A level Physics A

H556/03 Unified physics

Question Set 7

1   This question is about a resistance wire made of nichrome.

(a)* It is suggested that the resistance R of a length of nichrome wire varies with temperature θ in °C according to the equation

$$R = R_0 (1 + k\theta)$$

where R_0 is the resistance of the wire at $0\,°C$ and k is a constant for the wire.

Fig. 1.1 shows a diagram of the arrangement of apparatus in an experiment to test the relationship between R and θ and to determine the value of k.
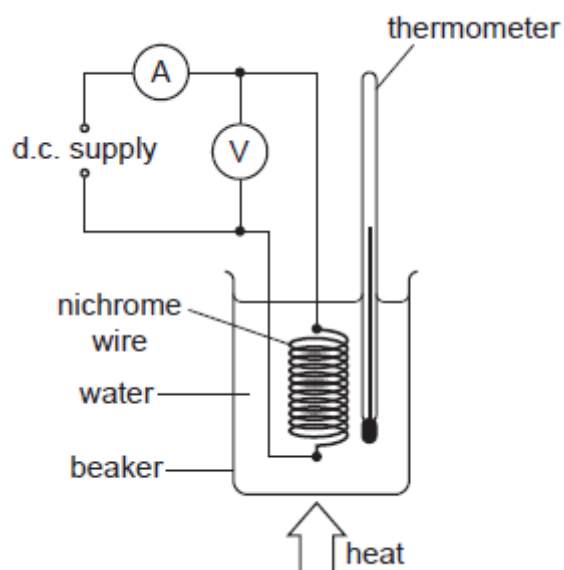

Fig. 1.1

The resistance wire is coiled and placed in a water bath.

Describe how you would carry out the experiment, analyse the data to verify the relationship between R and θ and determine a value for k.
In your description, state any precautions that you would take to improve the accuracy and precision of the measurements.

[6]

(b) A student is investigating a 230 V, 1.0 kW heating element. The heating element is shown in Fig. 1.2.
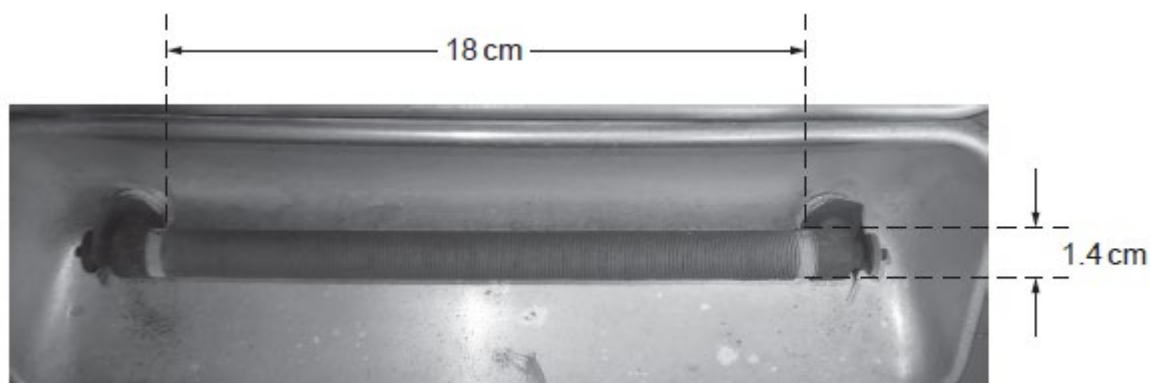

Fig. 1.2

A length of nichrome wire is wound in a spiral groove along 18 cm of a ceramic cylinder of diameter 1.4 cm. The distance between the centres of adjacent turns of the wire is 1.5 mm.

The numbers labelling the reels of loose wire on the laboratory shelf are the *imperial standard wire gauge* (swg). The student wishes to find out which reel holds the same wire as that wound on the heating element of Fig. 1.2.

The book of data gives the following information:

resistivity of nichrome at operating temperature = $1.1 \times 10^{-6}\,\Omega$m

swg	24	26	28	30	32
diameter of wire/ 10^{-3} m	0.56	0.46	0.38	0.32	0.27
cross-sectional area / 10^{-6} m^2	0.25	0.16	0.11	0.08	0.06

(i) Show that the resistance of the nichrome wire wound on the ceramic cylinder is 53 Ω.

[2]

(ii) Show that the length of wire wound on the heating element is 5.3 m.

[2]

(iii) Use the information given in **(i)** and **(ii)** to determine the swg number of the wire used as the heating element.

swg number = ... [3]

Total Marks for Question Set 7: 13

OCR

Oxford Cambridge and RSA