

Unit 9 Solutions Review – Accel.

Name/Period: Key

- Describe a solution (use the vocabulary you've learned in this chapter):
A solution is made up of 2 parts: the solute which gets dissolved + the solvent which does the dissolving
- Give 4 examples of solutions (not just solids dissolved in liquids): *(variety of answers)*
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- Define the following terms in your own words:
 - Solvent *does the dissolving by surrounding the solute particles*
 - Solute *gets dissolved*
 - Soluble - *substance will dissolve in a given solvent*
 - Insoluble - *substance that won't dissolve in a solvent*
- Describe in detail what happens as a crystal of salt (NaCl) dissolves in water.
The partially negative oxygen in H₂O surrounds the positive sodium ions and the partially positive hydrogen in H₂O surround the negative chloride ions until all the NaCl is into the solution
- How is the dissolving process different in sugar (as compared with salt)?
Sugar is covalent rather than ionic like salt, so there aren't ions for the H₂O to surround. Instead the H₂O molecules surround the sugar + interact with the OH group on sugar
- What three things can be done to increase the rate at which a solid dissolves? How do they affect the rate?
 - Agitate - *causes particles to interact more*
 - Increase Temp. - *particles move faster + interact more*
 - decrease particle size (increase surface area) - *more surface area, so particles interact more*
- Dissolving is a (PHYSICAL / CHEMICAL) change.
- What is solubility?
maximum amount of solute that can be dissolved in a given amount of solvent at a given temp.
- How does temperature generally affect solubility:
 - For solids? *↑ temp. ↑ solubility (direct)*
 - For gases? *↑ temp. ↓ solubility (indirect)*
- Can you do anything else, besides change temperature, to change solubility (or how much dissolves)? If yes, what?
Yes for gases change the pressure. ↑ Pressure ↑ solubility ↓ Pressure ↓ solubility
- How would you prepare a supersaturated sugar solution? (Hint: Think about the supersaturated lab we did in class)
Begin w/ more sugar than water and heat the solution until all the sugar dissolves then quickly cool the solution using an ice water bath
- What is one test you could do to determine if a solution was saturated, unsaturated, or supersaturated? Describe how the results would be different for unsaturated, saturated, supersaturated solutions. *Add another crystal of solute*
unsaturated - the crystal dissolves
saturated - the crystal sinks to the bottom + doesn't dissolve
supersaturated - the solution crystallizes
- Water is known as the Universal Solvent
- When determining solubility remember, "like dissolves like."
- Why doesn't oil dissolve in water? Does it dissolve in anything? If so, what type of solvent would it dissolve in?
oil is nonpolar + water is polar
Yes it would dissolve in other nonpolar substances
- How do you know if a molecule is polar or nonpolar?
all nonmetals
polar - unshared pairs on central atom + asymmetrical
nonpolar - no unshared pairs on central atom + symmetrical
- Circle which of the following compounds will dissolve in water: MgCl₂ SeO₂ SiO₂ PCl₃
ionic
- Justify your answer to the above question.

$$\begin{array}{ccc} \text{O} = \text{Se} - \text{O} & \text{O} = \text{Si} = \text{O} & \text{O} - \text{P} - \text{Cl} \\ \text{polar} & \text{nonpolar} & \text{polar} \end{array}$$

H₂O is polar it dissolves polar + ionic
 Si has 4 valence e-

19. What is solution concentration? How much solute is contained in a certain amount of solvent
20. List the equations for each of the concentration units we learned about this unit:
- a. Percent by mass: $\frac{\text{mass solute}}{\text{mass solution}} \times 100$
- b. Percent by volume: $\frac{\text{volume solute}}{\text{volume solution}} \times 100$
- c. Molarity: $M = \frac{\text{mol solute}}{L \text{ solution}}$
- d. Molality: $m = \frac{\text{mol solute}}{\text{kg solvent}}$
21. What unit do we use to describe solution concentration **most often** in chemistry? M (molarity)
22. If a solution is "strong" it is Concentrated and if it is "weak" it is dilute.

