

CHEM1612 Problem Sheet 7 (Week 8)

1. Classify the solutions formed from the following salts as *acidic*, *basic* or *neutral*.
  - (a)  $\text{KNO}_3$       (b)  $\text{FeCl}_3$       (c)  $\text{Ca}(\text{OH})_2$
  - (b)  $(\text{NH}_4)_2\text{SO}_4$       (e)  $\text{NaN}_3$       (f)  $\text{BaCl}_2$
  
2. The  $K_{\text{sp}}$  of  $\text{Ca}_3(\text{PO}_4)_2 = 1.3 \times 10^{-32} \text{ M}^5$ .
  - (a) Calculate the solubility of  $\text{Ca}_3(\text{PO}_4)_2$  in water in  $\text{mol L}^{-1}$  and  $\text{g L}^{-1}$ .
  - (b) Calculate the molar solubility of  $\text{Ca}_3(\text{PO}_4)_2$  in  $0.20 \text{ M Na}_3\text{PO}_4$  solution.
  
3. Will a precipitate occur if a  $0.01 \text{ M Ag}^+$  solution is mixed with an equal volume of  $0.01 \text{ M}$  sulfuric acid?  $K_{\text{sp}}(\text{Ag}_2\text{SO}_4) = 2 \times 10^{-5} \text{ M}^3$
  
4. Give the oxidation number of the underlined element in the following.
  - (a)  $\text{KMMnO}_4$       (b)  $\text{SO}_4^{2-}$       (c)  $\text{Na}_2O}_2$       (d)  $\text{MgH}_2$
  - (e)  $\text{NH}_4^+$       (f)  $\text{Br}F_3$       (d)  $[\text{Ni}(\text{NH}_3)_6]^{2+}$       (e)  $\text{K}_4[\text{Fe}(\text{CN})_6]$
  
5.  $K_{\text{stab}}$  of  $[\text{Zn}(\text{NH}_3)_4]^{2+}$  is  $8 \times 10^8 \text{ M}^{-4}$ . What is the molarity of  $\text{Zn}^{2+}(\text{aq})$  ions in the solution made by adding water to zinc nitrate ( $0.10 \text{ mol}$ ) and ammonia ( $3.0 \text{ mol}$ ) so that the final volume of solution is  $1.5 \text{ L}$ ?
  
6. Human haemoglobin has a molecular weight of  $6.45 \times 10^4$ , a concentration in blood of  $15.0 \text{ g}$  per  $100 \text{ mL}$  and contains  $3.4 \text{ g}$  of iron per  $\text{kg}$ . It reacts with oxygen to form a complex that contains 4 molecules of oxygen per molecule of haemoglobin.
  - (a) Calculate the volume of oxygen per  $100 \text{ mL}$  of fully oxygenated blood at  $311 \text{ K}$  and  $101.3 \text{ kPa}$ .
  - (b) Calculate the number of iron atoms in each molecule of haemoglobin.
  - (c) Magnetic studies show that the haemoglobin molecule contains 4 unpaired electrons per iron atom. What is the oxidation state of the iron?