**A sample AP style essay.**

3. Water is essential to all living things.

(a) **Discuss** THREE properties of water.

(b) **Explain** each of the following in terms of the properties of water. You are not limited to the three properties discussed in part (a):

• the role of water as a medium for the metabolic processes of cells

• the ability of water to moderate temperature within living organisms and in organisms’ environments

• the movement of water from the roots to the leaves of plants

**A sample AP style answer key**

**(a) Discuss** THREE properties of water (**6 points maximum)**:

Name of property **and** correct description **(2 points)**.

Points **MUST** provide both property and description.

**Property and Description**

* Polarity of water: Polar covalent bonds created by unequal sharing of electrons between O and H **within** the molecule
* Specific heat/high heat capacity: Heat absorption without temperature change
* High heat of vaporization: Water molecules absorb energy as it changes state/breaking of bonds by absorbing energy
* Adhesion: Attraction to other molecules that are polar or have charge
* Cohesion: Attraction to other water molecules due to polar nature of water/surface tension
* Three states of matter Ice–liquid–gas (vapor): Kinetic energy differences and/or Expands at 4°C to become less dense
* Repels hydrophobic material: Moves aside nonpolar substances

**(b) Explain** each of the following in terms of water properties **(6 points maximum; 2 points for each part)**. To earn 10 points, students must get at least 1 application point for each area.

**Water’s role as a medium** for the metabolic processes of cells **(2 points maximum)**:

* Diffusion—allows for movement of materials through an aqueous solution down the concentration gradient
* Osmosis—movement of water across membranes due to water potential differences (down the gradient)
* Solvent—dissociation/ionization of materials
* Buffer—explanation of role water plays in formation of bicarbonate ion

**Water’s ability to moderate temperature** within living organisms/environments **(2 points**

**maximum)**:

* Specific heat—moderates climates, maintains stable temperature in cells, constant internal environment
* High heat of vaporization—perspiration cooling, evaporative cooling
* Ice forming and acting as insulator for lakes, keeping water in liquid state

**Water from the roots to the leaves** of plants **(2 points maximum)**:

* Transpiration—moving water away from leaves due to water potential differences/evaporation through stomata
* Capillary action of water due to adhesion and cohesion
* Root pressure—driven by osmosis/movement of water into roots
* Negative pressure potential—caused by surface tension of water as it is pulled up xylem