**CHEM 1032 – Spring 2023 - Challenge Question 8**

# How does redox help us remove toxic compounds?

Depending on its oxidation state, chromium is either a toxic compound (*google Erin Brockovich*) or a possibly essential nutrient. Analyze the reaction below to see if mixing $H_2CrO_4$ with arsenic is a beneficial reaction.

$$H_3AsO_3\ (aq) + H_2CrO_4\ (aq) \leftrightarrows H_3AsO_4\ (aq) + Cr^{3+}$$

A. First, identify the oxidation state of As and Cr in the products and reactants. Show your work.

*Having trouble? Review questions from Chapter 16: 1 and 2.*

B. Which compound is being reduced? Which compound is being oxidized? Which compound is the reducing agent? Which compound is the oxidizing agent? Explain your answer.

*Having trouble? Review questions from Chapter 16: 5.*

C. Balance the redox reaction in acidic conditions. Clearly show all of your work.

*Having trouble? Review questions from Chapter 16: 4.*

D. The relevant half reactions are shown below. Calculate the value of $E°_{cell}$. Is the reaction spontaneous or nonspontaneous? Explain.

| | |
|---|---|
| $H_3AsO_4 + 2\ H^+ + 2e^- \leftrightarrows H_3AsO_3 + H_2O$ | $E°$ 0.575 V |
| $H_2CrO_4 + 6\ H^+ + 3\ e^- \leftrightarrows Cr^{3+} + 4\ H_2O$ | $E°$ 2.36 V |

*Having trouble? Review questions from Chapter 16: 21 and 22.*

E. Chromium (VI) is a toxic species. Using specific information from Parts A, B, C, and D determine if the reaction shown above is beneficial in making chromium less toxic. Explain. Is arsenic a good choice for the reaction? Explain.