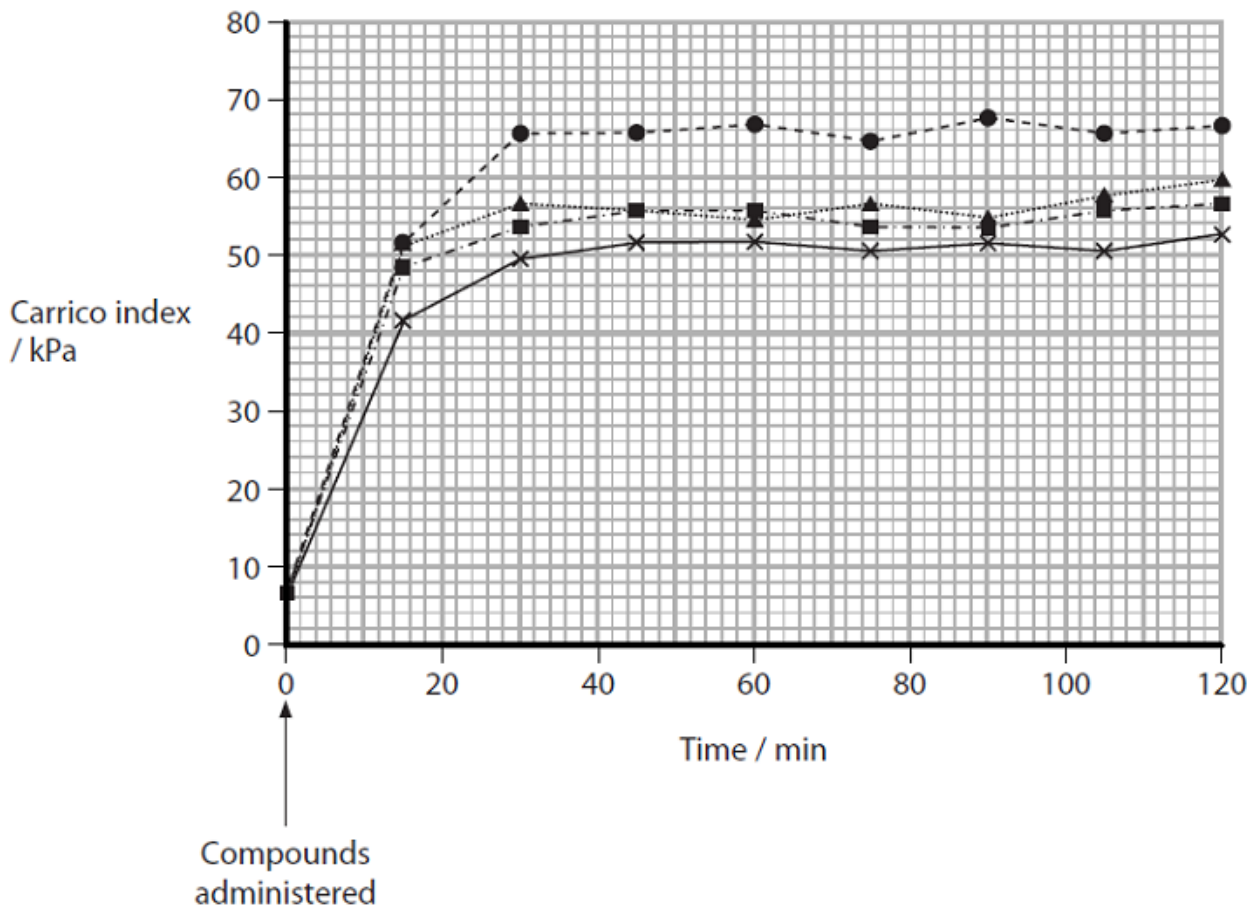
Each group of rabbits was given a different treatment.

- One group received compound A.
- One group received compound B.
- One group received both compound A and compound B.
- One group received a natural surfactant control.

