Chemguide – questions

REDOX POTENTIALS FOR OTHER SYSTEMS

For these questions you will need to look at this table taken from the Chemguide page.

|		E^0 (volts)
$Li^+_{(aq)} + e^-$ ⇌ $Li_{(s)}$		-3.03
$K^+_{(aq)} + e^-$ ⇌ $K_{(s)}$		-2.92
$Ca^{2+}_{(aq)} + 2e^-$ ⇌ $Ca_{(s)}$		-2.87
$Na^+_{(aq)} + e^-$ ⇌ $Na_{(s)}$		-2.71
$Mg^{2+}_{(aq)} + 2e^-$ ⇌ $Mg_{(s)}$		-2.37
$Al^{3+}_{(aq)} + 3e^-$ ⇌ $Al_{(s)}$		-1.66
$Zn^{2+}_{(aq)} + 2e^-$ ⇌ $Zn_{(s)}$		-0.76
$Fe^{2+}_{(aq)} + 2e^-$ ⇌ $Fe_{(s)}$		-0.44
$Pb^{2+}_{(aq)} + 2e^-$ ⇌ $Pb_{(s)}$		-0.13
$2H^+_{(aq)} + 2e^-$ ⇌ $H_{2(g)}$		0
$Cu^{2+}_{(aq)} + 2e^-$ ⇌ $Cu_{(s)}$		+0.34
$Fe^{3+}_{(aq)} + e^-$ ⇌ $Fe^{2+}_{(aq)}$		+0.77
$Ag^+_{(aq)} + e^-$ ⇌ $Ag_{(s)}$		+0.80
$Cr_2O_7^{2-}_{(aq)} + 14H^+_{(aq)} + 6e^-$ ⇌ $2Cr^{3+}_{(aq)} + 7H_2O_{(l)}$		+1.33
$Cl_{2(g)} + 2e^-$ ⇌ $2Cl^-_{(aq)}$		+1.36
$Au^{3+}_{(aq)} + 3e^-$ ⇌ $Au_{(s)}$		+1.50

1. a) The cell diagram used to find the standard redox potential of the Cl_2/Cl^- system can be summarised like this:

$$Pt_{(s)} [H_{2(g)}] \mid 2H^+_{(aq)} \parallel Cl_{2(g)} , 2Cl^-_{(aq)} \mid Pt_{(s)}$$

$$E^0 = +1.36 \, v$$

Explain what that would look like in practice. Draw a fully labelled diagram if you want to, but a description is perfectly adequate.

b) Explain what an E^0 value of +1.36 volts implies about these two equilibria

$$2H^+_{(aq)} + 2e^- ⇌ H_{2(g)}$$

$$Cl_{2(g)} + 2e^- ⇌ 2Cl^-_{(aq)}$$
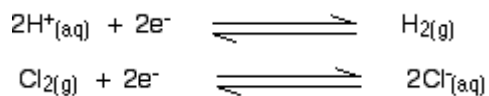
c) The E^0 value for the Fe^{3+}/Fe^{2+} is +0.77 volts. Write down the cell diagram (as in part (a)) for the determination of this value.

2. a) Looking at the table on the previous page, what is the strongest oxidising agent present?

b) Chlorine gas and dichromate(VI) ions in acidic solution are both oxidising agents. Which is the stronger?

c) Which of the following changes would be the easiest?

-   Converting iron(II) ions into iron(III) ions.
-   Converting chloride ions into chlorine.
-   Converting chromium(III) ions into dichromate(VI) ions.