

Name \_\_\_\_\_

**CHM 1045 GENERAL CHEMISTRY I**  
**EXAM 3 20021a**

MULTIPLE CHOICE (Circle the correct answer) (3 points each)

1. Equal moles of ammonia and nitrogen at the same temperature and pressure have the same
  1. masses.
  2. density.
  3. percent nitrogen.
  4. number of atoms.
  5. volumes.
  
2. For a gas, which of the following would NOT increase the volume of the gas (if all other conditions remain constant)?
  1. Increasing the temperature
  2. Increasing the pressure
  3. Increasing the number of moles of the gas
  4. Increasing the temperature and decreasing the pressure
  5. Eating a Taco Bell burrito (not the answer)
  
3. Which of the following relates the volume of gas to the number of moles of the gas?
  1. Charles' law
  2. Avogadro's hypothesis
  3. Dalton's law
  4. Graham's law
  5. Boyle's law
  
4. A sample containing a mixture of hydrogen, oxygen, and water vapor has a total pressure of 648 mmHg at 22°C. The vapor pressure of water at 22°C is 19.8 mmHg. If the hydrogen exerts 253T of pressure, what is the pressure of the oxygen?
  1. 1.00 atm.
  2. 0.0261 atm.
  3. 0.853 atm.
  4. 0.494 atm.
  5. 0.499 atm.

5. What is the relationship between a gas density ( $D$ ) and the molecular weight ( $M$ ) of the gas?
1.  $PV=nRT$
  2.  $D=MP/RT$
  3.  $M=nPTR$
  4.  $D=M$
  5.  $D=m/V$
6. According to the postulates of the kinetic theory of gases, the average speed ( $\mu_{\text{rms}}$ ) of the molecules of a given gas is proportional to the
1. absolute temperature.
  2. Celsius temperature squared.
  3. absolute temperature squared.
  4. square root of the absolute temperature.
  5. reciprocal of the square of the absolute temperature.
7. All of the following are postulates of the kinetic-molecular theory of gases EXCEPT
1. The collisions between molecules are elastic.
  2. The gas molecules are in constant motion.
  3. The volumes of the molecules are small compared with the volume of the container.
  4. Collisions with the container wall cause pressure.
  5. At a constant temperature, all molecules of the gas are moving at the same speed.
8. The volume of one mole of an ideal gas (Careful!)
1. is decreased by decreasing the temperature of the gas molecules.
  2. always has a value of 22.4 L.
  3. can only be measured at STP.
  4. is always lower than that of a real gas.
  5. is decreased by decreasing the pressure of the gas.
9. If the  $\Delta H = +132$  kJ for a certain process, that process
1. is exothermic.
  2. is endothermic.
  3. occurs rapidly.
  4. cannot occur.
  5. requires a catalyst.

10. The quantity of heat needed to raise the temperature of one gram of a substance  $1^{\circ}\text{C}$  is the sample's
1. specific heat.
  2. work.
  3. enthalpy.
  4. heat capacity.
  5. calorimetry.
11. Which of the following is NEVER one of the units of  $R$ , the gas constant?
1. Liters
  2. Torr
  3. Kelvins
  4. Atm
  5.  $^{\circ}\text{C}$
12. In a bomb calorimeter, reactions are carried out
1. at 1 atm pressure and  $25^{\circ}\text{C}$ .
  2. at 1 atm pressure and  $0^{\circ}\text{C}$ .
  3. at a constant pressure and  $25^{\circ}\text{C}$ .
  4. at a constant pressure.
  5. at a constant volume.
13. The fact that each gas in a mixture exerts its own individual pressure, and that the total pressure is the sum of these individual pressures is contained in
1. Dalton's Law.
  2. Boyle's Law.
  3. Hess's Law.
  4. Charles' Law.
  5. LA Law.
14. All of the following have a standard enthalpy of formation value of zero at  $25^{\circ}\text{C}$  and 1.00 atm except
1.  $\text{Ne}_{(\text{g})}$ .
  2.  $\text{Fe}_{(\text{s})}$ .
  3.  $\text{CO}_{(\text{g})}$ .
  4.  $\text{F}_{2(\text{g})}$ .
  5.  $\text{C}_{(\text{s})}$ .

