

**Chem 10123, Quiz 7**

April 1, 2020

**Answer Key**

1. An aqueous solution of  $\text{KMnO}_4$  is standardized by the following procedure. A 0.9812-g sample of pure  $\text{FeSO}_4$  (molar mass = 151.92) is dissolved in some dilute acid. This  $\text{FeSO}_4$  solution is then titrated by careful addition of the  $\text{KMnO}_4$  solution from a buret. To reach the end point, 35.60 mL of the  $\text{KMnO}_4$  solution is required.

(a) (3 points) *Write and balance the net-ionic equation* for the reaction that occurs during the titration, assuming that the products are  $\text{Fe}^{3+}$  and  $\text{Mn}^{2+}$ .



(b) (4 points) **SHOW ALL WORK.** Determine the molarity of the  $\text{KMnO}_4$  solution.

$$(0.9812 \text{ g FeSO}_4) (1 \text{ mole} / 151.92 \text{ g}) (1 \text{ mole Fe}^{2+} / 1 \text{ mole FeSO}_4)$$

$$= 0.006459 \text{ mole Fe}^{2+}$$

$$(0.006459 \text{ mole Fe}^{2+}) (1 \text{ mole MnO}_4^- / 5 \text{ mole Fe}^{2+}) = 0.001292 \text{ mole MnO}_4^-$$

$$(0.001292 \text{ mole MnO}_4^-) / 0.03560 \text{ L} = 0.03628 \text{ M KMnO}_4$$

2. (5 points) **SHOW ALL WORK.** A certain metal (M) forms the chloride  $\text{MCl}_3$ . Electrolysis of molten  $\text{MCl}_3$  by a current of 4.00 amp for 15.0 minutes deposits 2.39 g of metal M at the cathode. Perform an appropriate calculation and identify the metal M.



$$(4.00 \text{ amp}) (15.0 \text{ min}) (60 \text{ sec/min}) = 3600 \text{ amp}\cdot\text{sec} = 3600 \text{ coul}$$

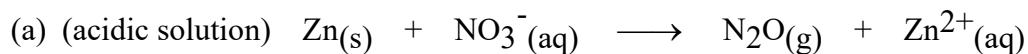
$$(3600 \text{ coul}) (1 \text{ mole e}^- / 96485 \text{ coul}) = 0.03731 \text{ mole e}^-$$

$$(0.03731 \text{ mole e}^-) (1 \text{ mole M} / 3 \text{ mole e}^-) = 0.01244 \text{ mole M}$$

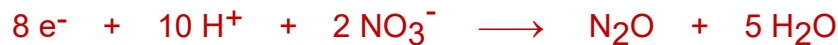
$$\text{molar mass of M} = 2.39 \text{ g} / 0.01244 \text{ mole} = 192.9 \text{ g/mole}$$

$$\therefore \text{M} = \text{Ir}$$

3. (8 points) Use the *ion-electron method* to balance each of the following redox reactions. For each reaction, write *complete, balanced equations* for the individual half-reactions and for the overall net ionic equation.



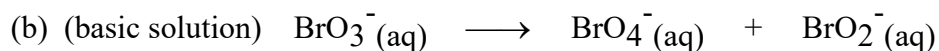
**Reduction** Half Reaction:



**Oxidation** Half Reaction:



**Net Ionic** Equation:



**Reduction** Half Reaction:



**Oxidation** Half Reaction:



**Net Ionic** Equation:

