

Be able to define

Solvent & Solute

Dipole interaction

Hydrogen bonding

Surface tension

Vapor pressure

Saturated

Unsaturated & Supersaturated

Miscible & Immiscible

ANSWERS

Solvent & Solute

Solvents are the liquid base that dissolves the stuff in a solution. The stuff that dissolves is the solute. Salt water has water as the solvent, salt as the solute.

Dipole interaction

When a polar molecule is near other polar molecules, the positive side of one molecule is attracted to the negative side of the next molecule. This inter-molecular attraction is the result of polar bonds, which are the result of electronegativity between two bonded atoms.

Hydrogen bonding

This is a type of dipole interaction, but when hydrogen is the atom bonding, it so readily loses its electron, the electronegativity is so great, the polarity of the bonds so great, that this kind of dipole interaction (hydrogen present) is so much stronger than "regular" dipole interaction, it gets its own name.

Surface tension

At the surface of a liquid the molecules readily stick together, or bond molecule to molecule. This creates a sort of skin on the surface of water. All liquids have surface tension, water greater than most due to its strong hydrogen bonding.

Vapor pressure

In a sealed system, the added pressure provided by the gas created by the evaporation of a liquid. Water has a low vapor pressure (it doesn't evaporate well) because of the many hydrogen bonds between the molecules.

Saturated

A given sample of solvent can only hold a certain amount of solute. When a solvent has all the solute it can carry, it's said to be filled, or saturated.

Unsaturated & Supersaturated

If a solvent can hold more solute than is present, that solution is said to be unsaturated (not filled up). Sometimes certain molecules (sugar in water) can be dissolved into the solvent beyond the "normal" capacity. Often you superheat the solvent, then cool it down slowly and without shaking it, and the cooler solvent will continue to hold more solute than you could stir in if the solvent started at that cooler temperature.

Miscible & Immiscible

When 2 liquids (or more) are mixed together, they will dissolve into one another, or not. Polar solvents dissolve polar solutes, while nonpolar solvents dissolve nonpolar solutes. Like dissolves like.

If 2 or more liquids dissolve into each other they're said to be miscible.

If they don't, they're immiscible.

Oil and vinegar would be immiscible. Milk and water would be miscible.

1. Can you put 130 grams KNO_3 into 100 mL of water at 60°C ?
2. Can you put 140 grams KI into 100 mL of water at 10°C ?
3. You have a 100 mL saturated solution of KClO_3 at 50°C , what happens if you cool it down to just 40°C ?
4. Your saturated 100 mL solution of NaNO_3 at 20°C is heated up to 50°C . How many more grams of solute will fit into the hotter solution?
5. How many grams of ammonia fit into 100 mL of water at 10°C ?

Then... How many grams of ammonia would fit into just 43 mL of water also at 10°C ?

1. Can you put 130 grams KNO_3 into 100 mL of water at 60°C ? No, it will saturate at 105 g at that temperature.
2. Can you put 140 grams KI into 100 mL of water at 10°C ? No, it will saturate at 135 g at that temperature.
3. You have a 100 mL saturated solution of KClO_3 at 50°C , what happens if you cool it down to just 40°C ? At the warmer temp it can hold 22 g, but at 40°C it can only hold 15 g, so, 7 grams will fall out of solution as a solid to the bottom of the beaker.
4. Your saturated 100 mL solution of NaNO_3 at 20°C is heated up to 50°C . How many more grams of solute will fit into the hotter solution? Colder it can hold 88 grams, but warmer it could hold 115 grams. That's 27 more grams to fit into the hotter solution.
5. How many grams of ammonia fit into 100 mL of water at 10°C ? That would be 70 grams

Then... How many grams of ammonia would fit into just 43 mL of water also at 10°C ?

$$\begin{array}{cccccc}
 10^\circ\text{C} & \frac{\text{NH}_3}{\text{H}_2\text{O}} & \frac{70 \text{ g}}{100 \text{ mL}} & \frac{X \text{ g}}{43 \text{ mL}} & & 100 X = 3010 \\
 & & & & & X = 30.1 \text{ g NH}_3
 \end{array}$$

6. How many grams of NaCl would saturate 43 mL water at 90°C?

$$90^{\circ}\text{C} \quad \frac{\text{NaCl}}{\text{H}_2\text{O}} \quad \frac{40 \text{ g}}{100 \text{ mL}} \quad \frac{X}{43 \text{ mL}} \quad \begin{array}{l} 100 X = 1720 \\ X = 17.2 \text{ g NaCl} \end{array}$$

7. How many grams NaNO₃ would saturate a 1420 mL solution at 50°C?

$$50^{\circ}\text{C} \quad \frac{\text{NaNO}_3}{\text{H}_2\text{O}} \quad \frac{115 \text{ g}}{100 \text{ mL}} \quad \frac{X}{1420 \text{ mL}} \quad \begin{array}{l} 100 X = 163,300 \\ X = 1633 \text{ g NaNO}_3 \end{array}$$

8. How many grams NH₄Cl saturates a 25.0 mL solution in water at 70°C?

$$70^{\circ}\text{C} \quad \frac{\text{NH}_4\text{Cl}}{\text{H}_2\text{O}} \quad \frac{62 \text{ g}}{100 \text{ mL}} \quad \frac{X}{25.0 \text{ mL}} \quad \begin{array}{l} 100 X = 1550 \\ X = 15.5 \text{ g NH}_4\text{Cl} \end{array}$$