15. Which of the following units is NOT equal to standard atmospheric pressure?

1. 760 Torr
2. 14.7 lbs/in<sup>2</sup>
3. 120,325 Pa
4. 1000 millibars
5. 1.00 atm

SHORT ANSWER (5 points)

1. Write the equation that is associated with the value of  $\Delta H^\circ_f = -1433 \text{ KJ}$  for  $\text{CaSO}_4(\text{s})$ .

FILL IN THE BLANKS (12 points)

1. The ratio of the rates of effusion of a known gas and an unknown gas can be used to calculate the \_\_\_\_\_ of the unknown gas.
2. Gases display non-ideal behavior when the pressure is too \_\_\_\_\_ (high/low) or the temperature is too \_\_\_\_\_ (high/low).
3. In van der Waal's equation for real gases, the term "nb" corrects for \_\_\_\_\_ and the term  $a(n/V)^2$  corrects for \_\_\_\_\_.
4. The amount of heat required to raise the temperature of 1 gram of water 1 degree celsius is called a \_\_\_\_\_ and is equal to \_\_\_\_\_ Joules.
5. A \_\_\_\_\_ function is a function that depends only on initial and final conditions and not the number of steps required to get from initial to final conditions. \_\_\_\_\_ Law relates this concept to chemical reactions and enthalpy changes.
6. If one is given all the Standard Enthalpies of Formation of all compounds in a chemical reaction, the overall  $\Delta H^\circ$  of the reaction can be calculated by doing what with the given  $\Delta H^\circ_f$  's?  
\_\_\_\_\_  
\_\_\_\_\_

**PROBLEMS: (For all problems show all work including math and unit manipulation. Be careful of significant figures and watch your units. ex. Atm and Torr) (6 points each)**

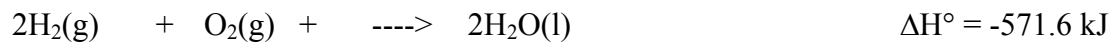
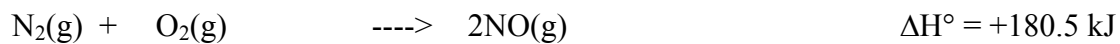
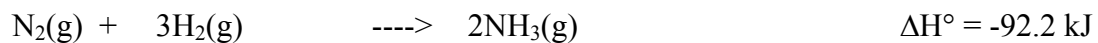
1. A balloon holds 8.00 L of a WET gas (with water) at 772 mmHg of pressure at 25.0°C. What volume would the DRY gas have at STP? (Assume the rubber of the balloon to have no effect on the expansion or contraction of the gas.) (Vapor pressure of water at 25°C is 22Torr)

3. What would be the pressure of 11.5 moles of an ideal gas contained in a 30.00 L container, if the temperature was 127.0°C?

4. For the reaction  $C(s) + O_2(g) \rightarrow CO_2(g)$   $\Delta H^\circ = -394 \text{ kJ/mol}$

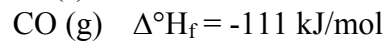
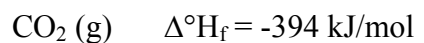
How much heat is evolved when 350g of carbon is burned with an excess of oxygen?  
(C=12.0g/mol , O=16.0g/mol , CO<sub>2</sub>=44.0g/mol)

5. Given the following data:



Calculate the  $\Delta\text{H}^\circ$  for the reaction  $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \text{ ----> } 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$   
(4 points)

6. Consider the following data:



Calculate the total enthalpy change under standard conditions for the reaction.

