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.

1. Which of the following is an observed property of liquids?
    a. Liquids have a fixed shape and variable volume.
    b. Liquids that are soluble mix homogeneously.
    c. Liquids compress and expand significantly.
    d. Liquids are less dense than gases.
    e. none of the above.
2. Predict the physical state of ammonia at -50°C (Mp = -77°C, Bp = -33°C) and normal atmospheric pressure.
    a. solid
    b. liquid
    c. gas
    d. solid and liquid
    e. liquid and gas

3. Which of the following is true of the intermolecular attractions in liquids?
    a. Nonpolar molecules are attracted by dispersion forces.
    b. Nonpolar molecules are attracted by dipole forces.
    c. Nonpolar molecules are attracted by hydrogen bonds.
    d. all of the above
    e. none of the above

4. If the molecules in a liquid have a very strong attraction for each other, which of the following properties has a relatively high value?
    a. boiling point
    b. viscosity
    c. surface tension
    d. all of the above
    e. none of the above

5. If the molecules in a liquid have a very weak attraction for each other, which of the following properties has a relatively high value?
    a. boiling point
    b. surface tension
    c. vapor pressure
    d. viscosity
    e. all of the above

6. Consider the following liquids with similar molar masses. Predict which has the strongest intermolecular attraction based only on vapor pressure data.
    a. acetic acid (vapor pressure @ 20°C = 14 mm Hg)
    b. butane (vapor pressure @ 20°C = 1550 mm Hg)
    c. ethyl chloride (vapor pressure @ 20°C = 1050 mm Hg)
    d. ethyl methyl ether (vapor pressure @ 20°C = 1260 mm Hg)
    e. isopropyl alcohol (vapor pressure @ 20°C = 35 mm Hg)

7. Consider the following liquids with similar molar masses. Predict which has the strongest intermolecular attraction based only on boiling point data.
    a. acetic acid (Bp @ 760 mm Hg = 118°C)
    b. butane (Bp @ 760 mm Hg = -0.5°C)
    c. ethyl chloride (Bp @ 760 mm Hg = 12°C)
    d. ethyl methyl ether (Bp @ 760 mm Hg = 11°C)
    e. propyl alcohol (Bp @ 760 mm Hg = 97°C)

8. Consider the following liquids with similar molar masses. Predict which has the weakest intermolecular attraction based on surface tension data.
    a. butyl alcohol (surface tension @ 20°C = 25 dynes/cm)
    b. ethyl ether (surface tension @ 20°C = 17 dynes/cm)
    c. ethyl formate (surface tension @ 20°C = 24 dynes/cm)
    d. proprionic acid (surface tension @ 20°C = 27 dynes/cm)
    e. propyl chloride (surface tension @ 20°C = 18 dynes/cm)

9. Which of the following is an example of a molecular crystalline solid?
    a. dry ice, CO_2
    b. fluorite, CaF_2
    c. marble, $CaCO_3$
    d. iron pyrite, FeS_2
    e. none of the above

10. Which of the following is an example of an ionic crystalline solid?
    a. halite, NaCl
    b. phosphorus, P_4
    c. sucrose, $C_{12}H_{22}O_{11}$
    d. urea, $CO(NH_2)_2$
    e. none of the above

11. Which of the following is an example of a metallic crystalline solid?
    a. potassium, K
    b. titanium, Ti
    c. vanadium, V
    d. all of the above
    e. none of the above

12. Which of the following illustrates the bond polarity between H-O in water?
    a. (δ+) H-O (δ+)
    b. (δ+) H-O (δ-)
    c. (δ-) H-O (δ+)
    d. (δ-) H-O (δ-)

13. What is the number of nonbonding electron pairs in the Lewis structure of the water molecule?
    a. 0
    b. 1
    c. 2
    d. 3
    e. 4

14. Based only on intermolecular attraction, predict which of the following liquids has the highest boiling point.
    a. CH_3-CO-OH
    b. CH_3-CH_2-O-CH_3
    c. CH_3-CH_2-S-CH_3
    d. CH_3-CH_2-CH_2-Cl
    e. CH_3-CH_2-CH_2-CH_2-CH_3

15. Ammonia (NH_3) has hydrogen bonding and hexane (C_6H_{14}) has dispersion forces as intermolecular forces. Circle all that are correct.
    a. Water has weaker surface tension than hexane.
    b. Hexane has a lower vapor pressure than water.
    c. Hexane has a lower boiling point than water.
    d. Water has a lower viscosity than hexane.
    e. Hexane has nonpolar covalent bonds between its atoms.
    f. 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.
    a. Propyl chloride has weaker surface tension than butyl alcohol.
    b. Propyl chloride has a lower vapor pressure than butyl alcohol.
    c. Butyl alcohol has a lower boiling point than propyl chloride.
    d. Butyl alcohol has a lower viscosity than propyl chloride.
    e. 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?
    a. colloid principle
    b. Henry's Law
    c. solubility principle
    d. Tyndall effect
    e. none of the above

18. What is the term for a liquid composed of polar molecules?
    a. inorganic solvent
    b. organic solvent
    c. nonpolar solvent
    d. polar solvent
    e. none of the above

19. What is the term for a liquid composed of nonpolar molecules?
    a. inorganic solvent
    b. organic solvent
    c. nonpolar solvent
    d. polar solvent
    e. none of the above

20. What is the term for the concentration expression that relates the moles of solute per liter of solution?

21. What is the term that refers to liquids that dissolve completely in one another?

22. Circle all of the following liquids that would be miscible with methanol, CH_3OH.
    a. water
    b. ethanol, C_2H_5OH
    c. pentane, C_5H_{12}
    d. toluene, C_7H_8
    e. ethyl amine, C_2H_5NH
    f. carbon tetrachloride, CCl_4

23. Circle all of the following liquids that would be miscible with bromine, Br_2 (l).
    a. water
    b. ethanol, C_2H_5OH
    c. pentane, C_5H_{12}
    d. toluene, C_7H_8
    e. ethyl amine, C_2H_5NH
    f. carbon tetrachloride, CCl_4

24. What are the three factors that can increase the rate of dissolving?
    a.
    b.
    c.

25. Answer the following for a 12.00 % KBr aqueous solution.
    a. What is the solute?
    b. What is the solvent?
    c. Write two unit factors relating solute to solution.
    d. 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?

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?

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

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

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

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

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

33. What is the volume of water required to make a 2.50 M $NaNO_3$ solution containing 3.99 g of $NaNO_3$?

34. What is the volume of 3.00 M sulfuric acid that contains 9.809 g of H_2SO_4 solute?