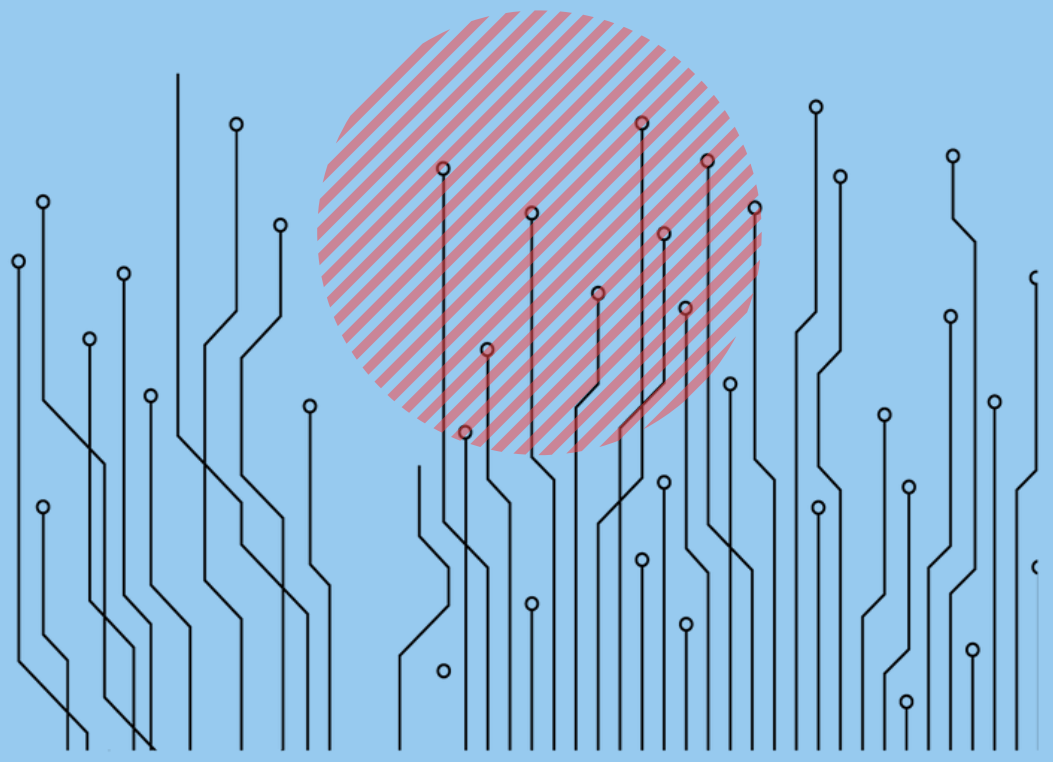
Cambridge International AS & A Level

PHYSICS

Paper 4

Topical Past Paper Questions
+ Answer Scheme

2016 - 2021



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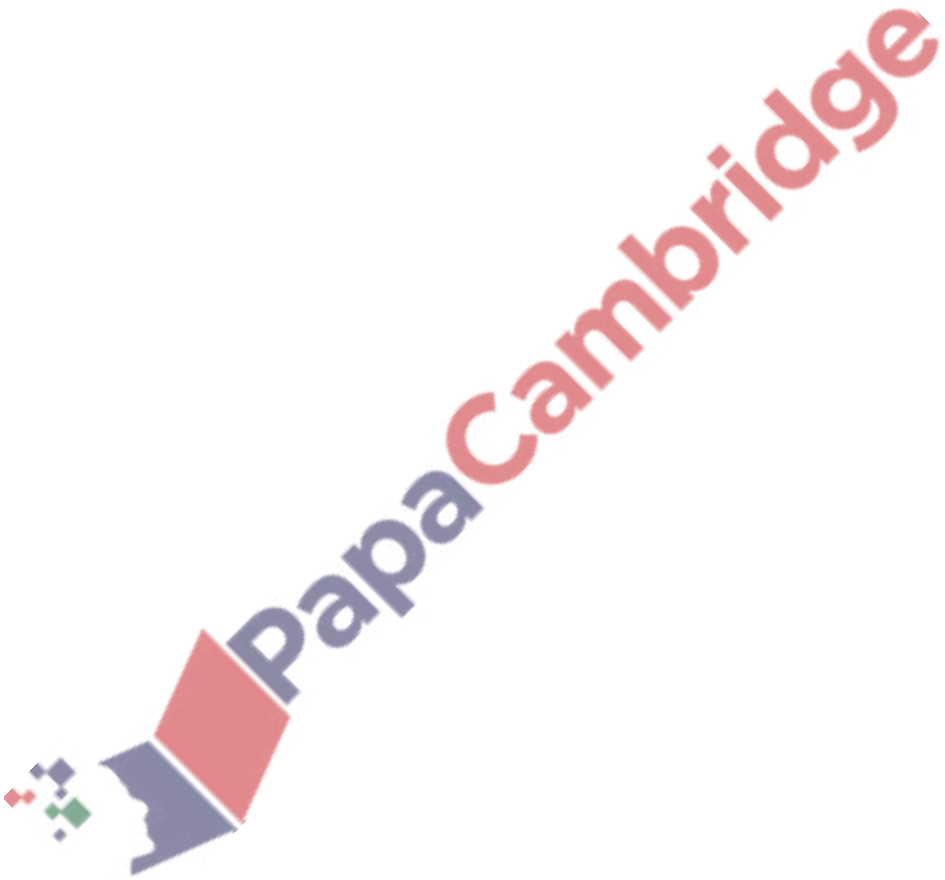
Chapter 10

Current of electricity



215. 9702_m20_qp_42 Q: 7

(a) On Fig. 7.1, sketch the temperature characteristic of a negative temperature coefficient (n.t.c.) thermistor. Label the axes with quantity and unit.

