2 At room temperature, a metal wire has a diameter of 1.02 mm and a resistance per unit length of $1.73\,\Omega\,m^{-1}$.

The wire is connected to a d.c. power supply. When the power supply is first switched on, the wire heats up from room temperature to a higher constant temperature in a time of 60 s.

(a) Calculate the resistivity of the wire at room temperature.

resistivity = ... Ω m [3]

(b) **(i)** The first law of thermodynamics, when applied to a system, can be expressed as:

$$\Delta U = q + w$$

where ΔU is the increase in internal energy of the system,
q is the heat supplied to the system and
w is the work done on the system.

Use the words **positive**, **negative** and **zero** to complete Table 2.1 for the three terms in the equation for the wire at the times shown. You may use each word once, more than once or not at all.

Table 2.1

time after being switched on / s	ΔU	q	w
0–59			
60–100			

[2]

(ii) At its higher constant temperature, the current in the wire is 12A and the potential difference across it is 230V.

Complete Table 2.2 to show the values of ΔU, q and w for a time of 40s at this higher constant temperature.

Table 2.2

ΔU/J	q/J	w/J

[3]

[Total: 8]