CHEMISTRY 0110  Material not on Exam 1 or 2 Practice  
Make sure to only use a calculator and the infosheet when working these practice exam problems. You should be able to complete this entire practice within 50 minutes.

MULTIPLE CHOICE:

1. Under identical conditions, the gas that is most dense is
   a) CO
   b) H₂S
   c) SO₃
   d) CH₄
   e) SF₆

2. The root mean squared velocity (RMS) would be greatest for
   a) 5 g of C₃H₈ at 0°C
   b) 18 g of H₂S at 100°C
   c) 25 g of CO₂ at 0°C
   d) 8 g of SO₂ at 100°C
   e) 5 g of C₃H₈ at 100°C

3. Real gases deviate from the ideal gas equation at very high pressures
   a) because molecules occupy space, which is then no longer available for molecular motion.
   b) because the molecules are in such close proximity that small attractive forces become important.
   c) because the molecules slow their velocity at higher pressures.
   d) because as the pressure increases so does the temperature, and the molecules may start to decompose.
   e) Both answers a and b are correct.

4. For which reaction is \( \Delta H_{\text{rxn}} \) a standard enthalpy of formation?
   a) \( 2\text{HNO}_3(\text{l}) + \text{NO}(\text{g}) \rightarrow 3\text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \)
   b) \( \text{Sn}(\text{s}) + 2\text{Cl}_2(\text{g}) \rightarrow \text{SnCl}_4(\text{l}) \)
   c) \( 2\text{Cl}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{Cl}_2\text{O}(\text{g}) \)
   d) \( \text{C}_2\text{H}_5\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l}) \)
   e) \( 2\text{Cl}_2\text{O}(\text{g}) \rightarrow 2\text{Cl}_2(\text{g}) + \text{O}_2(\text{g}) \)

5. Which of the following materials would work the best as a thermal insulator?
   a) Al  specific heat = 0.901 J/(g °C)
   b) Cu  specific heat = 0.384 J/(g °C)
   c) Ethanol specific heat = 2.43 J/(g °C)
   d) Fe  specific heat = 0.449 J/(g °C)
   e) Water specific heat = 4.18 J/(g °C)

6. Use the thermochemical equations below to calculate the enthalpy of reaction in kJ for
NOCl(g) + Cl(g) $\rightarrow$ NO(g) + Cl$_2$(g).

(1) N$_2$(g) + O$_2$(g) + Cl$_2$(g) $\rightarrow$ 2NOCl(g)  $\Delta H^o$ = 105.2 kJ
(2) N$_2$(g) + O$_2$(g) $\rightarrow$ 2 NO(g)  $\Delta H^o$ = 180.7 kJ
(3) Cl$_2$(g) $\rightarrow$ 2 Cl(g)  $\Delta H^o$ = 243.2 kJ

a) 529.1  
b) 264.6  
c) –42.70  
d) –83.85  
e) –167.7

7. The boiling point of HF is higher than HCl due to
   A) ion-dipole forces.  D) dipole-dipole forces.
   B) hydrogen bonding.  E) ion-ion forces.
   C) London forces.

8. Which of the following has the highest vapor pressure at room temperature?
   A) acetic acid, CH$_3$COOH  D) ethanol, CH$_3$CH$_2$OH
   B) dimethylether, CH$_3$OCH$_3$  E) water, H$_2$O

9. Which of the following has the greatest surface tension?
   A) mercury  B) water  C) benzene  D) propane, C$_3$H$_8$  E) NH$_3$

10. The meniscus of mercury curves downward in a glass tube forming a "∩" shape. This means
    A) mercury tends to cover the greatest possible area of the glass.
    B) the cohesive forces between mercury atoms are not as strong as the adhesive forces between mercury and glass.
    C) mercury has a low surface tension.
    D) the cohesive forces between mercury atoms are stronger than the adhesive forces between mercury and glass.
    E) mercury has a large capillary action.

CALCULATIONS: Show all of your work for each calculation.
11. For the reaction \(2\text{C}_2\text{H}_5\text{OH(l)} + 6 \text{O}_2(g) \rightarrow 42 \text{CO}_2(g) + 6 \text{H}_2\text{O(l)}, \Delta H^o = -5624 \text{ kJ}\). How much heat is produced when 86.0 g of ethanol is burned? (5 points)

12. Consider the three flasks in the diagram below. Assuming the connecting tubes have negligible volume, what is the partial pressure of each of the gases and the total pressure when all the stopcock valves are opened? (5 points)

13. Assume that you have 227 g of nitroglycerin (mw = 227 g/mol) that takes up all of the space in a 500.0 mL steel container at 244 K. The container is designed to withstand 850 atm of pressure. An explosion occurs, raising the temperature of the container and its contents to 698 K. Will the container withstand this explosion? Assume ideal gas behavior and that the nitroglycerin completely reacted. (6 points)

14. A 19.6 g sample of metal was heated to 61.67 °C and then placed into 26.7 g of water in an insulated container. The temperature of the water increased from 25.0 °C to 30.0 °C. What is the specific heat of the metal? (6 points)