Water at Work

Trace how water supports life in a tide pool.

MAQ.1.2 "Describe the role of water within biological systems (e.g., provides the medium necessary to allow for life processes such as protein synthesis, enzymatic reactions, and passive transport)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB As you read, number four examples of water helping materials move or react, then underline the materials involved in each example.

A Fish in a Changing Tide Pool

1. At low tide, a tide pool can look still, but water is busy carrying materials. A small fish draws water across its gills. Oxygen dissolved in that water moves into the blood because oxygen is more concentrated in the water than in the blood. This movement is diffusion, a form of passive transport that does not require the fish's cells to spend energy. The blood then delivers oxygen to cells, where it helps release usable energy from food. Without water flowing past the gills, the fish cannot get oxygen from its surroundings in this way.

2. Inside each fish cell, water makes up much of the cytoplasm, the fluid around its structures. Amino acids can move through this watery space to ribosomes. There, ribosomes join amino acids in the order specified by a messenger RNA molecule to build proteins. Water does not supply the instructions or become the finished protein. Instead, it provides a medium in which these materials can move and meet. Many reactions also depend on enzymes, which speed chemical changes. When enzyme molecules and their reactants are dispersed in cell water, they can come together and react.

3. As sunlight warms the tide pool, evaporation can make its water saltier. If the pool becomes saltier than the fluid inside a fish's cells, water tends to move out of those cells across their membranes. This passive movement of water is called osmosis. The fish can regulate its internal salt and water levels, but a large change can strain that balance. If cells lose too much water, the watery space needed for materials to move and meet shrinks. Protein production and enzyme-driven reactions may then be disrupted. Water is not just the fish's habitat; it is also essential inside its cells.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does water at the gills make passive transport of oxygen into the fish possible?

2. What does water in the cytoplasm do for protein synthesis, and what does it not do?

3. How does water inside cells help enzyme-driven reactions occur?

4. If the tide pool becomes much saltier, how can passive movement of water affect protein production and enzyme reactions?

3 YOUR TURN

Your own words

A seaweed cell is moved from seawater into much fresher water. In four sentences, predict how water moves across its membrane and explain how the change might affect protein synthesis and enzyme reactions inside the cell.

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PART 1 · READ AND MARK

As you read, number four examples of water helping materials move or react, then underline the materials involved in each example. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does water at the gills make passive transport of oxygen into the fish possible?	**Water carries dissolved oxygen past the gills. Oxygen diffuses from the water, where its concentration is higher, into the blood.**
2	What does water in the cytoplasm do for protein synthesis, and what does it not do?	**It provides a medium through which amino acids can move to ribosomes. It does not provide the instructions for building proteins.**
3	How does water inside cells help enzyme-driven reactions occur?	**Cell water disperses enzymes and their reactants so they can move, meet, and react.**
4	If the tide pool becomes much saltier, how can passive movement of water affect protein production and enzyme reactions?	**Water moves out of the fish's cells by osmosis. If they lose too much water, materials have less watery space in which to move and meet, which may disrupt protein production and enzyme-driven reactions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Because the surrounding water is fresher, water moves into the seaweed cell by osmosis. Entering water can dilute substances in the cytoplasm. This change in the watery medium may alter how amino acids reach ribosomes for protein synthesis. It may also change how often enzymes meet reactants, so their reactions may change.

Accept explanations that connect a process to water carrying or dispersing materials, rather than simply stating that organisms need water. For the open task, accept reasonable effects described as possibilities; extra water does not necessarily make cell reactions faster.