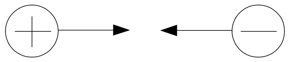
Year 11 Physics **_ANSWERS_**

Test: Electric Circuits

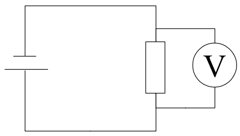
1.

(a)  (same length, opposite direction)

(b) The electrons are more strongly attracted to either the balloon or the hair so they are transferred from one to the other. Where they move from becomes positive and where they move to becomes negative. Positive and negative then attract.

(c) Charges can move easily through conductors but not insulators.

2.

(a) 

(in parallel)

(b) (this is just a suggestion so there's not only one right answer)
Measuring the potential difference is a good way of knowing how much energy was used up by that electric component.

3.

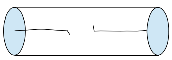
(a) They flow in opposite directions.

(b) Current is about the movement of the charges (rate/speed) but doesn't tell us how much energy they carry, whereas voltage is about the energy carried but doesn't say how many charges are flowing.

(c) Electrical wiring becomes hot as atoms resist electrons flowing through the metal. Having more current means more resisted flow and therefore more heat. This heat could build up so much that it ignites the materials around the wire.

(d)
$$I = \frac{q}{\Delta t} = \frac{1.50}{5.00} = 0.300 \text{ A}$$

This is greater than 250 mA (0.250 A) so the fuse wire will melt.



(e) $\Delta V = IR$

$$\therefore R = \frac{\Delta V}{I}$$
$$= \frac{0.05}{0.3}$$
$$= 0.2\ \Omega$$

(f) A thicker wire will have **less** resistance.

4.

(a) For resistors in parallel:

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$$
$$= \frac{1}{36} + \frac{1}{18}$$
$$= \frac{1}{12}$$
$$\therefore R_t = 12\ \Omega$$

(b) For resistors in series:

$$R_t = R_1 + R_2$$
$$= 12 + 13$$
$$= 25\ \Omega$$

(c) $\Delta V = IR$

$$\therefore I = \frac{\Delta V}{R}$$
$$= \frac{12}{25}$$
$$= 0.48\ \text{A}$$

This is the current using the total resistance and voltage. Since the current is the same for all series components, this is also the current through the 13 Ω resistor.

(d) Potential difference across just the 13 Ω resistor is:

$$\Delta V = IR$$
$$= 0.48 \times 13$$
$$= 6.2\ \text{V}$$

So potential difference across the parallel section is 12 – 6.2 = 5.8 V. Since the voltage is the same for all parallel components, this is also the voltage across the 18 Ω resistor.

5. $$efficiency = \frac{useful\ energy}{total\ energy} \times 100$$

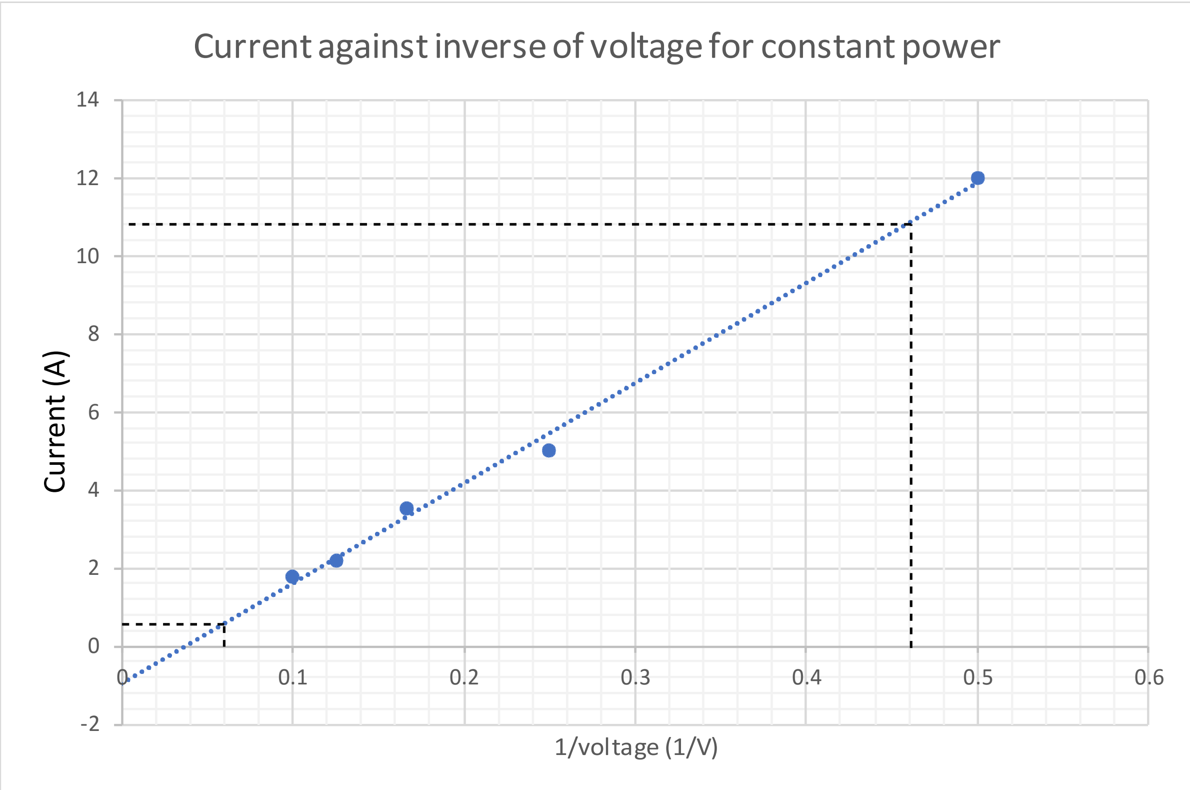
$$\therefore total\ energy = \frac{useful\ energy \times 100}{efficiency}$$

$$= \frac{0.28 \times 100}{60}$$

$$= 0.47\ \text{kWh}$$

At 30 c per kWh the cost is 0.47×30 = 14 c.

6.



(a) $$slope = \frac{rise}{run}$$

$$= \frac{10.8 - 0.6}{0.46 - 0.06}$$

$$= 26\ \text{A V}$$

(b) $P = VI$

$$\therefore I = \frac{P}{V}$$

In $y = mx$ form this becomes:

$$I = P\frac{1}{V}$$

This means slope = P

$\therefore P = 26\ \text{W}$