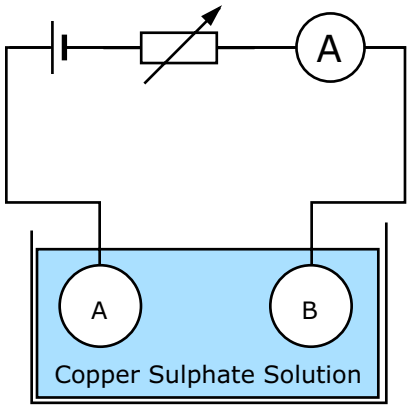
Electrolysis 1

Name & set

Copper plating is one of many common uses of electrolysis. A copper plating circuit is sketched below.



Copper sulphate is $CuSO_4$

a. What happens to copper sulphate molecules as they dissolve in water?

_____

_____

_____ [2]

b. Due to the electrolytic solution, an electric circuit is completed between the electrodes.

(i) Indicate, on the diagram ,with solid arrows the direction of the conventional current in the wires **and** in the solution. [2]

(ii) What carries the current in the wires, _____ [1]

What carries the current in the solution? _____ [1]

(iii) Label each electrode positive or negative appropriately. [1]

(iv) With dashed (----) arrows, mark the movement of the labeled charged particles in the wires and in the solution.

Explain how and why only pure copper is deposited on one of the electrodes, and on which one.

_____

_____

_____ [2]

d. How many electrons are needed to neutralise one copper ion?

One electron carries a charge of 1 .6 $\times$ 10^{-19} Coulomb. How much charge does each copper ion need to be neutralised i

_____

_____

_____ [3]

e. Two 10 penny pieces are clipped into the beaks of each croc clip.

The surface area of one 10 p piece is 2 $\times$ 200 = 400 mm^2 (double sided).

The width of a (square) copper atom is 2 $\times$ 10^{-10}m = 2 $\times$ 10^{-7}mm.

Work out how many atoms are needed to plate both sides of the coin with a layer of one atom thick copper.

_____

_____

_____ [3]

f,. How much charge needs to be transferred on one of the electrodes to completely copper plate the 10 p.?

_____

_____

_____ [2]

g. Copper plating works best when the layer is built up slowly, so good contact is made between the newly arrived copper and the coin. Therefore a small current of 1 milli Amp is allowed to flow in the circuit. How long does the current need to flow to get a one atom thick copper layer onto the coin?

_____

_____

_____ [3]

h. After copper plating many coins, the blue-ness of the copper sulphate solution fades away with use. Explain why.

_____

_____

_____ [2]