Electrostatics – Part 4

We have learnt:

- how to calculate the new charge on objects that were charged and then touched each other
- that each object will have the same charge as the other after touching
- that only a whole number of electrons can be transferred
- that electron charge is grouped in units called Coulombs
- that electrons will be transferred from the object that is more negative (or less positive)

Now we will learn how to calculate HOW MUCH charge is transferred from one object to another when they touch.

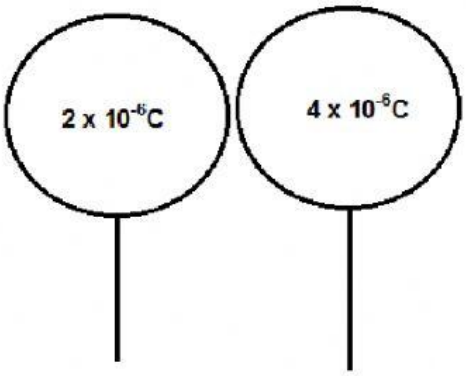
$$Q_{transferred} = Q_{final} - Q_{initial}$$

- To calculate $Q_{transferred}$, we first need to calculate Q_{new} which is the value we then use for Q_{final}.

- For $Q_{initial}$ we can use the initial charge before touching from EITHER of the objects. The answer will be the same no matter which initial charge you use; one object will give a positive answer and the other a negative answer.

- Remember that electrons are transferred FROM the more negative object TO the less negative one, but it's the same number of electrons coming FROM and going TO!

To calculate the charge that was transferred:



First calculate Q_{new}:

$$Q_{new} = \frac{Q1 + Q2}{2}$$
$$= \frac{2 \times 10^{-6} + 4 \times 10^{-6}}{2}$$
$$= 3 \times 10^{-6}C$$

Then calculate $Q_{transferred}$:

$Q_{transferred} = Q_{final} - Q_{initial}$
$= 3 \times 10^{-6} - 2 \times 10^{-6}$ .....using Q_1
$= 1 \times 10^{-6}C$

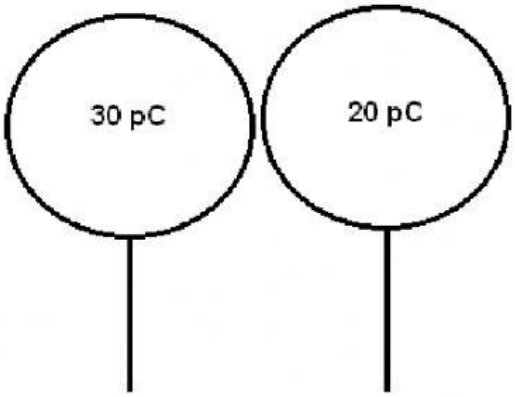
Or

$Q_{transferred} = Q_{final} - Q_{initial}$
$= 3 \times 10^{-6} - 4 \times 10^{-6}$ .....using Q_2
$= -1 \times 10^{-6}C$

Exercise 3

Calculate the charge transferred from one sphere to the next if the following spheres are brought into contact in the following exercise:

2.



Always enter the object on the left as Q1 and the right as Q2 as this is the way the answers are set up

