Friday Worksheet 1 **Name: …….**
Secondary cells

1) The cell reaction when a 12 V car battery releases energy is given by the equation below.

$Pb(s) + PbO_2(s) + 4H^+(aq) + 2SO_4^{2-}(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

a) When the battery is being **recharged**, write the equation to the reaction that occurs at the negative electrode

b) Write the reaction that occurs at the cathode when the battery is discharging.

c) What voltage should be used to recharge the battery?

2) The rechargeable nickel-cadmium cell is used to power small appliances such as portable computers. When the cell is being used, the electrode reactions are represented by the following equations.

$NiO_2(s) + 2H_2O(l) + 2e. \Rightarrow Ni(OH)_2(s) + 2OH^-(aq)$

$Cd(s) + 2OH^-(aq) \Rightarrow Cd(OH)_2(s) + 2e.$

Consider the following statements

I cadmium is deposited on the negative electrode
II the pH of the electrolyte increases
III the direction of electron flow in the external circuit is from the anode to the cathode
IV the negative electrode loses mass.
V the pH around the cathode increases.

Which of the above occurs during the **recharging** of the nickel-cadmium cell?

3) A rechargeable cell, used in laptop computers, contains a metal alloy (designated M) which has hydrogen atoms adsorbed on its surface, and nickel in the form of NiO(OH)(s) and $Ni(OH)_2(s)$.
The half reactions, written as reduction reactions, as they would appear on the electrochemical series are:
$H_2O(l) + e \Rightarrow H$ (adsorbed on M) $+ OH^-(aq)$
$NiO(OH)(s) + H_2O(l) + e. \Rightarrow Ni(OH)_2(s) + OH^-(aq)$

a) While this cell is generating electricity, the metal alloy acts as the negative electrode. When this cell is discharging :

i. what species acts as the oxidant?

ii. what happens to the pH of the electrolyte ?

b) When recharging what is produced at the electrode connected to the positive terminal of the power source?