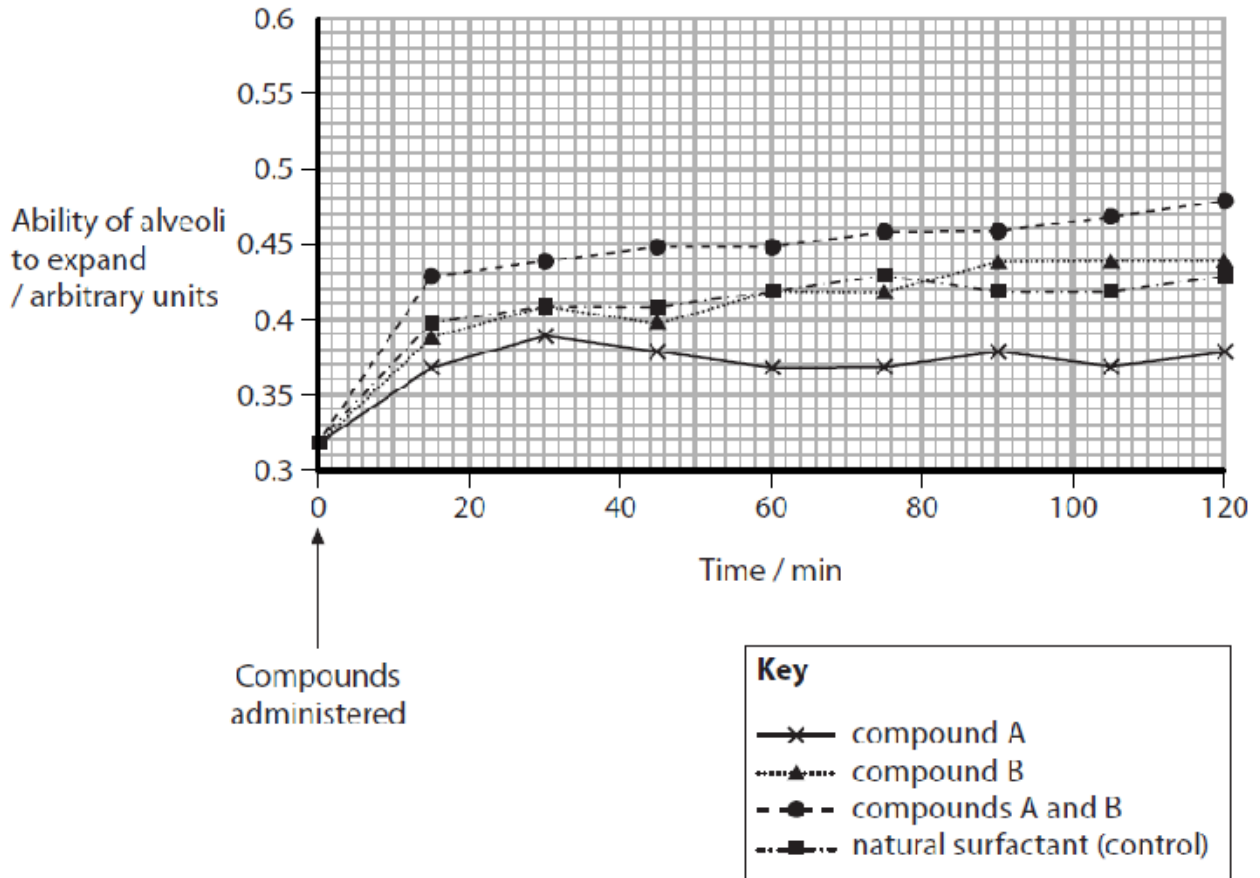
The mean Carrico index of each group of rabbits and the ability of the alveoli to expand were determined every 15 minutes.

Graph 1 and Graph 2 show the results of this investigation.

Graph 1 Effect of compounds A and B on the Carrico index



Graph 2 Effect of compounds on the ability of alveoli to expand



Analyse the data to explain the potential use of these two compounds to treat ARDS in human babies.

(6)

[illegible]

(Total for question = 6 marks)

Q2.

A student planned to keep two species of fish in an aquarium.

One species of fish should be kept at a minimum temperature of 25 °C. The other species

requires a minimum concentration of oxygen of 7.5 mg dm^{-3} water.

Explain why the student chose to keep these two species of fish in an aquarium at 30°C .

(4)

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(Total for question = 4 marks)

Q3.

Answer the questions with a cross in the boxes you think are correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Acute respiratory distress syndrome (ARDS) is a condition that can occur in babies.

In ARDS, cells in the alveoli do not produce enough of a substance called surfactant.

The alveoli cannot expand sufficiently when the baby inhales.

The diagram shows the alveoli of a baby with ARDS and the alveoli of an unaffected baby.



Alveoli of a baby with ARDS



Alveoli of an unaffected baby

The surfactant in the alveoli reduces the surface tension of water.

(i) Which bond is responsible for the cohesive forces between water molecules that contribute to the surface tension of water?

(1)

- ☐ **A** covalent
- ☐ **B** ionic
- ☐ **C** hydrogen
- ☐ **D** hydrophobic

(ii) Surfactant contains phospholipid molecules.

How many of the following components are found in phospholipids?

(1)

- 1 amino acids
- 2 fatty acids
- 3 glycerol
- 4 phosphate

- ☐ **A** one
- ☐ **B** two
- ☐ **C** three
- ☐ **D** four

(Total for question = 2 marks)

Q4.

The photograph shows a wombat, an animal that lives in dry parts of Australia.



