



**Q2.**

(a) ATP is useful in many biological processes. Explain why.

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**(4)**

**(Total 4 marks)**



**Q3.**

Water and inorganic ions have important biological functions within cells.

- (a) Give **two** properties of water that are important in the cytoplasm of cells. For each property of water, explain its importance in the cytoplasm.

Property 1.....

Biological importance within cells.....

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Property 2.....

Biological importance within cells.....

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**(4)**

- (b) Other than sodium, name **one** inorganic ion and give **one** example of its biological importance in a cell.

Name of inorganic ion.....

Biological importance.....

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**(2)**

- (c) Compare and contrast the processes by which water and inorganic ions enter cells.

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**(3)**

**(Total 9 marks)**



**Q1.**

Scientists investigated treatment of a human bladder infection caused by a species of bacterium. This species of bacterium is often resistant to the antibiotics currently used for treatment.

They investigated the use of a new antibiotic to treat the bladder infection. The new antibiotic inhibits the bacterial ATP synthase enzyme.

- (a) Place a tick (✓) in the appropriate box next to the equation which represents the reaction catalysed by ATP synthase.

$ATP \rightarrow ADP + P_i + H_2O$	
$ATP + H_2O \rightarrow ADP + P_i$	
$ADP + P_i \rightarrow ATP + H_2O$	
$ADP + P_i + H_2O \rightarrow ATP$	

**(1)**

- (b) The new antibiotic is safe to use in humans because it does **not** inhibit the ATP synthase found in human cells.

Suggest why human ATP synthase is not inhibited and bacterial synthase is inhibited.

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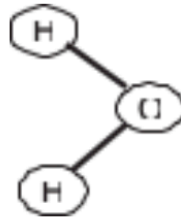
**(1)**



**Q4.**

Fig. 2.1 represents a water molecule.

Fig. 2.1



Ponds provide a very stable environment for aquatic organisms.

Three properties of water that contribute to this stability are as follows:

- the density of water decreases as the temperature falls below 4 °C so ice floats on the top of the pond
- it acts as a solvent for ions such as nitrates (NO<sub>3</sub><sup>-</sup>)
- a large quantity of energy is required to raise the temperature of water by 1 °C.

Explain how these three properties help organisms survive in the pond. (8 marks)

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**(8)**  
**(Total 8 marks)**





**Q2.**

- (a)
1. Releases energy in small / manageable amounts
    1. Accept less than glucose
  2. (Broken down) in a one step / single bond broken immediate energy compound / makes energy available rapidly
    2. Accept easily broken down
  3. Phosphorylates / adds phosphate makes (phosphorylated substances) more reactive / lowers activation energy
    3. Do not accept phosphorus or P on its own
  4. Reformed / made again
    4. Must relate to regeneration

**4**

**Q3.**

- (a)
1. Polar molecule
  2. Acts as a (universal) solvent
- OR**
3. (Universal) solvent
  4. (Metabolic) reactions occur faster in solution
- OR**
5. Reactive
  6. Takes place in hydrolysis / condensation / named reaction
- Polar molecule so acts as (universal) solvent so (metabolic reactions are faster = 3 marks*

**[4]**

- (b) Name of ion
- Correct function within cell
- Ions other than sodium in specification are  $H^+$ ,  $Fe^{2+}$  and  $PO_4^{3-}$  but accept any correct ion (other than sodium) plus relevant function = 2.*
- Allow ion to be named in words but not as element, e.g, iron ion but not iron.*

**4**

- (c)
1. Comparison: both move down concentration gradient
  2. Comparison: both move through (protein) channels in membrane
    - Accept aquaporins (for water) and ion channels
  3. Contrast: ions can move against a concentration gradient by active transport

**2**

**3**  
**[9]**



Q1.

(a)

$\text{ATP} \rightarrow \text{ADP} + \text{P}_i + \text{H}_2\text{O}$	
$\text{ATP} + \text{H}_2\text{O} \rightarrow \text{ADP} + \text{P}_i$	
$\text{ADP} + \text{P}_i \rightarrow \text{ATP} + \text{H}_2\text{O}$	<input checked="" type="checkbox"/>
$\text{ADP} + \text{P}_i + \text{H}_2\text{O} \rightarrow \text{ATP}$	

1

- (b) 1. Human ATP synthase has a different tertiary structure to bacterial ATP synthase  
**OR**  
 Human ATP synthase has a different shape active site to bacterial ATP synthase  
**OR**  
 Antibiotic cannot enter human cells/mitochondria  
**OR**  
 Antibiotic not complementary (to human ATP synthase)

1

Q4.

**ice floats**

(ice less dense because) molecules spread out  
 molecules form, crystal structure / lattice / AW  
 ice forms insulating layer / clearly described  
 water (below ice), does not freeze / still liquid /  
 remains water / kept at higher temperature  
 organisms do not freeze  
 animals / organisms, can still, swim / move  
 allows, currents / nutrients, to circulate

**solubility**

ions / named ion, polar / charged  
 ions / named ion, attracted to / bind to / interact with, water  
 (named) organisms / plants / animals,  
 uptake / AW, minerals / named mineral / nutrients  
 correct use of named, mineral / nutrient, in organism

**temperature stability**

many / stable, (hydrogen) bonds between molecules  
 at lot of energy to, force apart molecules / break bonds  
 high (specific) heat capacity  
 temperature does not change much / small variation in temperature  
 effect of temperature on , enzymes / metabolic rate  
 gases remain soluble  
 hydrogen bonds

8



<p><b>09.1</b></p>	<p><b>Iron ions</b></p> <p>1. Haemoglobin binds/associates with oxygen <b>OR</b> Haemoglobin transports/loads oxygen;</p> <p><b>Sodium ions</b></p> <p>2. <u>Co-transport</u> of glucose/amino acids (into cells); 3. (Because) sodium moved out by active transport/Na – K pump; 4. Creates a sodium concentration/diffusion gradient; 5. Affects osmosis/water potential;</p> <p><b>Phosphate ions</b></p> <p>6. Affects osmosis/water potential; 7. Joins nucleotides/in phosphodiester bond/in backbone of DNA/RNA/in nucleotides; 8. Used in/to produce ATP; 9. Phosphorylates other compounds (usually) making them more reactive; 10. Hydrophilic/water soluble part of phospholipid bilayer/membrane;</p>	<p>5 max</p>	<p>Must have MP1 for 5 max</p> <p>3 max for sodium and 3 max for phosphate</p> <p>1. Ignore reference to 2<sup>+</sup> or 3<sup>+</sup> in Fe<sup>2+</sup> or Fe<sup>3+</sup></p> <p>Accept 5. OR 6. – <b>not</b> both</p> <p>Accept for 1 mark, Sodium ions cause water reabsorption in kidneys OR Sodium ions establish resting potential (in neurones) OR Sodium ion diffusion creates action potential</p> <p>8. Reject 'energy produced'</p>
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