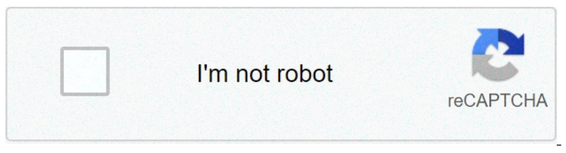

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Unsaturated saturated and supersaturated worksheet

Don't know these terms? Read this worksheet. If a solution can hold more solute (it isn't full yet) it is: Unsaturated Saturated Supersaturated If a solution cannot hold any more solute (it is full) it is: Unsaturated Saturated Supersaturated If a solution holds more solute than it should be able (its over full) it is: Unsaturated Saturated Supersaturated A solution is saturated at 25 g per 100g of H2O. If 25 grams is dissolved in 100g of H2O, it is: Unsaturated Saturated Supersaturated A solution is saturated at 25 g per 100g of H2O and holds 22 grams in 100g of H2O. It is: Unsaturated Saturated Supersaturated A solution is saturated at 25 g per 100g of H2O and holds 31 grams in 100g of H2O. It is: Unsaturated Saturated Supersaturated A solution can hold 10 grams per 100g of H2O. If 8 g is dissolved in 100g of H2O of water, it is: Unsaturated Saturated Supersaturated A solution can hold 15 grams per 100g of H2O. If it holds 30 g in 200g of H2O of water, it is: Unsaturated Saturated Supersaturated A solution can hold 12 grams per 100g of H2O. If it holds 35 g in 200g of H2O of water, it is: Unsaturated Saturated Supersaturated A solution can hold 9 grams per 100g of H2O. If it holds 15 g in 200g of H2O of water, it is: Unsaturated Saturated Supersaturated A solution can hold 12 grams per 100g of H2O. How many grams can 300 g of H2O hold? Put in just the number - no units, please. 12 18 24 30 36 48 A solution can hold 15 grams per 100g of H2O. How many grams can be dissolved in 200 g of H2O?Put in just the number - no units, please. A solution can hold 20 grams per 100g of H2O. If 300 g of H2O has 50 grams dissolved in it, how much more can still be dissolved? Put in just the number - no units, please. Learning Objectives Define saturated. Define unsaturated. Apply a solubility conversion factor to calculate the amount of solute that can be dissolved in a specified quantity of solvent. Define supersaturated. Explain how supersaturated solutions are created. As discussed in the previous section of this chapter, a solubility limit is expressed as a ratio that relates the maximum amount of a solute that can dissolve to a standardized 100.-gram, or 100.-milliliter, quantity of solvent. Because of its fractional format, a solubility proportion can be applied as a conversion factor and utilized to calculate the maximum amount of solute that can dissolve in a non-standard amount of solvent. For example, use the solubility information that is presented in Table 7.9.1 to calculate the maximum amount of urea that can dissolve in 255 grams of water at 20 degrees Celsius. In order to eliminate the given unit, "grams of water," the solubility of urea, CO(NH2)2, which has a reported value of 108 g/100. g H2O, must be applied as a conversion factor. Additionally, the chemical formula for urea, CO(NH2)2, must be incorporated into the numerator of this solubility proportion, as shown below, in order to achieve the desired unit transformation. In all of the examples that have been previously presented in this text, the final step in every mathematical process has been the application of the correct number of significant figures to the calculated quantity. However, because a solubility limit corresponds to the exact amount of solute that can dissolve in a specific amount of solvent, any numerical value that is calculated using a solubility proportion should not be rounded. \({\text {255}}\) \({\cancel{\rm{g} \; \rm{H_2O}}} \times\) \(\dfrac{108 \; \rm{g} \; \rm{CO(NH_2)_2}}{100. \; \cancel{\rm{g} \; \rm{H_2O}}}\) = \({\text {275.4}}\) \({\rm{g} \; \rm{CO(NH_2)_2}}\) Based on this calculated value, exactly 275.4 grams of urea, CO(NH2)2, can be dissolved in 255 grams of water, H2O. If exactly this quantity of solute is added to the indicated amount of water, the resulting solution is saturated, as it contains exactly the maximum amount of solute that can be dissolved in the corresponding amount of solvent. An unsaturated solution is generated if less than this calculated quantity of solute is added to the indicated amount of solvent. Because the amount of solute that is added to prepare an exactly-saturated and an unsaturated solution is equal to or less than, respectively, the quantity of solute that can dissolve in a particular amount of solvent, all of the solute that is added to the solvent will successfully dissolve in both of these types of solutions. Therefore, since no solute particles are evident in either of the resultant solutions, an unsaturated solution is visually-identical to a solution that is exactly saturated, as shown in the first and second images, respectively, in Figure \(\PageIndex{1}\). Figure \(\PageIndex{1}\): An unsaturated solution and an exactly-saturated solution, respectively. These solutions can, however, be differentiated through the addition of more solute. Because an unsaturated solution does not contain the maximum of amount of solute that can dissolve in the quantity of solvent that is present, additional solute can be incorporated into this type of solution. Therefore, if a small amount of solute is added to an unsaturated solution, that solute will successfully dissolve, and no solute particles will be evident in the resultant solution, as shown in the first image in Figure \(\PageIndex{2}\). In contrast, since an exactly-saturated solution already contains the maximum amount of solute that can dissolve in the quantity of solvent that is present, more solute cannot be incorporated into this type of solution. As a result, if a small amount of solute is added to an exactly-saturated solution, that solute will not dissolve, and the corresponding solute particles will be evident in the resultant solution, as shown in the second image in Figure \(\PageIndex{2}\). Figure \(\PageIndex{2}\): An unsaturated solution and an exactly-saturated solution, respectively, after more solute has been added. This excess solute can only be dissolved by manipulating the temperature of the solution. As stated in the previous section, because the solubility of a solid or a liquid solute is generally directly, or linearly, proportional to its temperature, raising the temperature of a solution that contains a solid or a liquid solute increases the number of solute particles that can be dissolved in the corresponding solvent. Therefore, since more solute can be dissolved in a given amount of solvent at higher temperatures, the excess solute that is present in a saturated solution can be dissolved by the increasing the temperature of that solution. If the solution is then carefully cooled back to its initial temperature, the excess solute will remain dissolved. The resultant solution is supersaturated, as it contains more than the maximum amount of solute that should dissolve in the given quantity of solvent. Because the amount of solute that is contained in a supersaturated solution exceeds the natural quantity of solute that should be dissolved, supersaturated solutions are highly unstable, and the excess solute readily crystallizes if the solution is disturbed.

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