Source: © Blue Gum Pictures/Alamy Stock Photo

Wombats are herbivores, feeding on grasses, leaves and bark. Wombats also dig in the soil for roots.

They have behavioural and physiological adaptations to survive periods of severe drought.

The effect of drought on the health of wild wombats was investigated.

Changes in body mass, body condition and the chemical constituents of stomach contents and faeces were recorded.

These changes were related to the changes in the quality and quantity of the food of wombats.

Explain why drought affects the quality and quantity of the food of wombats.

(5)

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(Total for question = 5 marks)

Q5.

Which statements describe some properties of water that are useful to plants?

- 1 Hydrogen bonding makes water a polar solvent.
- 2 Cohesive forces between water molecules allow the water to move in an unbroken stream.
- 3 Weak hydrogen bonds between water molecules attract the molecules to each other and allow water molecules to move easily in relation to one another.

(1)

- ☐ **A** 1 and 2 only
- ☐ **B** 2 and 3 only
- ☐ **C** 1 and 3 only
- ☐ **D** 1, 2 and 3

(Total for question = 1 mark)

Q6.

Transpiration moves water and mineral ions from the roots to the leaves of plants.

Explain how transpiration depends on the dipole nature of water.

(3)

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(Total for question = 3 marks)

Q7.

Macroalgae and microalgae are photosynthetic organisms.

Seaweeds are macroalgae that live attached to rock in coastal areas.

Some seaweeds are green, some are brown and some are red.

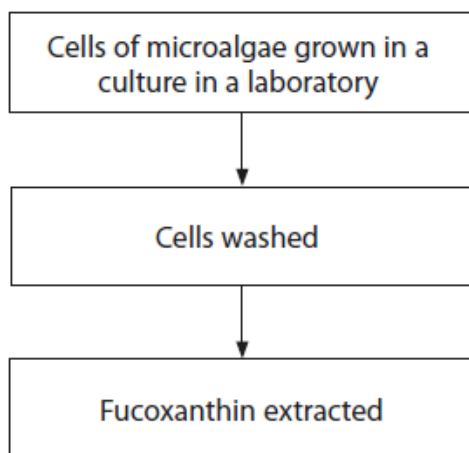
The colour of seaweeds depends on the photosynthetic pigments contained in their cells.

Green seaweeds contain chlorophyll, brown seaweeds contain chlorophyll and fucoxanthin and red seaweeds contain chlorophyll and phycoerythrin.

Fucoxanthin is found in both macroalgae and microalgae.

Fucoxanthin has anti-inflammatory, anti-tumour, anti-diabetes, anti-malarial and anti-obesity activity in humans.

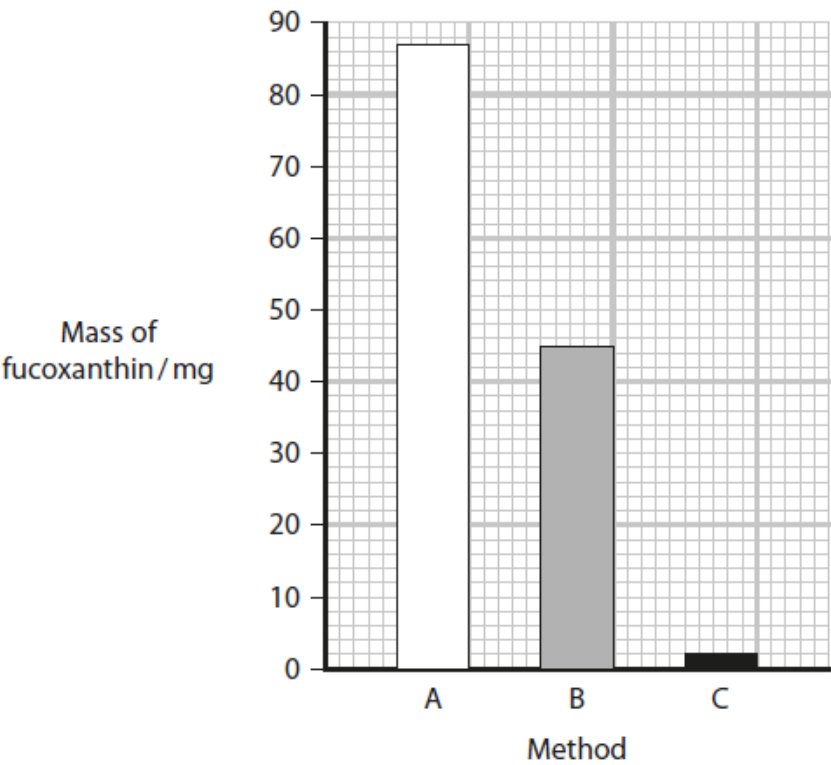
The diagram outlines the steps taken to extract fucoxanthin from microalgae.



