

Temperature

Question paper 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Temperature
Sub Topic	
Paper Type	Theory
Booklet	Question paper 2

Time Allowed: 32 minutes

Score: /26

Percentage: /100

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) A student states, quite wrongly, that temperature measures the amount of thermal energy (heat) in a body.

State and explain two observations that show why this statement is incorrect.

1.
.....
.....
2.
.....
.....

[4]

- (b) A thermometer and an electrical heater are inserted into holes in an aluminium block of mass 960g, as shown in Fig. 3.1.

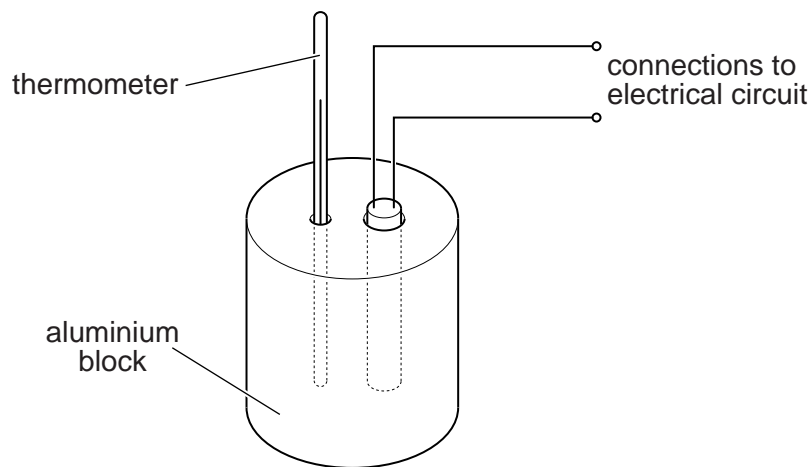


Fig. 3.1

The power rating of the heater is 54W.

The heater is switched on and readings of the temperature of the block are taken at regular time intervals. When the block reaches a constant temperature, the heater is switched off and then further temperature readings are taken. The variation with time t of the temperature θ of the block is shown in Fig. 3.2.

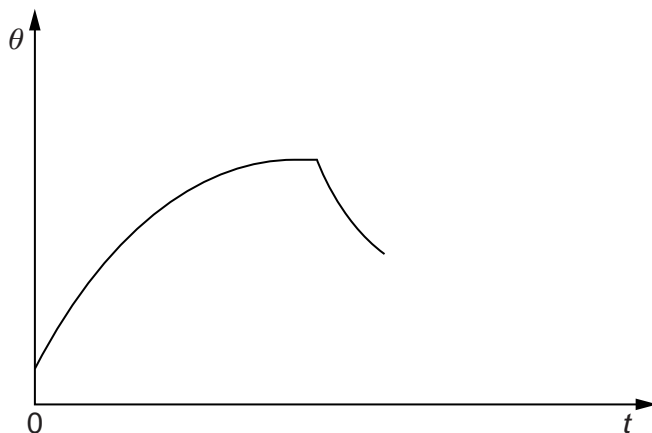


Fig. 3.2

- (i) Suggest why the rate of rise of temperature of the block decreases to zero.

.....
.....
..... [2]

- (ii) After the heater has been switched off, the maximum rate of fall of temperature is 3.7K per minute.

Estimate the specific heat capacity of aluminium.

specific heat capacity = J kg⁻¹ K⁻¹ [3]

- 2 The electrical resistance of a thermistor is to be used to measure temperatures in the range 12 °C to 24 °C. Fig. 3.1 shows the variation with temperature, measured in degrees Celsius, of the resistance of the thermistor.

