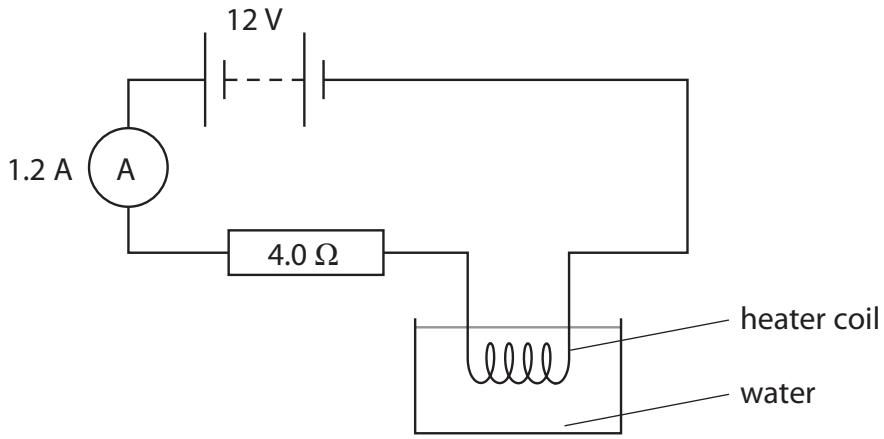
1 The diagram shows a heater coil and a resistor connected to a 12 V battery and an ammeter. The ammeter reading is 1.2 A.



(a) (i) State the equation linking voltage, current and resistance.

(1)

V= I * R

(ii) Calculate the voltage across the 4.0 Ω resistor.

(2)

V = 1.2 * 4 = 4.8V

Voltage = ... V

(iii) Show that the voltage across the heater coil is about 7 V.

(2)

12 - 4.8 = 7.2V

(iv) Calculate the energy transferred to the heater coil in 5.0 minutes.

(3)

E = P*t = I*V*t = 1.2 * 7.2 * (5 * 60) = 2592J

Energy transferred = ... J

(v) At first, the temperature of the water increases.

After a while, the temperature reaches a steady value below the boiling point of water.

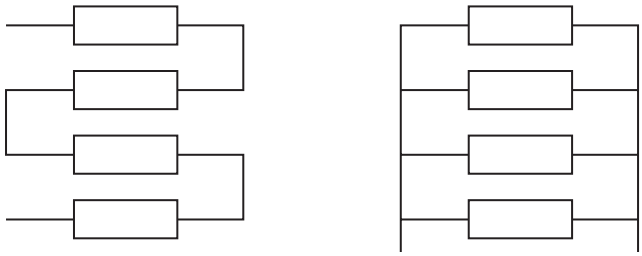
Explain why the temperature reaches a steady value.

(2)

As the water temperature increases the rate of heat leaving the water rises, eventually the rate of heat leaving equals the rate of heat entering through the col and the temperature stays constant.

(b) Resistors can be used as heating elements in the rear windows of cars.

The diagram shows two possible designs.



X **Y**

(i) Complete the table by placing a tick (✓) in the correct boxes.

(1)

Design	Series	Parallel
X	✓	
Y		✓

(ii) Describe the advantages and disadvantages of design **X** when used as a heater in a car window.

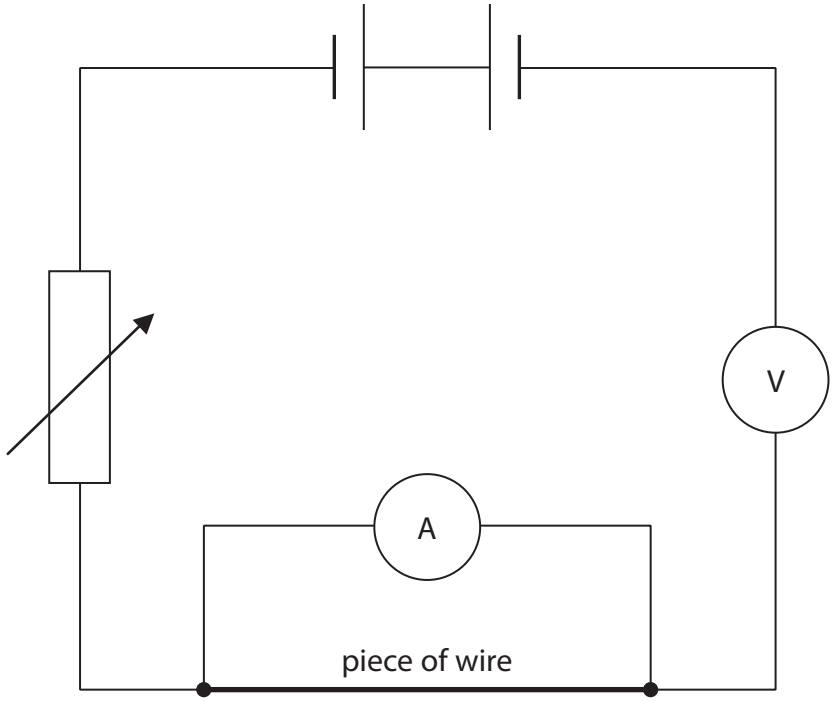
(3)

