0 6   **Figure 11** shows how the resistance of an LDR varies with light intensity.
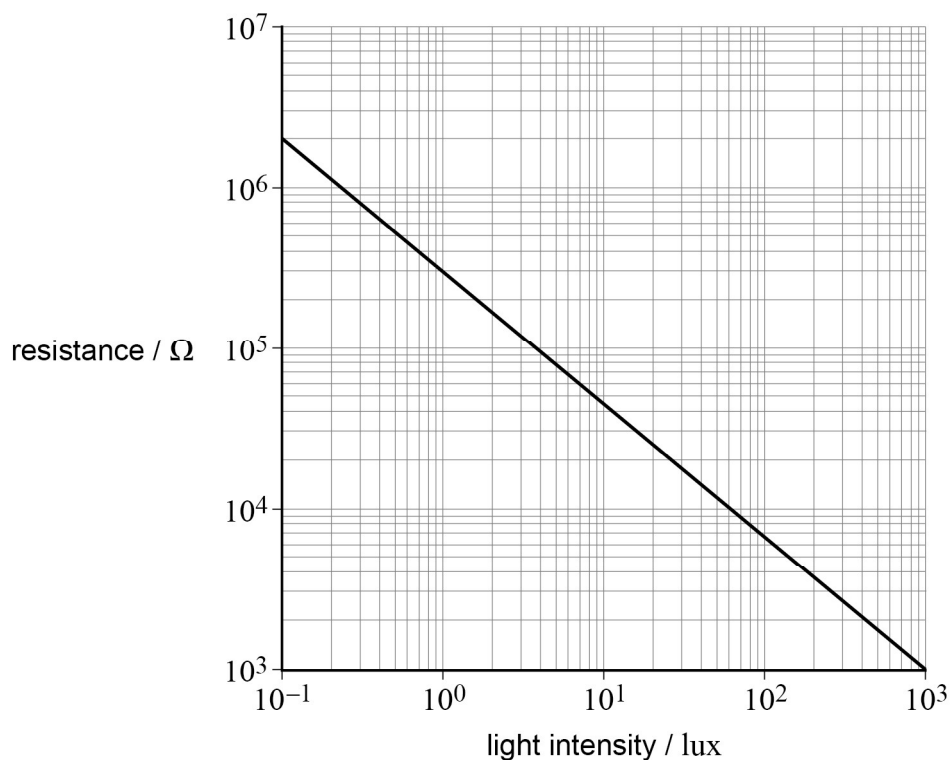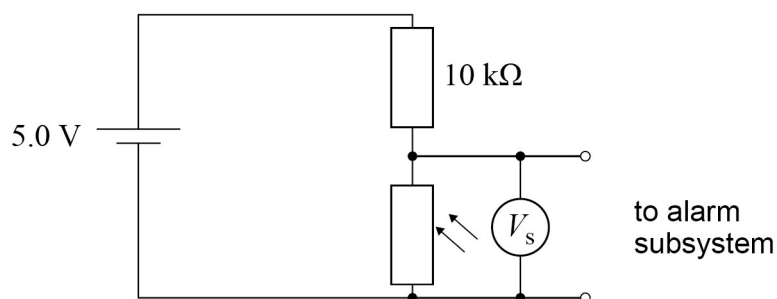
Figure 11

The LDR is used as part of an alarm system in a dim room. **Figure 12** shows one proposal for a sensor circuit for this system.

Figure 12

The power supply to the sensor has an emf of 5.0 V and a negligible internal resistance. A negligible current is drawn from the sensor circuit by the alarm subsystem.

A light beam illuminates the LDR. When the light beam is broken the LDR is not illuminated by the light beam. This causes the alarm to sound.

Do not write
outside the
box

Table 3 shows how the light intensity at the LDR changes.

Table 3

	Light intensity / lux
LDR illuminated by light beam	4.0
LDR **not** illuminated by light beam	1.0

0 6 . 1 Show that the current in the sensor circuit when the LDR is **not** illuminated by the light beam is approximately $16\ \mu\text{A}$.