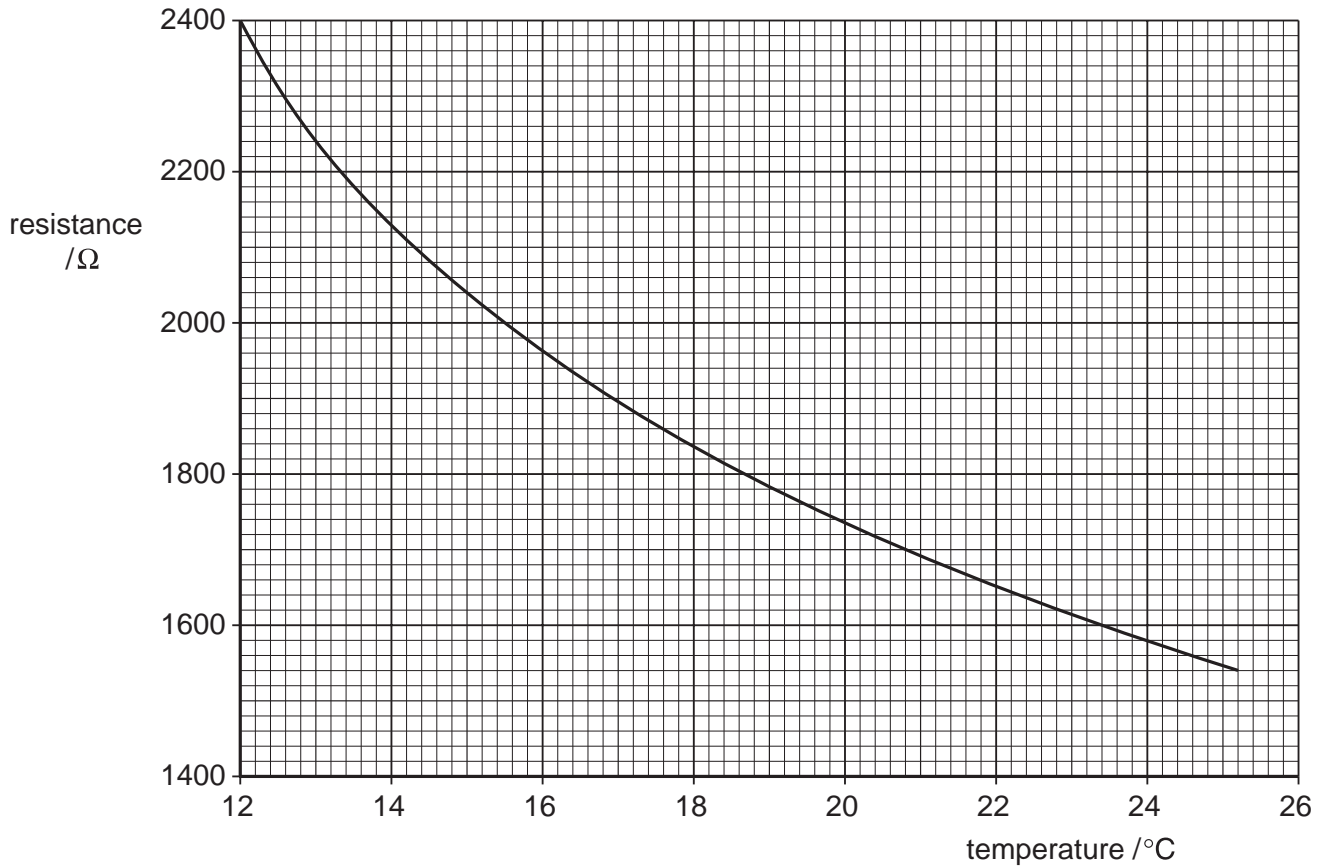


Fig. 3.1

- (a) State and explain the feature of Fig.3.1 which shows that the thermometer has a sensitivity that varies with temperature.

.....

 [2]

- (b) At one particular temperature, the resistance of the thermistor is $2040 \pm 20 \Omega$.
 Determine this temperature, in kelvin, to an appropriate number of decimal places.

temperature = K [3]

- 3 The e.m.f. generated in a thermocouple thermometer may be used for the measurement of temperature.

Fig. 7.1 shows the variation with temperature T of the e.m.f. E .

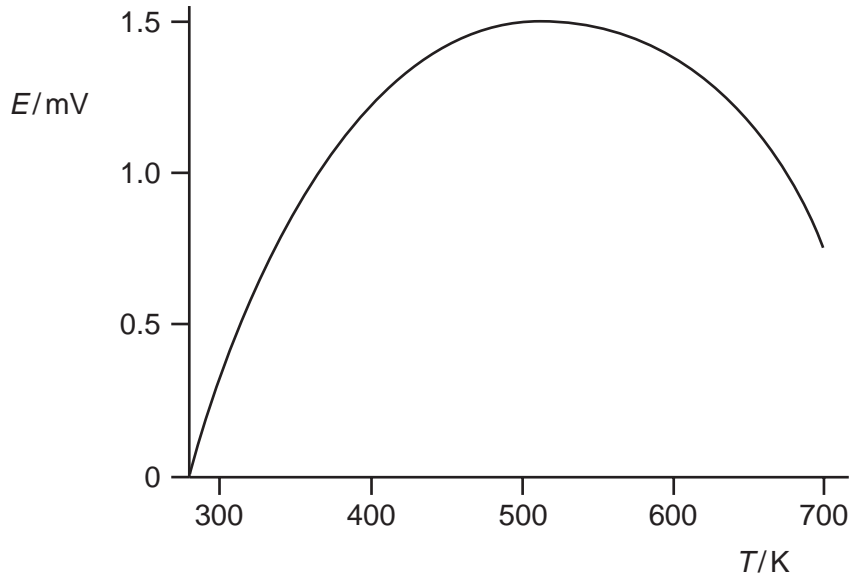


Fig. 7.1

- (a) By reference to Fig. 7.1, state two disadvantages of using this thermocouple when the e.m.f. is about 1.0 mV.

1.
2.[2]

- (b) An alternative to the thermocouple thermometer is the resistance thermometer.

