**Quiz 8**

# 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. Permanganate ion can oxidize sulfite to sulfate in basic solution (18 points):

MnO4- (aq) + SO32- (aq) 🡪 MnO2 (s) + SO42- (aq) E° = 1.51 V

* 1. Write the balanced chemical reaction.

Oxidation: (2 OH- (aq) + SO32- (aq) 🡪 SO42- (aq) + H2O (l) + 2 e-) x 3 E° = 0.92 V

Reduction: + (3 e- + 2 H2O (l) + MnO4- (aq) 🡪 MnO2 (s) + 4 OH- (aq)) x 2 E° = 0.59 V

6 OH-(aq) + 3 SO32- (aq) + 6 e- + 4 H2O (l) + 2 MnO4- (aq) 🡪 3 SO42- (aq) + 3 H2O (l) + 6 e- +2 MnO2 (s) + 8 OH- (aq)

Net Ionic Equation: 3 SO32- (aq) + H2O (l) + 2 MnO4- (aq) 🡪 3 SO42- (aq) + 2 MnO2 (s) + 2 OH- (aq)

* 1. Write the line notation for the reaction.

Pt (s) | SO32- (aq), SO42- (aq), OH- (aq) || MnO4- (aq), OH- (aq) | MnO2 (s) | Pt (s)

* 1. Determine the potential for the reaction at 298 K when the concentrations of the reactants and products are as follows: [MnO4-] = 0.150 M, [SO32-] = 0.356 M, [SO42-] = 0.178 M, and [OH-] = 0.0100 M.

$$E\_{cell}=E^{°}-\frac{RT}{nF}lnQ=E^{°}-\frac{RT}{nF}ln\left(\frac{[SO\_{4}^{2-}]^{3}[OH^{-}]^{2}}{[SO\_{3}^{2-}]^{3}[MnO\_{4}^{-}]^{2}}\right)$$

$$E\_{cell}=1.51 V-\frac{\left(8.3145\frac{J}{mol K}\right)\left(298 K\right)}{\left(6 mol e^{-}\right)\left(96485\frac{C}{mol e^{-}}\right)}ln\left(\frac{(0.178 M)^{3}(0.0100 M)^{2}}{(0.356 M)^{3}(0.150 M)^{2}}\right)$$

$$E\_{cell}=1.51 V--0.0318 V=1.54 V$$

* 1. Will the value of Erxn increase or decrease as the reaction proceeds?

Erxn will decrease as the reaction proceeds.

1. Complete the following statements (2 points):
	1. In a galvanic cell, oxidation occurs at the (anode, cathode).
	2. The cathode is the (positive, negative) electrode.
2. When using the voltmeter (2 points):
	1. The black electrode is attached to the (anode, cathode).
	2. The meter is set to (DC, AC).