

Friday Worksheet

Name:

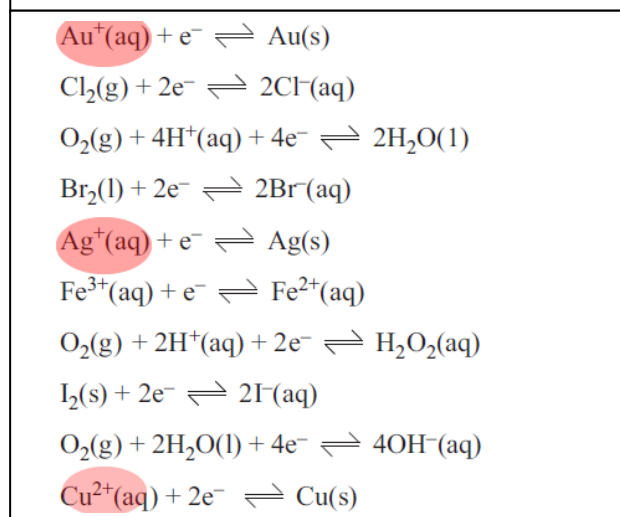
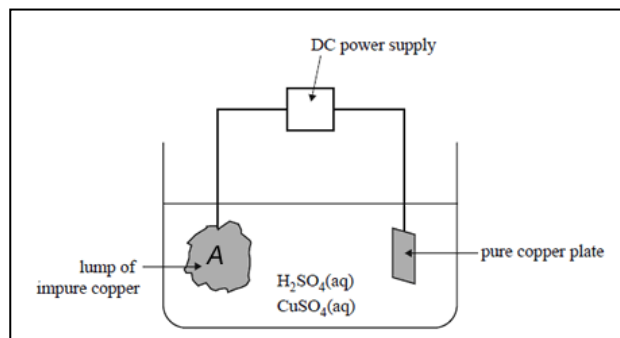
Electrolysis worksheet 2

1) An electrolytic process known as electrorefining is the final stage in producing highly purified copper. In a small-scale trial, a lump of impure copper is used as one electrode and a small plate of pure copper is used as the other electrode. The electrolyte is a mixture of aqueous sulfuric acid and copper sulfate.

a) Samples of copper mined typically contain impurities such as silver, gold, cobalt, nickel and zinc. Cobalt, nickel and zinc are oxidised from the copper lump and exist as ions in the electrolyte. Silver and gold are not oxidised and form part of an insoluble sludge at the base of the cell.

i. Why should silver and gold never be present as cations in the electrolyte?

Ag^+ and Au^+ ions are stronger oxidants than Cu^{2+} and hence will deposit before copper.

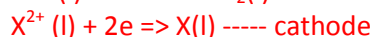


2) An electrolytic cell was set up using an unknown, molten metal salt, XBr_2 .

The apparatus was set up as shown on the right.

a) A current of 1.35 Amperes was applied for 29.0 minutes and 0.772 g of metal X was produced.

a. Write a balanced half-equation for the anode and cathode reactions in this electrolytic cell.



b. Identify metal X deposited on the electrode

Step 1 find the total charge delivered

$\Rightarrow Q = It = 1.35 \times 29.0 \times 60 = 2349$

Step 2 find the mol of electrons

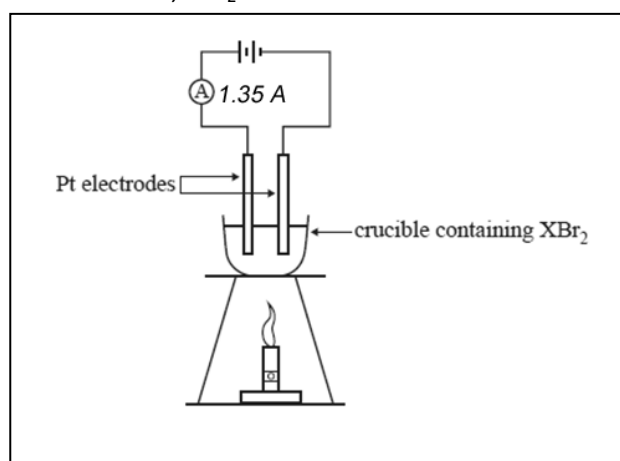
$\Rightarrow 2349 / 96500 = 0.0243$

Step 3 find the mol of metal X

$\Rightarrow n_x = \frac{1}{2} n_e = 0.0243 / 2 = 0.01215$

Step 4 find the molar mass of metal X

$\Rightarrow \text{molar mass} = \text{mass} / \text{mol} = 0.772 / 0.01215 = 63.5$ Hence it is copper.



3) Describe two differences between:

i. a fuel cell, and an electrolytic cell,

Fuel cell	Electrolytic cell
Chemical energy => electrical energy	electrical energy=> Chemical energy
Anode (-) cathode (+)	Anode (+) cathode (-)

Note that students should not reproduce learnt responses such as “reactants are constantly supplied and products continually removed. The reason is that there are electrolytic cells, such as the Downs Cell that also has reactants constantly supplied (NaCl (l)) and products continually removed (Na(l)). The membrane cell also has reactants (NaCl (aq))constantly fed through the cell and products (NaOH(aq) and Cl₂(g))continually removed.

ii. a galvanic cell and a fuel cell,

Fuel cell	Galvanic cell
Reactants constantly supplied and products continually removed.	Amount of reactants is finite and products accumulate.
Expensive	Relatively cheap