State two advantages that a thermocouple thermometer has over a resistance thermometer.

1.
.....
2.
.....[2]

- 4 (a) An operational amplifier (op-amp) may be used as a comparator.
State the function of a comparator.

.....
.....
..... [2]

- (b) The variation with temperature θ of the resistance R of a thermistor is shown in Fig. 9.1.

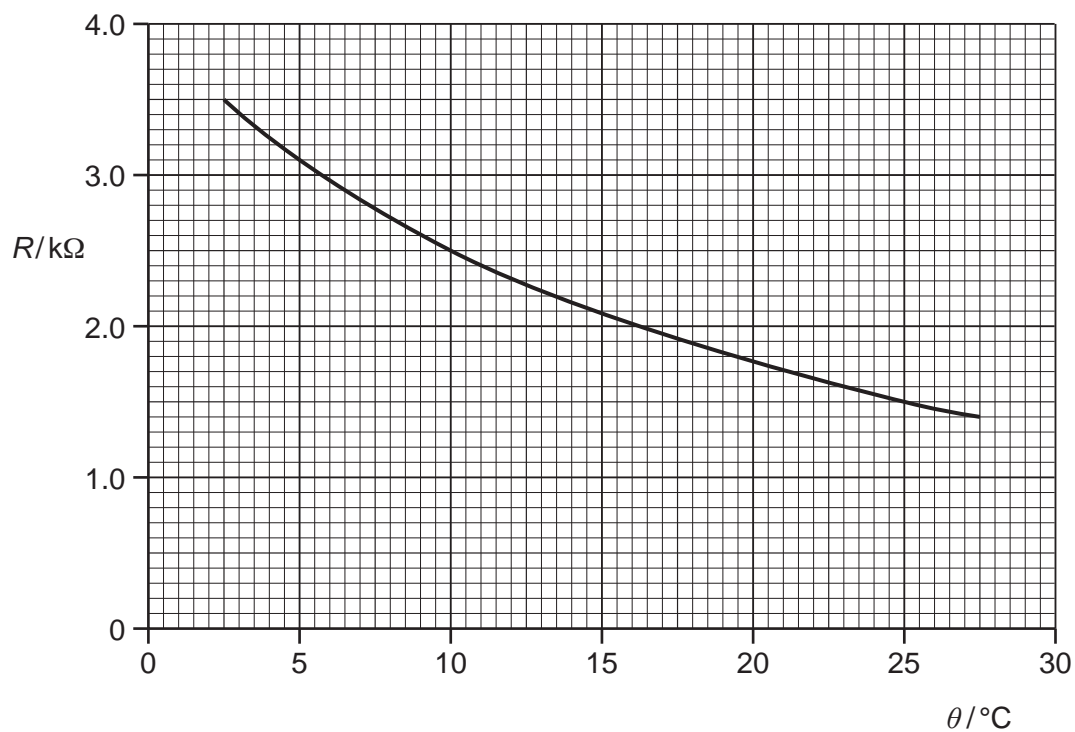


Fig. 9.1

The thermistor is connected into the circuit of Fig. 9.2.

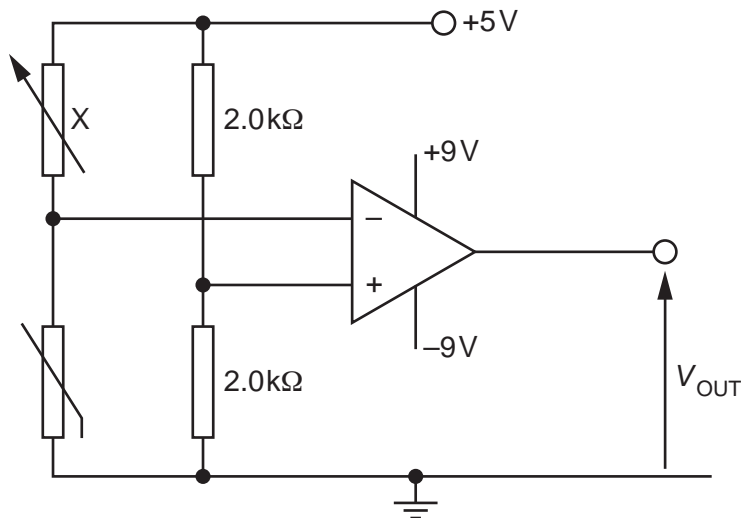


Fig. 9.2

The op-amp may be considered to be ideal.

- (i) The temperature of the thermistor is 10 °C.
Determine the resistance of the variable resistor X such that the output potential V_{OUT} is zero.

resistance = Ω [2]

- (ii) The resistance of the resistor X is now held constant at the value calculated in (i).
Describe the change in the output potential V_{OUT} as the temperature of the thermistor is changed from 5 °C to 20 °C.

.....

 [4]