

1. (18%) For each of the following terms define it, then give an example –
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|---------------------|-------------------|
| a. buffer solution | d. reducing agent |
| b. weak acid | e. isotope |
| c. hydrogen bonding | f. cathode |
2. (12%) Name the following compounds in English (IUPAC)
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|--------------------|--------------------------------------|
| a. AgNO_2 | d. NaHSO_3 |
| b. KMnO_4 | e. $\text{K}_2\text{Cr}_2\text{O}_7$ |
| c. CuCl | f. NaH_2PO_4 |
3. (10%) a) What are resonance formulas? b) Write resonance formulas for nitric acid
c) Write resonance formulas for carbonate ion (a = 4%, b = c = 3%)
4. (15%) Potassium superoxide, KO_2 , reacts with water to generate oxygen.
- $$4\text{KO}_2(s) + 2\text{H}_2\text{O}(l) \rightarrow 4\text{KOH}(s) + 3\text{O}_2(g)$$
- If a reaction vessel contains 0.15 mol KO_2 and 0.10 mol H_2O , a) what is the limiting reactant? b) How many liters of oxygen can be produced at 1 atm and 25°C ? (a = 7%)
5. (15%) Hydrogen and iodine react according to the equation $\text{H}_2(g) + \text{I}_2(g) \rightleftharpoons 2\text{HI}(g)$
Suppose 1.00 mol H_2 and 2.00 mol I_2 are placed in a 1.00-L vessel. How many moles of hydrogen, iodine, and hydrogen iodide are each in the gaseous mixture when it reaches equilibrium at 458°C ? It is known that $K_c = 49.7$ at this temperature.
6. (15%) A buffer is prepared by mixing 60.0 mL of 0.100 M NH_3 with 40.0 mL of 0.100 M NH_4Cl . What is the pH of this buffer? (K_b of $\text{NH}_3 = 1.80 \times 10^{-5}$)
7. (15%) A 1.07-mg sample of an organic compound is dissolved in 78.1 mg of camphor. The solution melted at 176.0°C . a) What is the molecular weight of the compound? b) If the empirical formula of the compound is CH , what is the molecular formula? (For camphor the melting point is 179.5°C , and the freezing-point-depression constant is $40^\circ\text{C}/m$) (a = 8%, b = 7%).