[2 marks]

0 6 . 2 The alarm sounds when the potential difference V_S across the LDR changes by more than 25% of the power supply emf.

Discuss whether the circuit shown in **Figure 12** is suitable.
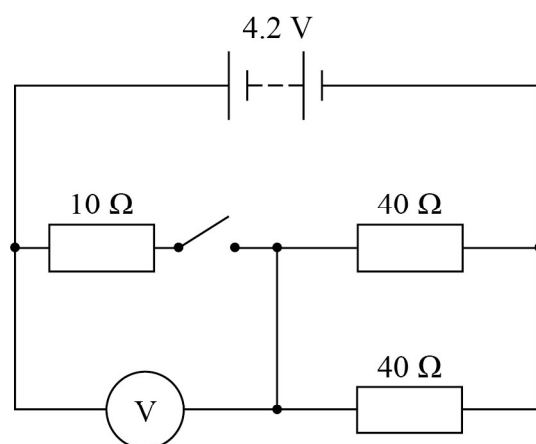Support your answer with a calculation.

[3 marks]

END OF SECTION A

Turn over ▶

5

2 7 The battery in this circuit has an emf of 4.2 V and negligible internal resistance.

4.2 V

10 Ω   40 Ω

V   40 Ω

What are the readings on the voltmeter when the switch is open (off) and when the switch is closed (on)?

[1 mark]

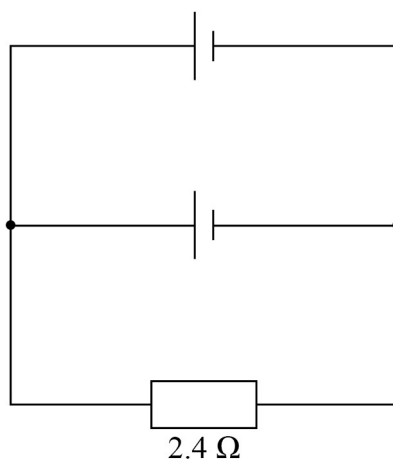|	Open	Closed	
A	0 V	2.1 V	○
B	4.2 V	2.1 V	○
C	0 V	1.4 V	○
D	4.2 V	1.4 V	○

Turn over for the next question

Turn over ▶

2 8 Two identical batteries each of emf 1.5 V and internal resistance $1.6\ \Omega$ are connected in parallel. A $2.4\ \Omega$ resistor is connected in parallel with this combination.
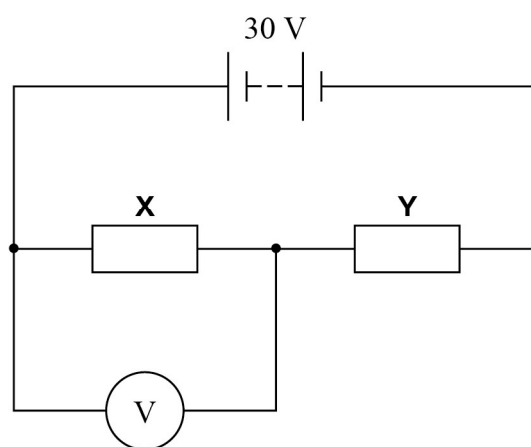

$2.4\ \Omega$

What is the current in the $2.4\ \Omega$ resistor?

[1 mark]

A 0.38 A ⬭

B 0.47 A ⬭

C 0.75 A ⬭

D 0.94 A ⬭

2 9 Two resistors **X** and **Y** are connected in series with a power supply of emf 30 V and negligible internal resistance.
The resistors are made from wire of the same material. The wires have the same length.
X uses wire of diameter d and **Y** uses wire of diameter $2d$.

What is the reading on the voltmeter?

[1 mark]

A 10 V ⬭

B 15 V ⬭

C 20 V ⬭

D 24 V ⬭

Turn over for the next question

Turn over ▶