WUCT: Chemistry of Movies Sample Questions

- 1. Colored fire is commonly used in movies as a special effect. In order to make different colors of fire, different metals must be put in the fire. The energy from the fire causes the electrons to move up to orbitals of higher energy, and then light of a certain frequency is produced giving way to different colors as electrons relax back down to their ground states.
 - a. Different metals produce different colors because of their differing ground state electron configurations and emission spectrums. Give the ground state noble gas electron configuration for lithium and barium.

b. Lithium gives a red color in a flame, whereas barium produces a green color. Which energy change (lithium or barium) from the ground state to the various excited states is greater?

c. The energy change between lithium's first excited state and ground state is 1.81 eV. Calculate the wavelength (in nm) of the photon that is released as the electron relaxes to the ground state.

- d. Determine which orbital filling rule(s) is broken by each of the following configurations for Barium:
 - i. [Xe] $6s^2$; Total spin = 1
 - ii. [Xe] $7s^2$; Total spin = 0
 - iii. [Xe] $6s^15d^1$; Total spin = 0

e. Which color flame is hotter: blue or red? Explain.

- 2. Fake blood is often used in movies for fighting scenes. The unbalanced equation for the chemical reaction that makes fake blood is $FeCl_3+KSCN \rightarrow K_3[Fe(SCN)_6]+KCl$.
 - a. Write the balanced equation of this chemical reaction.
 - b. If you start with 10.00 g of FeCl₃ and 40.00 g of KSCN, what is the limiting reactant?

c.	How many grams of KCl would be produced with the starting conditions given in part b?
d.	A chemistry student performed this experiment with the values in part b and calculated a percent yield of 65%. How many grams of $K_3[Fe(SCN)_6]$ did they produce?
e.	What is the oxidation number of Fe in the compound $K_3[Fe(SCN)_6]$?