P3.2 Summary questions

1 a a-3-x, b-1-z, c-2-y

b Potential difference = A difference in (electrical) potential produced by the separation of charge that enable charges to do work, the energy (work done) by a charge.
Resistance = A measure of how easy it is for a current to flow, resistance = p.d/current.

2 a i Given:
Current = 0.15 A
Time = 10 s
charge flow = current \times time
= 0.15 A \times 10 s
= 1.5 C

ii Given:
Resistance = 4 Ω
Current = 0.15 A
Potential difference = current \times resistance
= 0.15 A \times 4 Ω
= 0.6 V

iii Energy = p.d. \times charge
= 0.6 V \times 1.5 C
= 0.9 J

iv Power = \frac{energy}{time}
= \frac{0.9 J}{10 s}
= 0.09 W

b The wire contains a lattice of positive ions. As the electrons move through the wire they collide with the ions and transfer energy. The ions vibrate more and the wire gets hotter and glows.

c Given:
current = 0.8 A
resistance = 10 Ω
Power = current^2 \times resistance
= (0.8 A)^2 \times 10 Ω
Student Book answers

P3.2 Simple circuits

3 a i A series circuit has one loop, but a parallel circuit has more than one loop.

ii If one light bulb breaks, the others stay on.

b i resistance of green lamp = 3 Ω
resistance of blue lamp = 5 Ω
current = 1.5 A
p.d. across green lamp = current \times resistance
= 1.5 A \times 3 Ω
= 4.5 V
p.d. across blue lamp = current \times resistance
= 1.5 A \times 5 Ω
= 7.5 V

ii energy per second = power = potential difference \times current
for the green lamp: power = 4.5 V \times 1.5 A
= 6.8 W (2 sig fig)
for the blue lamp: power = 7.5 V \times 1.5 A
= 11 W (2 sig fig)

iii total potential difference = sum of p.d.s across the components in the circuit
= 4.5 V + 7.5 V
= 12 V

iv When they are connected in parallel the p.d. across each is the same but the resistance of the green lamp is less than the resistance of the blue lamp, so the current through the green lamp will be bigger. Therefore the energy transferred per second (P = VI, or I^2R) by the green lamp will be bigger, so it will be brighter.

4 a The resistance of a thermistor changes with temperature.

b Connect up a resistor, thermistor and power supply in series. Connect a voltmeter across the thermistor or the resistor.

As the temperature changes the resistance of the thermistor changes and so does the potential difference reading on the voltmeter.

c It would be more sensitive at low temperatures.

At low temperatures, a small change in temperature produces a large change in resistance.

d Monitoring the light level, e.g. in an office so that lights are turned off at night.

5 Both are series circuits.

Both contain a battery and two components.
The components (other than the battery) in the sensing circuit are different (a resistor and an LDR), but the components in the bulb circuit are the same.
A sensing circuit contains a voltmeter.
6 a i \( R = \frac{V}{I} \quad R = \frac{8}{0.6} = 13.33 \)

b i lamp

ii when the filament/wire in a lamp gets hotter, the resistance varies – at high temperatures the current increases as resistance, but at a slower rate making the non-linear graph. OR A diode only allows current to flow in one direction, below 0 on the potential difference axis the graph would be a straight line along the axis if Y was a diode, so it is a lamp.

c Y
d X 0.45 A, Y 0.6 A

e