**Quiz 5**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. If 15.00 mL of a ferrous ion solution is diluted with base and then titration with 42.57 mL of 0.1155 M potassium permanganate. Given the unbalanced equation (10 points):

Fe2+ (aq) + MnO4- (aq) → Fe3+ (aq) + MnO2 (s)

* 1. What is the balanced redox reaction?
	2. What is the molarity of ferrous ions in the original solution?
1. A 118 mL flask is evacuated and found to have a mass of 97.129 g. When the flask is filled with 768 torr of helium gas at 35 °C, it is found to have a mass of 97.171 g. Was the helium gas pure (10 points)?

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Fe2+ (aq) + MnO4- (aq) → Fe3+ (aq) + MnO2 (s)

* 1. What is the balanced redox reaction?

Red: MnO4- (aq) + 2 H2O (l) + 3 e- → MnO2 (s) + 4 OH- (aq)

Ox: **(**Fe2+ (aq) → Fe3+ (aq) + e-**) × 3**

Overall: MnO4- (aq) + 2 H2O (l) + 3 e- + 3 Fe2+ (aq) → MnO2 (s) + 4 OH- (aq) + 3 Fe3+ (aq) +3 e-

MnO4- (aq) + 2 H2O (l) + 3 Fe2+ (aq) → MnO2 (s) + 4 OH- (aq) + 3 Fe3+ (aq)

* 1. What is the molarity of ferrous ions in the original solution?

$$42.57 mL KMnO\_{4} soln×\frac{0.1155 mmol KMnO\_{4}}{1 mL KMnO\_{4} soln}×\frac{1 mmol MnO\_{4}^{-}}{1 mmol KMnO\_{4} }×\frac{3 mmol Fe^{2+}}{1 mmol MnO\_{4}^{-}}=\frac{14.750505 mmol Fe^{2+}}{15.00 mL Fe^{2+}}=0.983367 M Fe^{3+}≈0.9834 M Fe^{2+}$$

1. A 118 mL flask is evacuated and found to have a mass of 97.129 g. When the flask is filled with 768 torr of helium gas at 35 °C, it is found to have a mass of 97.171 g. Was the helium gas pure (10 points)?

V = 118 mL

mflask = 97.129 g

P = 768 torr

mflask + gas = 97.171 g

mgas = mflask + gas + mflask = 97.171 g – 97.129 g = 0.042 g

$$PV=nRT \& D=\frac{m}{V}\& MM=\frac{m}{n} ⇒MM=\frac{DRT}{P} $$

$$MM=\frac{mRT}{VP}=\frac{\left(0.042 g\right)\left(0.0821 \frac{L atm}{mol K}\right)\left(35 ℃+273.15\right)}{\left(118 mL\right)\left(768 torr\right)}×\frac{1000 mL}{1 L}×\frac{760 torr}{1 atm}=8.9\frac{g}{mol} ∴No, helium has an atomic mass of 4.0026\frac{g}{mol}$$