23. What is the percent by mass of a sodium chloride solution that contains 17.3 g NaCl in 394 g of solution?

$$\frac{17.3g}{394g} \times 100 = 4.39\%$$

24. What is the molarity of potassium nitrate solution that contains 23.5 g KNO_3 in 500.0 mL of solution? $\frac{L}{1000 \text{ mL}} = .500L$

$$\frac{23.5g \text{ KNO}_3}{101.1032g \text{ KNO}_3} = .232 \text{ mol KNO}_3 = \frac{.232 \text{ mol KNO}_3}{.500L} = .464M$$

25. **How would you prepare** 500 mL of 3.0 M NaOH from solid solute? Show your work and include all steps.

1. Calculate mass of NaOH needed: $M = \frac{m}{V}$ $3.0M = \frac{x}{.5L}$ $x = 1.5 \text{ mol NaOH}$ $1.5 \text{ mol NaOH} \times 39.997 \text{ g/mol NaOH} = 60.0g \text{ NaOH}$
2. weigh (measure) 60.0g NaOH on a balance + put in a 500 mL volumetric flask.
3. Add some H_2O (solvent) to dissolve the NaOH.
4. Add distilled H_2O to the calibration mark. Cap + invert to mix.

26. What does it mean to dilute a solution? What equation do we use for dilutions?

Lower the concentration by adding more solvent (H_2O) $M_1V_1 = M_2V_2$

27. If you have 12.0 M HCl stock solution, **how would you correctly prepare** 600.0 mL of 2.50M HCl solution? Show your work and include all steps.

1. Calculate the volume of stock solution needed using $M_1V_1 = M_2V_2$. $12.0M \times V_1 = 2.50M \times 600 \text{ mL}$ ($V_1 = 125 \text{ mL}$)
2. Measure 125 mL of stock solution in a graduated cylinder
3. Add some solvent to a volumetric flask then add the solute + swirl.
4. Add solvent to the calibration mark. Cap + invert to mix.

28. Calculate the molality when 75.0 grams of MgCl_2 is dissolved in 500.0 g of solvent.

$$\frac{75.0g \text{ MgCl}_2}{95.211g \text{ MgCl}_2} = .788 \text{ mol MgCl}_2 = \frac{.788 \text{ mol MgCl}_2}{.500 \text{ kg}} = 1.58m$$

29. How does the freezing point of a solvent change when a solute is added? How does the boiling point change?

The freezing point is lowered The boiling point increases

30. What is the new boiling point when 11.4 g of ammonia (NH_3) is dissolved in 200. g of water? K_b for water is $0.52^\circ\text{C}/m$.

$$\frac{11.4g \text{ NH}_3}{17.03052g \text{ NH}_3} = .669 \text{ mol NH}_3 = 3.35m$$

$$\Delta T_b = iK_b m$$

$$\Delta T_b = 1.512 \cdot 3.35$$

$$\Delta T_b = 1.74^\circ\text{C}$$

$$BP = 100^\circ\text{C} + 1.74^\circ\text{C} = 101.7^\circ\text{C}$$

31. What phase does each number represent?

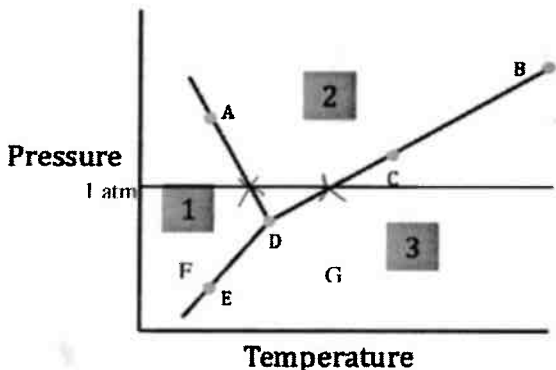
- 1 - solid
- 2 - liquid
- 3 - gas

32. What process is happening at the following letters?

- letter A: freezing or melting
- letter B: critical point
- letter C: vaporization or condensation
- letter E: sublimation or deposition

33. What letter represents the triple point? What is special about the triple point?

D it is where all 3 states of matter are present (solid, liquid, gas)



34. What is happening to the substance when it moves from letter F to letter G on the phase diagram?

sublimation it is going from a solid to a gas

35. where What is the normal freezing and boiling point for this substance?

1 atm where the x's are