The wiring is simpler and possibly cheaper to manufacture but if one of the heating coils breaks the rest will stop working.

(Total for Question 1 = 14 marks)

2 A student plans to measure the resistance of a piece of wire.

He sets up this circuit and finds that it does not work.



(a) Identify the three errors in the student's circuit.

(3)

1 **cells have opposite polarity**

2 **the ammeter is in parallel not series with the wire.**

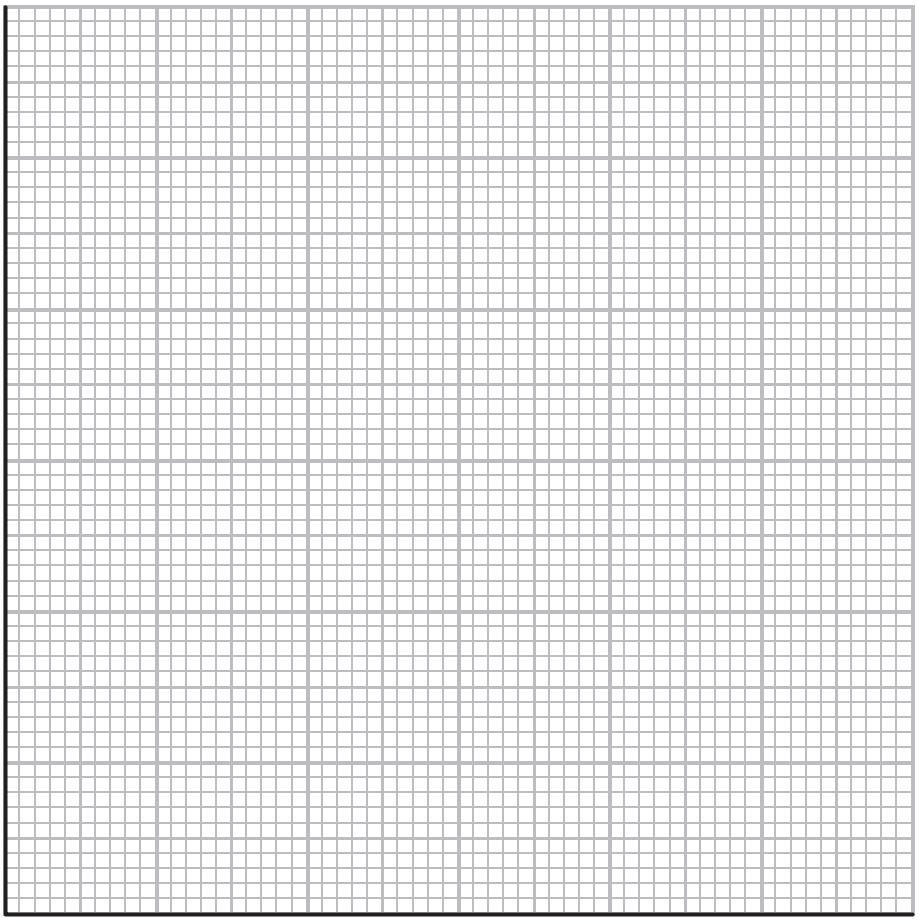
3 **the voltmeter is in series not parallel with the wire.**

(b) The student uses a correct circuit to obtain these results.

Current in amps	Voltage in volts
0.00	0.0
0.24	1.5
0.71	4.5
0.89	6.0
1.00	7.5
1.10	9.0

(i) Plot a graph to show the relationship between current and voltage for the wire.

