

KEY

Chapters 13 and 14

This is just a sample of what might be on the next exam.

Expect questions similar to this, the lecture note questions, and the MIDAS homework.

- Which of the following is an observed property of liquids?
 - Liquids have a fixed shape and variable volume.
 - Liquids that are soluble mix homogeneously.
 - Liquids compress and expand significantly.
 - Liquids are less dense than gases.
 - none of the above.
- Predict the physical state of ammonia at -50°C ($M_p = -77^{\circ}\text{C}$, $B_p = -33^{\circ}\text{C}$) and normal atmospheric pressure.
 - solid
 - liquid
 - gas
 - solid and liquid
 - liquid and gas
- Which of the following is true of the intermolecular attractions in liquids?
 - Nonpolar molecules are attracted by dispersion forces.
 - Nonpolar molecules are attracted by dipole forces.
 - Nonpolar molecules are attracted by hydrogen bonds.
 - all of the above
 - none of the above
- If the molecules in a liquid have a very strong attraction for each other, which of the following properties has a relatively high value?
 - boiling point
 - viscosity
 - surface tension
 - all of the above
 - none of the above
- If the molecules in a liquid have a very weak attraction for each other, which of the following properties has a relatively high value?
 - boiling point
 - surface tension
 - vapor pressure
 - viscosity
 - all of the above
- Consider the following liquids with similar molar masses. Predict which has the strongest intermolecular attraction based only on vapor pressure data.
 - acetic acid (vapor pressure @ $20^{\circ}\text{C} = 14 \text{ mm Hg}$)
 - butane (vapor pressure @ $20^{\circ}\text{C} = 1550 \text{ mm Hg}$)
 - ethyl chloride (vapor pressure @ $20^{\circ}\text{C} = 1050 \text{ mm Hg}$)
 - ethyl methyl ether (vapor pressure @ $20^{\circ}\text{C} = 1260 \text{ mm Hg}$)
 - isopropyl alcohol (vapor pressure @ $20^{\circ}\text{C} = 35 \text{ mm Hg}$)
- Consider the following liquids with similar molar masses. Predict which has the strongest intermolecular attraction based only on boiling point data.
 - acetic acid ($B_p @ 760 \text{ mm Hg} = 118^{\circ}\text{C}$)
 - butane ($B_p @ 760 \text{ mm Hg} = -0.5^{\circ}\text{C}$)
 - ethyl chloride ($B_p @ 760 \text{ mm Hg} = 12^{\circ}\text{C}$)
 - ethyl methyl ether ($B_p @ 760 \text{ mm Hg} = 11^{\circ}\text{C}$)
 - propyl alcohol ($B_p @ 760 \text{ mm Hg} = 97^{\circ}\text{C}$)

8. Consider the following liquids with similar molar masses. Predict which has the weakest intermolecular attraction based on surface tension data.
- butyl alcohol (surface tension @ 20°C = 25 dynes/cm)
 - ethyl ether (surface tension @ 20°C = 17 dynes/cm)**
 - ethyl formate (surface tension @ 20°C = 24 dynes/cm)
 - propionic acid (surface tension @ 20°C = 27 dynes/cm)
 - propyl chloride (surface tension @ 20°C = 18 dynes/cm)
9. Which of the following is an example of a molecular crystalline solid?
- dry ice, CO₂**
 - fluorite, CaF₂
 - marble, CaCO₃
 - iron pyrite, FeS₂
 - none of the above
10. Which of the following is an example of an ionic crystalline solid?
- halite, NaCl**
 - phosphorus, P₄
 - sucrose, C₁₂H₂₂O₁₁
 - urea, CO(NH₂)₂
 - none of the above
11. Which of the following is an example of a metallic crystalline solid?
- potassium, K
 - titanium, Ti
 - vanadium, V
 - all of the above**
 - none of the above
12. Which of the following illustrates the bond polarity between H-O in water?
- (δ+) H-O (δ+)
 - (δ+) H-O (δ-)**
 - (δ-) H-O (δ+)
 - (δ-) H-O (δ-)
13. What is the number of nonbonding electron pairs in the Lewis structure of the water molecule?
- 0
 - 1
 - 2**
 - 3
 - 4
14. Based only on intermolecular attraction, predict which of the following liquids has the highest boiling point.
- CH₃-CO-OH**
 - CH₃-CH₂-O-CH₃
 - CH₃-CH₂-S-CH₃
 - CH₃-CH₂-CH₂-Cl
 - CH₃-CH₂-CH₂-CH₂-CH₃
15. Ammonia (NH₃) has hydrogen bonding and hexane (C₆H₁₄) has dispersion forces as intermolecular forces. Circle all that are correct.
- Water has weaker surface tension than hexane.
 - Hexane has a lower vapor pressure than water.
 - Hexane has a lower boiling point than water.**
 - Water has a lower viscosity than hexane.
 - Hexane has nonpolar covalent bonds between its atoms.**
 - Water has nonpolar covalent bonds between its atoms.

