

A-Level Biology

ATP, Water and Inorganic Ions

Question Paper

Time available: 87 minutes

Marks available: 70 marks

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(a)

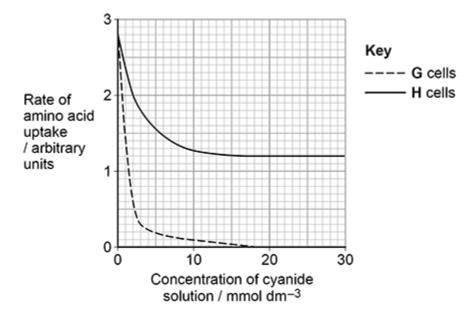
Describe how an ATP molecule is formed from its component molecules.				
			 	

(4)

A scientist investigated the effect of cyanide on the rate of amino acid uptake in two types of *Escherichia coli*, **G** and **H**.

- **G** cells produce enzymes involved in ATP production **only** on their cell-surface membrane.
- **H** cells produce enzymes involved in ATP production on their cell-surface membrane **and** in their cytoplasm.

The graph below shows her results.



ecrease in the rate of ar ition.	
Answer	%
	Answer

	
	-
	
	-
Water is used to hydrolyse ATP.	
Name the two products of ATP hydrolysis.	
l	

Hydrolysis of ATP is catalysed by the enzyme ATP hydrolase.

A student investigated the effect of ATP concentration on the activity of ATP hydrolase. She used shortening of strips of muscle tissue caused by contraction as evidence that ATP was being hydrolysed.

- She took four slides **A**, **B**, **C** and **D**, and added strips of muscle tissue of the same length to each slide.
- She then added the same volume of ATP solutions of different concentrations to the four slides and left each slide for five minutes.
- She then recorded the final length of each strip of muscle tissue.

Her results can be seen in the table.

Slide	Concentration of ATP solution added to slide / × 10 ⁻⁶ mol dm ⁻³	Final length of muscle tissue after 5 minutes / mm
Α	2	36
В	4	31
С	6	29
D	8	26

Other than those given, name two variables the student should have controll	ea.
l	
2	
Describe and explain the pattern shown by the data in the table.	
Description	
Explanation	
	

(2)

(e) The hydrolysis of 1 dm³ of a 1 mol dm⁻³ solution of ATP releases 30 500 J of energy.

60% of the energy released during the hydrolysis of 1 mol dm $^{-3}$ of ATP is released as heat; the rest is used for muscle contraction.

The student added $0.05~\text{cm}^3$ of ATP solution to slide D.

Calculate the energy available from ATP for contraction of the muscle on this slide.

Answer = _____ J (3)

(Total 10 marks)

3. The diagram below shows the structure of molecules found in organisms.

Ribose

Adenine

A B

H O H

HO OH

H H2N C C COOH

H D

(a)	Complete the table below by putting the correct letter, A, B, C or D, in the box next to each
	statement. Each letter may be used once, more than once, or not at all.

Letter	Statement
	is a monomer in an enzyme's active site
	is a monomer in cellulose
	is produced during photosynthesis and respiration
	forms a polymer that gives a positive result with a biuret test

(4)

- (b) Raffinose is a trisaccharide of three monosaccharides: galactose, glucose and fructose. The chemical formulae of these monosaccharides are:
 - galactose = $C_6H_{12}O_6$
 - glucose = $C_6H_{12}O_6$
 - fructose = $C_6H_{12}O_6$

Give the number of carbon atoms, hydrogen atoms and oxygen atoms in a molecule of raffinose.

Number of carbon atoms	
Number of hydrogen atoms	
Number of oxygen atoms	

(1)

	A biochemical test for reducing sugar produces a negative result with	141111030 3010	
	Describe a biochemical test to show that raffinose solution contains a	ı non-reducinç	g sugar.
			
			(Total 8 m
(a)	Describe the roles of iron ions, sodium ions, and phosphate ions in co	ells.	`
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	Describe how.	ire.
	(Tota	al 10 m
(a)	(Total Explain five properties that make water important for organisms.	al 10 m
(a)		al 10 m

Describe the biochemical tests you would use to confirm the presence of lipid, non-reducing sugar and amylase in a sample.		

(5)

(c)	Describe the chemical reactions involved in the conversion of polymers to monomers and monomers to polymers.	
	Give two named examples of polymers and their associated monomers to illustrate your answer.	
		
	<u> </u>	
		
		(5)
	(Total 15 mar	ks)

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Describe the μ	process of semi	i-conservative	replication of	DNA.	
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6.

(5) (Total 10 marks)

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F	Property 1
E	Biological importance within cells
_	
_	
F	Property 2
E	Biological importance within cells
_	
_	
	Other than sodium, name one inorganic ion and give one example of its biological mportance in a cell.
١	lame of inorganic ion
Е	Biological importance
_	
_	
C	Compare and contrast the processes by which water and inorganic ions enter cells.
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_	
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Water and inorganic ions have important biological functions within cells.

7.