(5)



(ii) Find the current when the voltage is 2.5 V.

(1)

(iii) Suggest why the line on the graph curves.

(1)

At higher currents the wire heats up and it's resistance increases.

(iv) Describe what else the student should do to find an accurate value for the resistance of the piece of wire at a constant temperature.

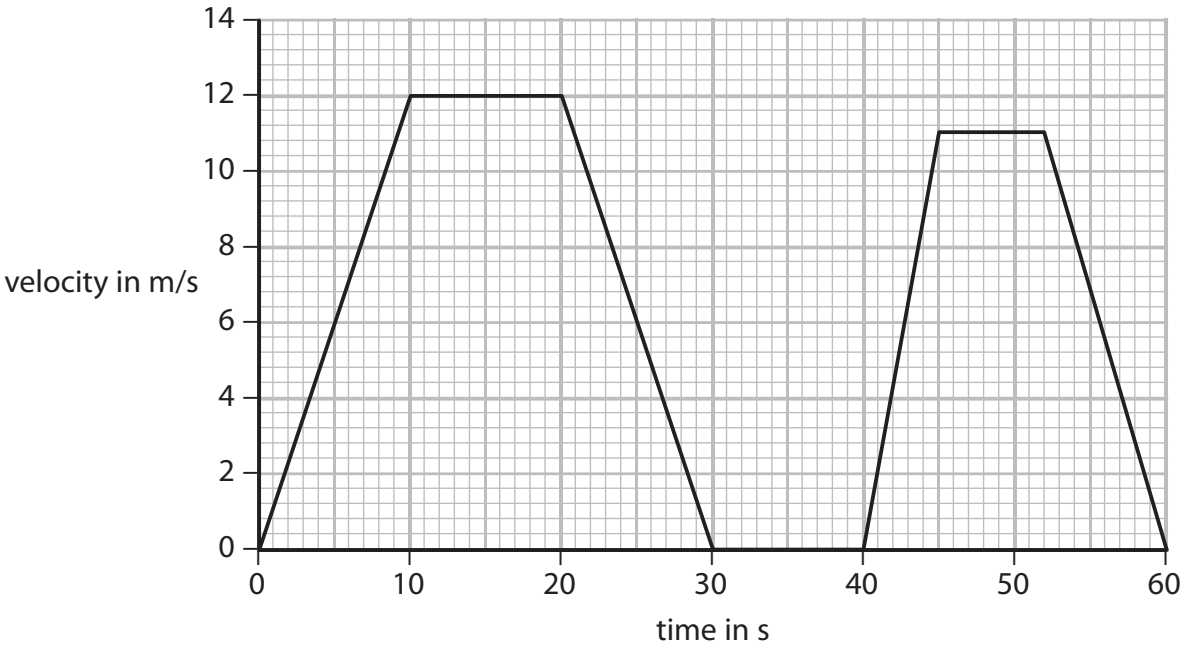
(4)

Immersing the wire in a water bath would keep it at a constant temperature. The student should coat the wire with an insulating material such as varnish first otherwise the conductivity of the water might interfere with the results. The students can also use a thermometer to check that the temperature doesn't change much during the experiment.

(Total for Question 2 = 14 marks)

4 A bus travels along a straight road.

The graph shows how the velocity of the bus changes during a short journey.



(a) (i) State the velocity of the bus after 25 s.

(1)

velocity = 6m/s m/s

(ii) How long is the bus stationary during its journey?

(1)

time = 10s s

(b) (i) State the equation linking acceleration, change in velocity and time taken.

(1)

accel = chnage in v / change in t

(ii) Calculate the acceleration of the bus during the first 10 seconds.

Give the unit.

(3)

a = 12 / 10 = 1.2 (m / s^2)

acceleration = **1.2** unit **m/s^2**

(c) (i) State the equation linking average speed, distance moved and time taken.

(1)

s = d / t

(ii) The bus moves a total distance of 390 m during the journey.

Calculate the average speed of the bus.

(2)

s = 390 / 60 = 6.5m/s

average speed = ... m/s

(d) The bus travels further in the first 30 seconds of its journey than it does during the last 30 seconds.

Explain how the graph shows this.

(2)

the area under the graph is larger in the first 30 seconds than the last 30 seconds.

(Total for Question 4 = 11 marks)