Tide Pool Connections

Trace how water's properties shape conditions at the shore.

MAQ.1.1 "Characterize the physical and chemical properties of water, including specific heat, surface temperature, universal solvent, and hydrogen bonding between water molecules (i.e., cohesion/adhesion/capillary action)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each water property named in the passage, circle an effect it causes in the tide pool, and draw a line connecting each property to its effect.

A Tide Pool Through the Day

1. At low tide, a tide pool sits beside sunlit rocks. The rocks warm quickly, but the water's surface temperature rises more slowly. Water has a high specific heat: it takes a lot of energy to raise the temperature of a given amount of water. After sunset, the rocks cool quickly while the pool loses heat more slowly. This slower heating and cooling can reduce sudden temperature swings for animals in the pool. Sunlight still warms the top layer first, so shallow water may be warmer at the surface than below. Depth, shade, and mixing also affect the temperature animals experience.

2. A tide brings seawater into the pool, leaving salt dissolved throughout it. Each water molecule, H_2O, has an uneven distribution of electrical charge: its oxygen end is slightly negative, and its hydrogen ends are slightly positive. These ends attract the charged particles that separate from salt crystals, helping the particles spread through the water. For this reason, water is often called the universal solvent, although it does not dissolve everything. Oil, for example, forms a separate layer instead of mixing readily with water. As pool water evaporates, the salt remains, and the water left behind becomes saltier.

3. Near the pool's edge, water clings to a narrow crack in the rock and can climb slightly above the pool's level. Water molecules attract one another through hydrogen bonds, weak attractions between the slightly positive hydrogen end of one molecule and the slightly negative oxygen end of another. This attraction gives water cohesion, which helps molecules pull neighboring molecules along. Water also sticks to some rock surfaces through adhesion. In a narrow crack, adhesion draws water against the rock while cohesion keeps the rising water connected. Together, these effects produce capillary action, which can move water through tiny spaces.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does the pool's temperature change more slowly than the rocks' temperature during the day and after sunset?

2. How does the electrical charge of a water molecule help explain why salt spreads through the pool but oil does not mix readily with it?

3. How do hydrogen bonds between water molecules help water move up the rock crack?

4. Why does water rise in a narrow rock crack rather than simply sticking to the rock at the pool's level?

3 YOUR TURN

Your own words

Imagine a shallow salt-marsh channel beside a strip of sand. In five sentences, predict how the water affects temperature from day to night, dissolves salt, and moves through tiny spaces between sand grains; explain the role of hydrogen bonds, cohesion, and adhesion.

ANSWER KEY

Tide Pool Connections

HIGH SCHOOL · MAQ.1.1

PART 1 · READ AND MARK

Underline each water property named in the passage, circle an effect it causes in the tide pool, and draw a line connecting each property to its effect. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does the pool's temperature change more slowly than the rocks' temperature during the day and after sunset?	**Water's high specific heat means it takes more energy to warm the pool, and the pool also loses heat more slowly than the rocks.**
2	How does the electrical charge of a water molecule help explain why salt spreads through the pool but oil does not mix readily with it?	**The slightly charged ends of water molecules attract the charged particles from salt crystals, helping them spread. Oil does not mix readily with water.**
3	How do hydrogen bonds between water molecules help water move up the rock crack?	**Hydrogen bonds give water cohesion, so molecules in the crack pull neighboring water molecules along.**
4	Why does water rise in a narrow rock crack rather than simply sticking to the rock at the pool's level?	**Adhesion draws water against the rock, while cohesion keeps water molecules connected as they rise. Together, these effects produce capillary action.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In sunlight, the channel water warms more slowly than nearby sand because water has a high specific heat. At night, it cools more slowly than the sand. The uneven electrical charge of water molecules helps salt separate into charged particles and dissolve. Adhesion draws water along sand-grain surfaces, while cohesion pulls other water molecules with it through tiny spaces, producing capillary action. Hydrogen bonds between water molecules cause that cohesion.

Accept descriptions of slower temperature change that correctly use high specific heat. For capillary action, look for both attraction to a surface and attraction between water molecules.