Fig. 7.1

[2]

(b) An n.t.c. thermistor and a resistor are connected as shown in Fig. 7.2.

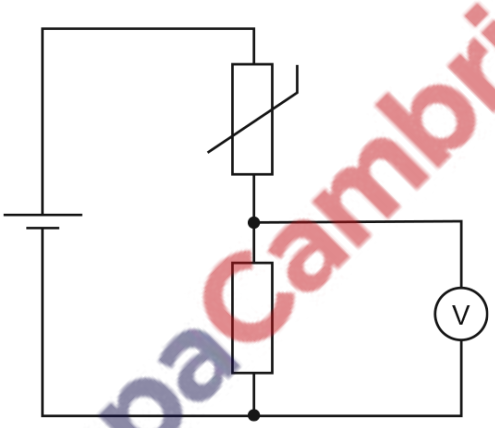


Fig. 7.2

The temperature of the thermistor is increased.

State and explain the change, if any, to the reading on the voltmeter.

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..... [2]

(c) The variation with the fractional change in length $\Delta x/x$ of the fractional change in resistance $\Delta R/R$ for a strain gauge is shown in Fig. 7.3.

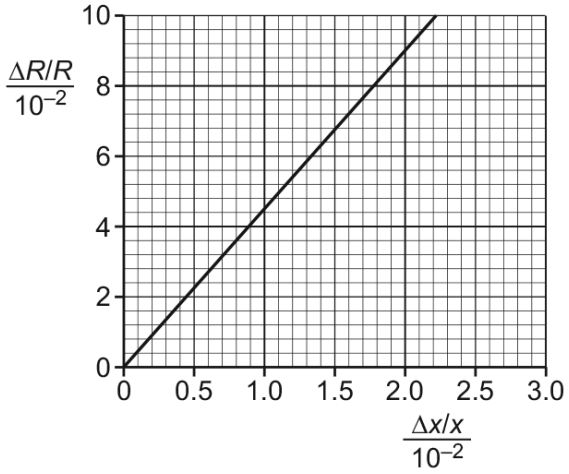

Fig. 7.3

The unstrained resistance of the gauge is 120 Ω. Calculate the new resistance of the gauge when it is extended to a strain of 0.020.

resistance = ... Ω [3]

[Total: 7]

216. 9702_s19_qp_42 Q: 7

(a) Use band theory to explain why the resistance of an intrinsic semiconductor decreases as its temperature rises.

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.....[5]

(b) The variation with temperature t of the resistance R of a thermistor is shown in Fig. 7.1.

