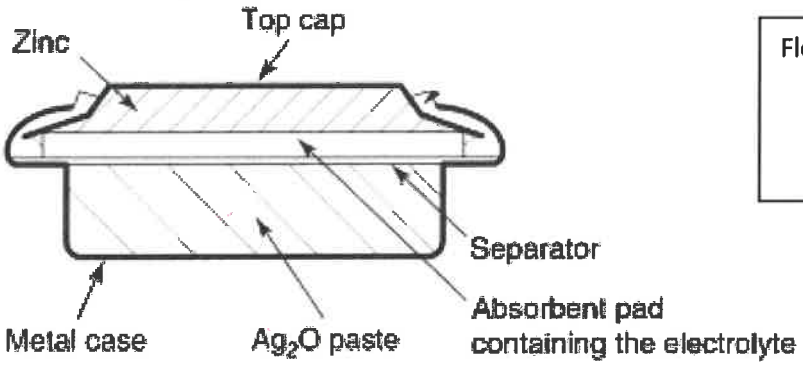
ATAR CHEMISTRY – UNIT 3
TASK 7 – Secondary Cell Validation

TOTAL MARKS: /14

Clearly write your answer in the space provided. Where applicable show all working out and for calculations express your answer to appropriate significant figures.

The silver oxide-zinc battery is rechargeable and utilises sodium hydroxide, NaOH, solution as the electrolyte. The battery is used as a backup in spacecraft if the primary energy supply fails.

Each cell consists of many 'stacks', the diagram of one 'stack' is shown below:



Flow of electrons: ↓

The overall reaction during **discharge** is:

release e^-

$$Zn + Ag_2O \rightarrow ZnO + 2Ag$$

1. Write balanced half equations occurring at each electrode during the **recharging** process:

non-spontaneous

Anode: ox	$Ag_{(s)} \rightarrow Ag^+ + e^-$
Cathode: Red	$Zn^{2+} + 2e^- \rightarrow Zn_{(s)}$

(2 marks)

2. In the box provided, draw the flow of electrons during the **discharging** process.

spontaneous

(1 mark)

3. Use the Standard Reduction Potential table to determine the overall EMF for the discharge of a cell containing 4 stacks.

(2 marks)

$+0.8 - (-0.76) = 0.8 + 0.76 = 1.56 \times 4$

$= 6.24\ V$

① 1.56 value ① 6.24 value including volts.

4. State the purpose of the separator and what the consequence would be if it were broken/removed from the stack.

(2 marks)

① keep electrodes apart / allow transfer of ions

① short circuit / circuit not complete

OR

Redox reaction will not be external.

5. The electrolyte is a sodium hydroxide (NaOH) paste with a 28.0%mass/mass ratio. If 45.0 mL of the electrolyte solution has a mass of 47.6 g, calculate the concentration of the electrolyte solution in mol L^{-1}.

(4 marks)

28% of 47.6g = 13.328g of NaOH

$n(NaOH) = \frac{m}{M} = \frac{13.328}{39.998} = 0.33321...$ moles

$[NaOH] = \frac{n}{V} = \frac{0.33321...}{0.045} = 7.40481...$ $mol L^{-1}$

$= 7.40 mol L^{-1}$

6. Would sodium chloride paste be a suitable electrolyte for this cell? Explain your answer.

(3 marks)

no marks without attempt of explanation.

① no

① Cl^- forms a precipitate with Ag^+

① Ag^+ concentration will decrease

OR solid build up will clog absorbent pad.