1. (2 pts) Which of the following is not a gas at room temperature?
   A) NH_3
   B) CO_2
   C) I_2
   D) CH_4
   E) H_2

2. (2 pts) Which is not a property of a gas?

3.
   A) Density varies with temperature
   B) Assumes the shape and volume of its container
   C) Are compressible
   D) Density is larger than that of a liquid
   E) Form homogeneous mixtures with one another

4. (3 pts) The air pressure in a volleyball is 75 psi. What is this pressure in torr?

5.
   A) 520 torr
   B) 562 torr
   C) 3900 torr
   D) 7600 torr
   E) 75,000 torr

6. (2 pts) For a substance that remains a gas under the conditions listed, deviation from the ideal gas law would be most pronounced at

7.
   A) 100°C and 2.0 atm.
   B) 0°C and 2.0 atm.
   C) –100°C and 2.0 atm.
   D) –100°C and 4.0 atm
   E) 100°C and 4.0 atm.

1. (2 pts) What is the name given to the attractive forces that hold molecules together in the condensed phase?

2.
   A) Ionic bonds
   B) Covalent bonds
   C) Intermolecular forces
   D) Electronegativity
   E) Electron attraction

3. (2 pts) Ammonia's unusually high melting point is the result of

4.
   A) dipole-dipole forces. .
   B) London dispersion forces.
   C) hydrogen bonding.
   D) covalent bonding
   E) ionic bonding.

5. (2 pts) Which of the following statements is true?

6.
   A) The higher the viscosity, the faster a liquid flows.
   B) The viscosity increases with increasing temperature.
   C) Liquids having strong intermolecular forces have higher viscosities than those that have weaker intermolecular forces.
   D) Water has a low viscosity because of hydrogen bonding.
   E) None of the answers is true.

7. (7.5 pts) Arrange the following in order of <u>increasing</u> boiling point. Make sure to support your reasoning with Lewis Structures and Intermolecular Forces.

RbCl CH_3Cl CH_3OH CH_4 $CH_3CH_2CH_2CH_2CH_2CH_3$

8. (4 pts) What mass of water would need to evaporate from your skin in order to dissipate 1.7×10^5 J of heat from your body?

$$H_2O(l) \rightarrow H_2O(g) \quad \Delta H_{vap} = 40.7 \text{ kJ/mol}$$

9. (8 pts) Liquid ammonia (boiling point = -33.4°C) can be used as a refrigerant and heat transfer fluid. How much energy (in kJ) is needed to heat 25.0 g of $NH_3(l)$ from -65.0°C to -12.0°C, assuming that the ammonia is still a liquid at -65.0°C?

Specific heat, NH_3 (l)	4.7 J/g °C
Specific heat, NH_3 (g)	2.2 J/g °C
Heat of vaporization, NH_3	23.5 kJ/mol

10. (10 pts) When active metals such as magnesium are immersed in **aqueous** acid solution, hydrogen gas is evolved. Calculate the volume of $H_2(g)$ at 45.0°C and 0.85 atm that can be formed when 275 mL of 0.725 M HCl solution reacts with 0.0345 g of Mg to give hydrogen gas and **aqueous** magnesium chloride.

11.

$$Mg_{(s)} + 2HCl_{(aq)} \rightarrow H_{2(g)} + MgCl_{2(aq)}$$

12. Suppose that you have two vessels connected by a valve—initially closed. One vessel is 1.50 L and initially contains only helium at 0.670 atm, and the other vessel is 3.50 L and initially contains only neon at 1.970 atm. The second vessel has an attached pressure gauge. The laboratory temperature is 20.0°C. Please predict what that pressure gauge reads after the valve between the vessels is opened and the system settles into a new static state.

13. Certain hydrates (materials with water incorporated into their crystal structures) can be heated to drive off the water (as steam). Suppose that you put 55.00 g of a hydrate into a 150.0°C oven, and the steam generated exerts a pressure of 2.50 atm in a 20.00-L vessel. Please calculate the percent-by-mass composition of water in that hydrate.

14 The vapor pressure of benzene is 0.0528 atm at 7.60°C. The heat of vaporization of benzene is 31.0 kJ/mol. Please predict the vapor pressure of benzene at 30.50°C.

15 A 1.45-g aliquot of water is injected into an evacuated 5.00-L flask at 65.00°C—and then the flask is sealed. The vapor pressure of water at this temperature is 0.247 atm. Please predict the mass of liquid water in the flask when this system reaches equilibrium.

16. A solution of 2.500 g of an unknown compound dissolved in 25.00 g of benzene is observed to freeze at 4.30°C. The freezing point of pure benzene is 5.50°C, and the freezing point depression constant 5.12°C/*m*. Please calculate the molar mass of the unknown compound.

17 Suppose you have a concentrated aqueous solution of hydrochloric acid that is 37.0% HCl by mass. The density of the solution is 1.19 g/mL. Please calculate the **molality** of this solution.