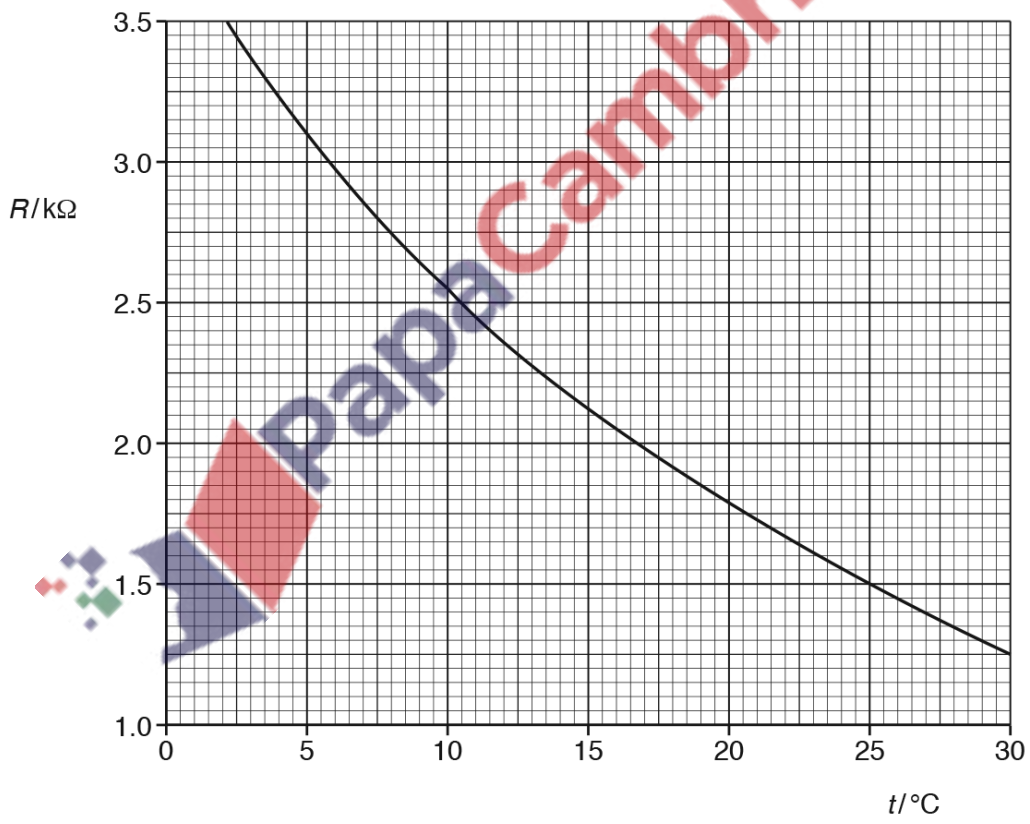

Fig. 7.1

The thermistor is connected into the circuit shown in Fig. 7.2.

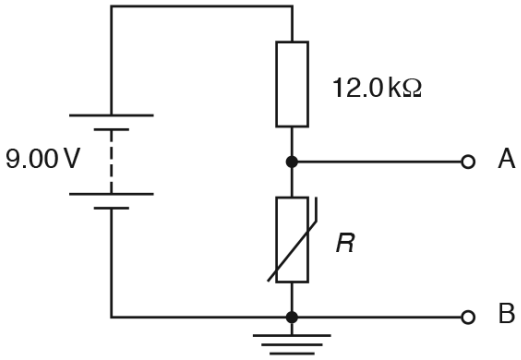

Fig. 7.2

The battery has electromotive force (e.m.f.) 9.00 V and negligible internal resistance.

When the temperature of the thermistor is 25 °C, the potential difference between the terminals A and B is 1.00 V.

The temperature of the thermistor changes from 25 °C to 10 °C.
Determine, to two significant figures, the change in potential difference between A and B.

change = ... V [3]

(c) The temperature of the thermistor in **(b)** changes from 25 °C to 10 °C at a constant rate.

State **two** reasons why the potential difference between A and B does **not** change at a constant rate.

1. .....

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2. .....

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[2]

[Total: 10]

217. 9702_m17_qp_42 Q: 7

(a) Describe, with a labelled diagram, the structure of a metal-wire strain gauge.

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.....[3]

(b) In a strain gauge, the increase in resistance ΔR depends on the increase in length ΔL. The variation of ΔR with ΔL is shown in Fig. 7.1.

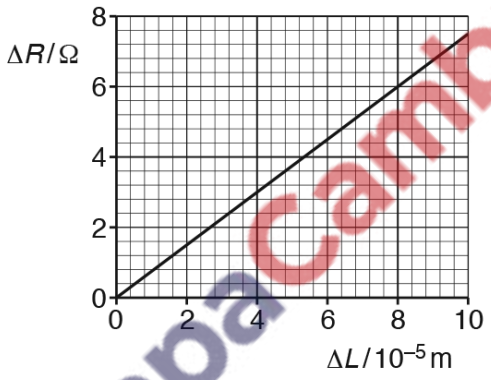

Fig. 7.1

The strain gauge is connected into a circuit incorporating an ideal operational amplifier (op-amp), as shown in Fig. 7.2.

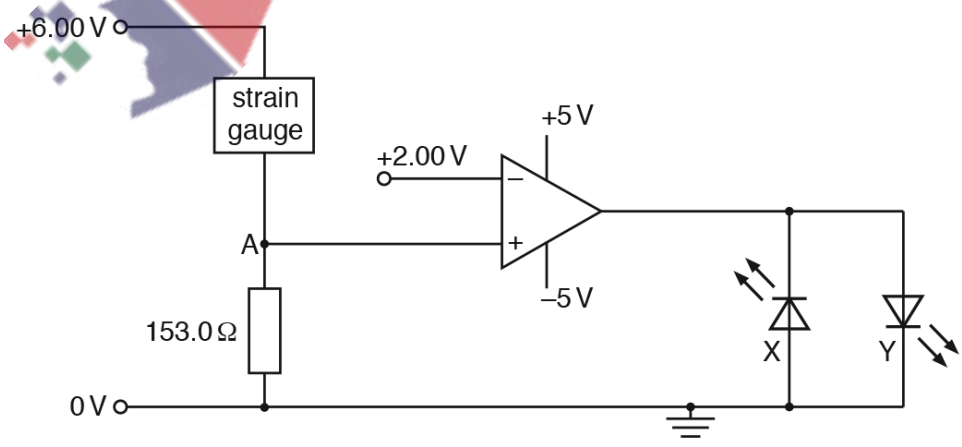

Fig. 7.2

(i) The strain gauge is initially unstrained with resistance 300.0 Ω.

Use data from Fig. 7.1 to calculate the increase in length ΔL of the strain gauge that gives rise to a potential of +2.00 V at point A in Fig. 7.2.

ΔL = ...m [3]

(ii) The strain gauge undergoes a further increase in length beyond the value in **(b)(i)**.

State and explain which one of the light-emitting diodes, X or Y, will be emitting light.

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.....[4]

[Total: 10]