The table shows three methods used for washing the cells and extracting the fucoxanthin.

Method	Liquid used for washing cells	Chemical used to extract fucoxanthin
A	water	ethanol
B	culture media	ethanol
C	culture media	water

The graph shows the mass of fucoxanthin extracted from 1 dm³ of cell culture.



(i) Calculate how many times more fucoxanthin was extracted using method A compared with method B.

(1)

Answer

(ii) Explain why different masses of fucoxanthin were extracted using these three methods.

(3)

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(Total for question = 4 marks)

Mark Scheme

Q1.

Question Number	Indicative content
*	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content Descriptions (D) • A, B increase Carrico index / alveolar expansion • A and B together gives the highest level of improvement in Carrico index / more than natural surfactant • Both compounds A and B together are best to treat ARDS / increase the Carrico index • A alone is least effective • B increases Carrico index more than A • in all cases, the improvement is rapid and persists from 30 to 120 minutes Analysis (A) • valid comparison with natural surfactant / control • B has similar increase in Carrico index as natural surfactant / control • A has lower increase compared to natural surfactant / control • positive correlation between alveoli expansion and Carrico index • improving alveoli expansion results in improvement in blood oxygenation which improves Carrico index • the artificial surfactants allow alveoli to expand, increasing surface area and oxygen diffusion into blood • unaffected baby has index of 67 which is what A and B reach Potential use (P) • rabbits may not respond in the same way as humans to the compounds • may not be safe in humans • small sample size • no comparison has been made with no surfactant

Level	Marks	
0	0	No awardable content
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The explanation will contain basic information with some attempt made to link knowledge and understanding Only D
2	3-4	An explanation will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure. D + A or D+ P
3	5-6	An explanation is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning which is clear and logically structured. D+A+P

Q2.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to four of the following: - because 30 °C is an appropriate temperature for one species and provides enough oxygen for the other species (1) - because if the temperature was above {30 / 40} °C there would be less oxygen dissolved in it (1) - so there would not be enough oxygen for {respiration / metabolism / ATP production} (1) - because if the temperature was above {25 / 30} °C the enzymes would be denaturing (1) - because the temperature was below {25 / 30} °C the enzymes would not have enough {kinetic energy / collisions / enzyme substrate complexes} (1)	Accept because 30 °C satisfies the requirements of both fish Do not accept start to denature Accept for 1 mark 30 °C is close to the optimum temperature for the enzymes	(4)

Q3.

Question Number	Answer	Mark
(i)	The only correct answer is C hydrogen <i>A is incorrect because covalent bonds do not form between neighbouring water molecules</i> <i>B is incorrect because ionic bonds do not form between neighbouring water molecules</i> <i>D is not correct because hydrophobic bonds do not form between neighbouring water molecules</i>	1

Question Number	Answer	Mark
(ii)	The only correct answer is C three <i>A is incorrect because there are three components</i> <i>B is incorrect because there are three components</i> <i>D is incorrect because amino acids are not a component</i>	1

Q4.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to five of the following: - because there would be less water to take up from the soil (1) - therefore there will be fewer {mineral ions / minerals} (transported to the rest of the plant / taken up) (1) - example of a mineral ion deficiency on the plant explained (1) - there will be less water for {photolysis / light-dependent reaction / photosynthesis} (1) - therefore there will be less GALP produced in the {light-independent reaction / Calvin cycle} (1) - therefore less {NPP / plant biomass} (1)	ACCEPT plants will {wilt / die} without water ACCEPT less glucose produced	(5)

Q5.

Question Number	Correct Answer	Additional guidance	Mark
	D		(1)

Q6.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the three of the following: • water has a (small) positively charged {hydrogen / end} and a (small) negatively charged {oxygen / end} (1) • therefore hydrogen bonds form (between water molecules) (1) • therefore water moved due to {cohesion / cohesive forces} (between water molecules) (1) • (because of) {adhesion / adhesive forces} between water and xylem (1)	ACCEPT cohesive properties ACCEPT adhesive properties water moves due to adhesive and cohesive forces =1 mark if no other mark awarded	(3)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	• 2.0 / 1.9 / 1.93 (times / x)	DO NOT ACCEPT 1.93 recurring	(1)
(ii)	An explanation that makes reference to three of the following: • water is more effective than culture media for washing (1) • {water is not the solvent / ethanol is the solvent} for fucoxanthin (1) • ethanol {increases permeability of / disrupts} (cell / vacuole) membrane (1) • more fucoxanthin extracted in method A (compared with method B) because water enters the seaweed {by osmosis / causing the cells to burst} (1)	ACCEPT more fucoxanthin extracted in A because washed with water	(3)