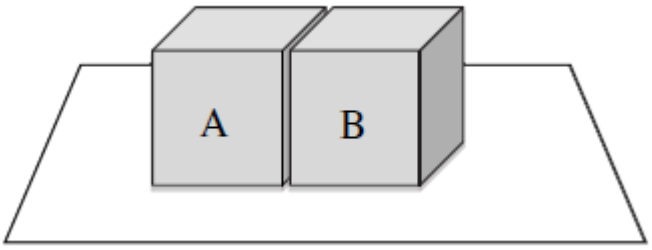
Name…….

Revision

Question 1

Two metal blocks which have the same mass of 2kg are placed in contact with each other. Block A is made of copper and Block B is made of an unknown metal.



Copper has a specific heat capacity of 385 J K^{-1} kg^{-1}

The copper block has a starting temperature of 550 K and the unknown block has a starting temperature of 300K.

After 3 minutes the blocks reach thermal equilibrium and are both at a temperature of 150°C.

a) Calculate the power transfer between the blocks at during this time.

150°C = 423 K

So copper block has lost = mcΔT

= 2 x 385 J K^{-1} kg^{-1} x (550-423)

= 97,800J

P transfer + 97800/ 180 = 543 W

b) What is the specific heat capacity of the unknown block?

mcΔT = mcΔT

2 x 385 J/kg x (550-423) = 2 x c x (423 - 300)

97800/ 246 = 398 J K^{-1} kg^{-1}

Question 2

Julie has 16 ceiling lights in her living room. Each light is rated 40 W and requires 36 V to work properly. Julie has the lights on for 3 hours per day on average.

a. Calculate the current through each light bulb. 2 marks

a. $I = \frac{P}{V}$

$= \frac{40}{36}$

$= 1.1 \text{ A}$

b. When all lights are on, how much combined charge would move through the 16 lights in 1 second? 2 marks

$16 \times 1.1 = 17.6 \text{ A}$

$Q = I \times t$

$= 17.6 \times 1$

$= 17.6 \text{ C}$

Julie has decided that she wants to reduce her power usage by installing energy-efficient light bulbs that use only 10 W, but still work at 36 V.

c. How much energy, in kWh, will Julie save per day if she uses the new light bulbs? 3 marks

$E = P \times t$

$E_{\text{before}} = 0.040 \text{ kW} \times 3 \times 16$

$= 1.92 \text{ kWh}$

$E_{\text{after}} = 0.010 \text{ kW} \times 3 \times 16$

$= 0.48 \text{ kWh}$

energy saved $= 1.92 - 0.48$

$= 1.44 \text{ kWh}$

Question 3

(a) Why was it not possible for atoms to form in the early universe?

Electrons can only be held by the nucleus below a certain temperature (about 3000 K).
The universe first had to cool (and expand) below this temperature, which took many years.

(b) Which is the main force that:

(i) holds protons and neutrons together?

Strong nuclear force

(ii) holds electrons in orbit?

Electromagnetic force

(c) Which of the forces in (b) are stongest?

The strong Nuclear force is much stronger than the electromagnetic force

(d) What is the name of the gauge boson associated with the forces in (b)

Strong nuclear – gluon
Electromagnetic - photon