

$$\Delta E_{\text{system}} = q + w \quad PV = nRT \quad R = 0.0821 \text{ (L*atm)/(mole*K)} \quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$P_T = p_1 + p_2 + p_3 \quad \chi = \text{moles A/total moles} \quad \chi_1 P_T = p_1$$

$$w = -P\Delta V \quad \text{K.E.} = \frac{1}{2} m * \mu_{rms}^2 \quad \mu_{rms} = \sqrt{\frac{3RT}{M}} \quad R = 8.314 \text{ J/(mole*K)}$$

$$d = \frac{PM}{RT} \quad J = \frac{\text{kg} * \text{m}^2}{\text{s}^2} \quad M = \text{molar mass}$$

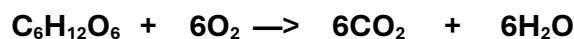
$$101\text{J} = \text{L} \times \text{atm} \quad 14.7 \text{ psi} = 1 \text{ atm} \quad 101325 \text{ Pa} = 1 \text{ atm} \quad 760 \text{ torr} = 1 \text{ atm}$$

At constant pressure, $q_p = \Delta H$, $\Delta H = \text{enthalpy of the reaction}$

$$q_{\text{gained}} = -q_{\text{lost}} \quad q = m * C_s * \Delta T \quad q = n * C_m * \Delta T$$

$$\Delta H_{\text{rxn}} = \Delta H_{\text{products}} - \Delta H_{\text{reactants}}$$

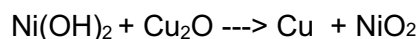
- (4 points) For the reaction given below, circle the reactant that is oxidized. Put a box around the reactant that is reduced.



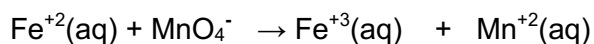
- (4 points) For the reaction given below, circle the reactant that is oxidized. Put a box around the reactant that is reduced.



- (3 points) What is the oxidation number for the nitrogen in a nitrate ion?
- (3 points) What is the oxidation number for the phosphorous in a phosphate ion?
- (3 points) What is the oxidation number for the chromium in a chromate ion?
- (3 points) What is the oxidation number for carbon in carbon monoxide?
- (3 points) What is the oxidation number for carbon in carbon dioxide?
- (3 points) What is the oxidation number for nitrogen in dinitrogen pentoxide?
- (10 points) Balance the following reaction in basic conditions. Show all of your work. Clearly show the oxidation numbers on each atom.



- (20 points) The concentration of iron(II) ions in water can be determined by titration with potassium permanganate in acidic solution as shown by the incomplete unbalanced reaction equation below.



- a. What is the oxidation number for the Iron(II) ion?
 - b. What is the oxidation number for the Iron(III) ion?
 - c. What is the oxidation number for the manganese in permanganate?
 - d. What is the oxidation number for the manganese(II) ion?
 - e. How many electrons are lost in the unbalanced oxidation half reaction?
 - f. How many electrons are gained in the unbalanced reduction half reaction?
 - g. How many electrons are transferred? (After multiplying the half reaction(s) by some factor(s))
 - h. How many moles of water are produced?
 - i. How many moles of H^+ are needed for this reaction? Is H^+ a product or a reactant?
11. (10 points) Sodium nitrate reacts with copper solid to form nitrogen monoxide and copper (II) ions. Write the balanced reaction in an acidic solution.
12. (10 points) A sample of gas at 2.0 atm and 50.0 mL is heated from 22°C to 140°C. If the pressure remains constant, what is the final volume of the gas?
13. (10 points) A balloon is filled with 5.00 L of helium at a pressure of 755 torr. What is the volume of the balloon at an altitude where the pressure in the balloon is 300 torr?
14. (10 points) One of the gas laws is related to breathing. What is this gas law? Fully describe the process of breathing and how this gas law is related to breathing.
15. (4 points) What causes 80% of all cases of emphysema? Explain how this causes emphysema.