$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

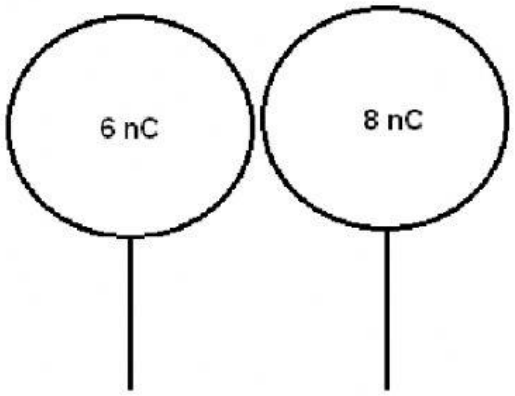
$$= \quad -$$

$$= \quad C$$

Q_{final} is the value you calculated for Q_{new}

You can use EITHER Q_1 or Q_2 for $Q_{initial}$

3.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

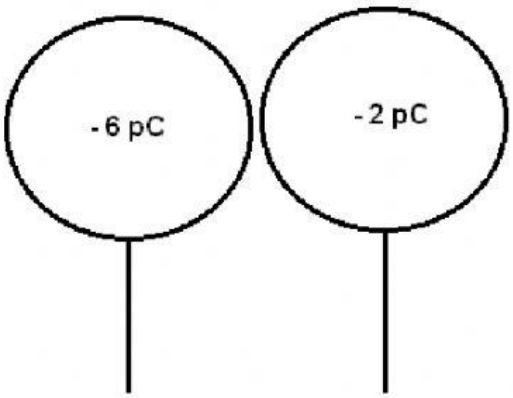
$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$

4.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

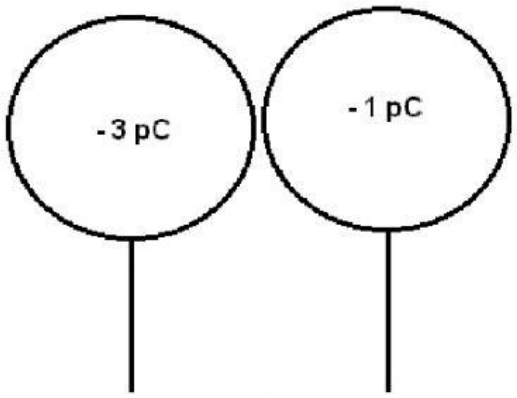
$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$

5.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

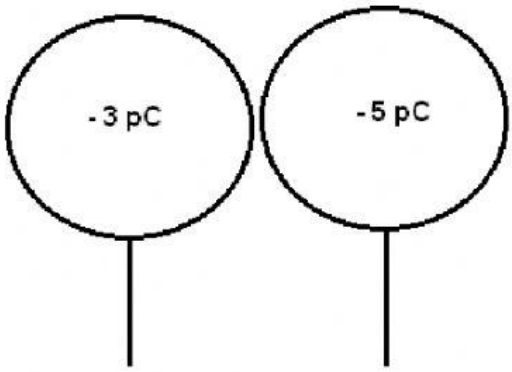
$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$

6.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

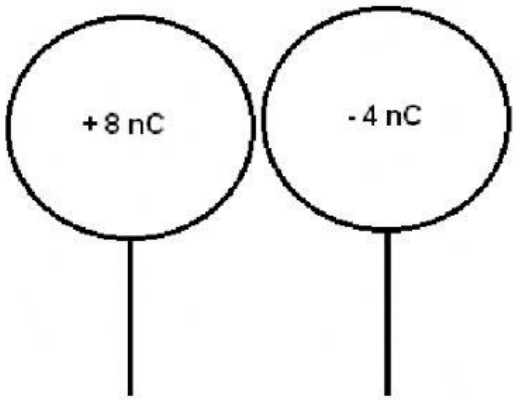
$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$

7.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{+}{2}$$

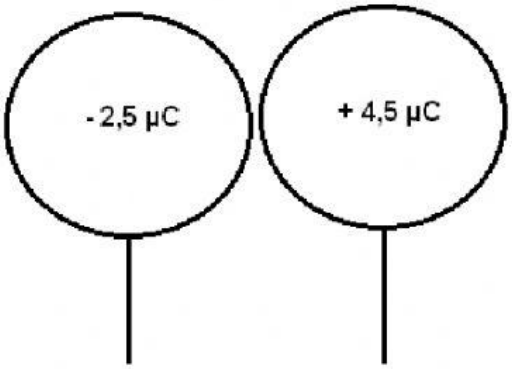
$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$

8.



$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{+}{2}$$

$$= \quad C$$

$$Q_{trans} = Q_{final} - Q_{initial}$$

$$= \quad -$$

$$= \quad C$$