b) The light bulb is now replaced by a lower resistance (brighter) light bulb. The terminal voltage will now be

- [x] less than before.
- [ ] the same as before.
- [ ] greater than before.

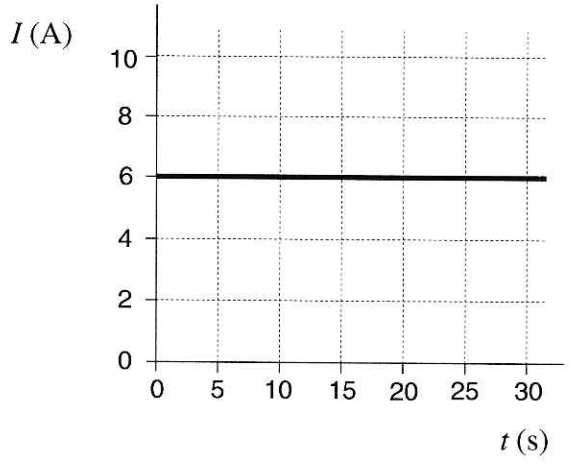
(Check one response.) **(1 mark)**

c) Using principles of physics, explain your answer to b). **(3 marks)**

The total resistance of the circuit will decrease, therefore the current through the battery will increase.

More potential will be dropped across the internal resistance, therefore the terminal voltage will decrease.

8. A power supply was connected to a resistor and a student plotted the graph of current, I, flowing through the resistor versus time, t, as shown below.



a) Calculate the area under the graph between $t = 0$ s and $t = 30$ s. **(2 marks)**

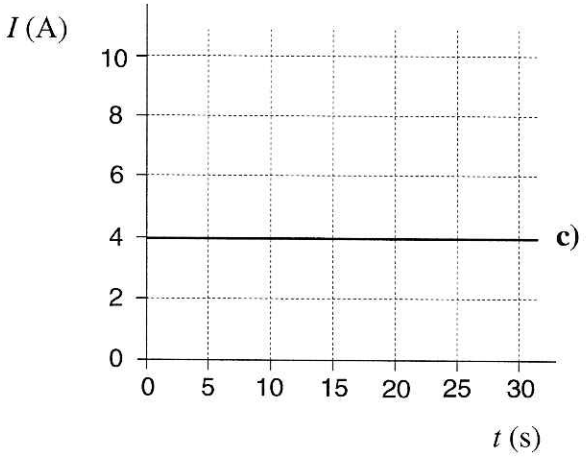
$Area = (6\text{ A})(30\text{ s})$

$180\text{ A}\cdot\text{s} = 180\text{ C}$

b) What does this area represent? **(1 mark)**

This area represents the charge delivered.

c) The same power supply is connected to a resistor of greater resistance. For this new set-up, sketch a possible graph on the axes below and label it c). **(2 marks)**



9. A 12 V battery transfers 33 C of charge to an external circuit in 7.5 s.

a) What current flows through the circuit? **(2 marks)**

$I = \frac{q}{t}$ ← ½ **mark**

$= \frac{33\text{ C}}{7.5\text{ s}}$ ← ½ **mark**

$= 4.4\text{ A}$ ← **1 mark**

b) What is the resistance of the circuit? **(2 marks)**

$R = \frac{V}{I}$ ← ½ **mark**

$= \frac{12}{4.4}$ ← ½ **mark**

$= 2.7\ \Omega$ ← **1 mark**

c) What is the power output of the battery? **(2 marks)**

$P = V \cdot I$ ← ½ **mark**

$= 12(4.4)$ ← ½ **mark**

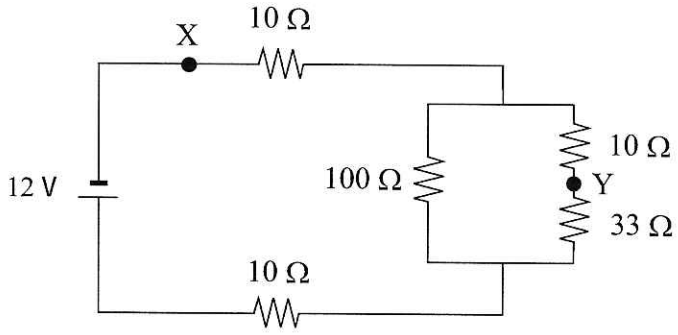
$= 53\text{ W}$ ← **1 mark**

d) The external circuit is most likely to consist of

- ☑ a bulb.
- ☐ a kettle.
- ☐ a calculator.

(Check one response.) **(1 mark)**

10. What is the potential difference between points X and Y? **(7 marks)**



$$R_T = 10\Omega + 10\Omega + \left(\frac{1}{100\Omega} + \frac{1}{(10\Omega + 33\Omega)}\right)^{-1}$$
$$= 10\Omega + 10\Omega + 30\Omega$$
$$= 50\Omega$$
} 2 marks

$$I_T = \frac{V_T}{R_T} = \frac{12V}{50\Omega} = 0.24A$$ } 1 mark

$$V_X = 10\Omega \times 0.24A = 2.4V$$ } 0.5 mark

$$I = \frac{7.2V}{43\Omega} = 0.167A$$ } 2 marks

$$V_Y = 10\Omega \times 0.167A = 1.67V$$ } 0.5 mark

$$\therefore V_{XY} = 2.4V + 1.67V = 4.07V$$ } 1 mark