16. Butyl alcohol has a boiling point of 117°C and propyl chloride has a boiling point of 47°C. Circle all that are correct.
- Propyl chloride has weaker surface tension than butyl alcohol.
 - Propyl chloride has a lower vapor pressure than butyl alcohol.
 - Butyl alcohol has a lower boiling point than propyl chloride.
 - Butyl alcohol has a lower viscosity than propyl chloride.
 - Propyl chloride has weaker intermolecular forces than butyl chloride.

CHAPTER 14

17. What principle states that the solubility of a gas in a liquid is proportional to the partial pressure of the gas above the liquid?
- colloid principle
 - Henry's Law
 - solubility principle
 - Tyndall effect
 - none of the above
18. What is the term for a liquid composed of polar molecules?
- inorganic solvent
 - organic solvent
 - nonpolar solvent
 - polar solvent
 - none of the above
19. What is the term for a liquid composed of nonpolar molecules?
- inorganic solvent
 - organic solvent
 - nonpolar solvent
 - polar solvent
 - none of the above
20. What is the term for the concentration expression that relates the moles of solute per liter of solution? **Molarity**
21. What is the term that refers to liquids that dissolve completely in one another?
miscible
22. Circle all of the following liquids that would be miscible with methanol, CH₃OH.
- water
 - ethanol, C₂H₅OH
 - pentane, C₅H₁₂
 - toluene, C₇H₈
 - ethyl amine, C₂H₅NH
 - carbon tetrachloride, CCl₄
23. Circle all of the following liquids that would be miscible with bromine, Br₂ (l).
- water
 - ethanol, C₂H₅OH
 - pentane, C₅H₁₂
 - toluene, C₇H₈
 - ethyl amine, C₂H₅NH
 - carbon tetrachloride, CCl₄
24. What are the three factors that can increase the rate of dissolving?
- Increasing temperature
 - Stirring
 - Grinding into smaller particles
25. Answer the following for a 12.00 % KBr aqueous solution.
- What is the solute? **KBr**
 - What is the solvent? **water (In an aqueous solution water is always the solvent.)**
 - Write two unit factors relating solute to solution.
 - Write two unit factors relating solute to solvent.

26. What is the mass of a 10.00% blood plasma sample that contains 2.50 g of dissolved solute?

$$10.00\% = \frac{2.50 \text{ g solute}}{X} \times 100\% \quad X = 25.0 \text{ g solute}$$

27. If 25.0 mL of urine has a mass of 25.725 g and contains 1.929 g of solute, what is the mass/mass percent concentration of the specimen?

$$\frac{1.929 \text{ g}}{25.725 \text{ g}} \times 100\% = 7.50\%$$

28. What is the mass of water required to prepare 5.25 kg of 15.0% calcium nitrate solution?

$$15.00\% = \frac{X}{5.25 \text{ Kg}} \times 100\% \quad X = 0.787 \text{ Kg solute (Ca(NO}_3)_2)$$

$$\text{Kg Water} = 5.25 \text{ Kg} - 0.787 \text{ Kg} = \mathbf{4.46 \text{ Kg water}}$$

29. What is the mass of copper (II) sulfide required to prepare 250.0 g of 10.00% CuS solution?

$$10.00\% = \frac{X \text{ g CuS}}{250.0 \text{ g}} = 25.00 \text{ g CuS}$$

30. What is the molarity (M) of a solution containing 0.556 mol of NaCl dissolved in water to make 500.00 mL?

$$M = \frac{0.556 \text{ mol NaCl}}{0.50000 \text{ L}} = 1.11 \text{ M NaCl}$$

31. What is the molarity of a solution containing 2.35 g of KI dissolved in enough water to make 300.00 mL?

$$2.35 \text{ g KI} \left(\frac{1 \text{ mol KI}}{166.00 \text{ g}} \right) = 0.0142 \text{ mol KI} = 0.0142 \text{ mol} / 0.300 \text{ L} = 0.0472 \text{ M KI}$$

32. What is the mass of HCl required to make 200.0 mL of a 0.500 M HCl solution?

$$200.0 \text{ mL} \left(\frac{1 \text{ L}}{1000 \text{ mL}} \right) \left(\frac{0.500 \text{ mol HCl}}{1 \text{ L}} \right) \left(\frac{36.46 \text{ g HCl}}{1 \text{ mol}} \right) = 3.65 \text{ g HCl}$$

33. What is the volume of water required to make a 2.50 M NaNO₃ solution containing 3.99 g of NaNO₃?

$$3.99 \text{ g NaNO}_3 \left(\frac{1 \text{ mol NaNO}_3}{85.00 \text{ g}} \right) \left(\frac{1 \text{ L}}{2.50 \text{ mol}} \right) = 0.0188 \text{ L NaNO}_3$$

34. What is the volume of 3.00 M sulfuric acid that contains 9.809 g of H₂SO₄ solute?

$$9.809 \text{ g H}_2\text{SO}_4 \left(\frac{1 \text{ mol H}_2\text{SO}_4}{98.08 \text{ g}} \right) \left(\frac{1 \text{ L}}{3.00 \text{ mol}} \right) = 0.0333 \text{ L H}_2\text{SO}_4$$

(98.09 g)(3.00 mol)