What every operator should know about temperature

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Knowledge	Principle	A practical consideration
Fahrenheit (F) and Celsius (C) conversions	$°C = (°F − 32) ÷ 1.8$ $°F = (°C × 1.8) + 32$	Though the metric scale is used widely, temperature is often measured and understood in Fahrenheit. Conversions are sometimes necessary.
Q_{10} reaction	For every 10°C increase in temperature, the chemical or biochemical reaction rate doubles. For every 10°C decrease in temperature, the chemical or biochemical reaction rate is reduced by half. This is a generalization supported by the Arrhenius Equation for chemical reactions.	We apply this principle at home when we use warm rather than cold water to dissolve sugar for making lemonade and at work when we make seasonal adjustments in the activated sludge solids retention time to account for the slower growth rate of nitrifying organisms at colder wastewater temperatures.
Gay–Lussac's Law	The pressure of a fixed mass and fixed volume of a gas is directly proportional to the temperature of the gas.	Chlorine containers have fusible plugs that are designed to melt at approximately 74°C (165°F). Without this safety device, temperatures above this level could increase the gas pressure in the fixed-volume container and cause it to rupture catastrophically.
Charles' Law	As absolute temperature increases, the volume of a gas increases proportionally. This is a variation of Gay–Lussac's Law. (Note: Absolute temperature is measured using Rankine and Kelvin scales, but the general principle applies using any temperature scale.)	
Solubility	Gas solubility in water generally decreases with increasing temperature (and vice versa). Chemical solubility in water generally increases with increasing temperature (and vice versa).	When performing a biochemical oxygen demand (BOD) analysis, we allow cold samples to reach room temperature to ensure dissolved oxygen and temperature reach equilibrium prior to incubation at 20°C. Otherwise, dissolved oxygen might come out of solution during incubation and bias the BOD result.
Water density	The density of water decreases with increasing temperature above 4°C.	Thermal stratification can occur in ponds and tanks when lower-density warm water flows into higher-density cold water. This can result in solids loss as the warm water flows across the surface.
Endothermic reactions	Endothermic reactions consume heat.	Photosynthesis is a not-so-obvious endothermic biochemical reaction. Ice packs in first-aid kits are more obvious, as they produce cold through a chemical reaction between ammonium nitrate and water when the packs are crushed.
Exothermic reactions	Exothermic reactions produce heat.	Remember the expression, "Do as you oughta, add acid to wata"? Mixing water and a strong acid causes an immediate and localized exothermic reaction that will cause splattering and create a safety hazard.
Evaporation and condensation	Evaporation is the change of a substance from a liquid phase to its gas phase as the temperature of the liquid increases. Condensation is the change of a substance from its gas phase to its liquid phase as the gas is cooled.	We can readily see evaporation and condensation occurring simultaneously at the surface of process tanks during cool weather. Evaporation must be measured when conducting a tank or pond leak test so the water loss is not measured as a leak. Tanks and pipes that convey cooler liquids in humid environments often are insulated to prevent condensation that can cause corrosion.

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