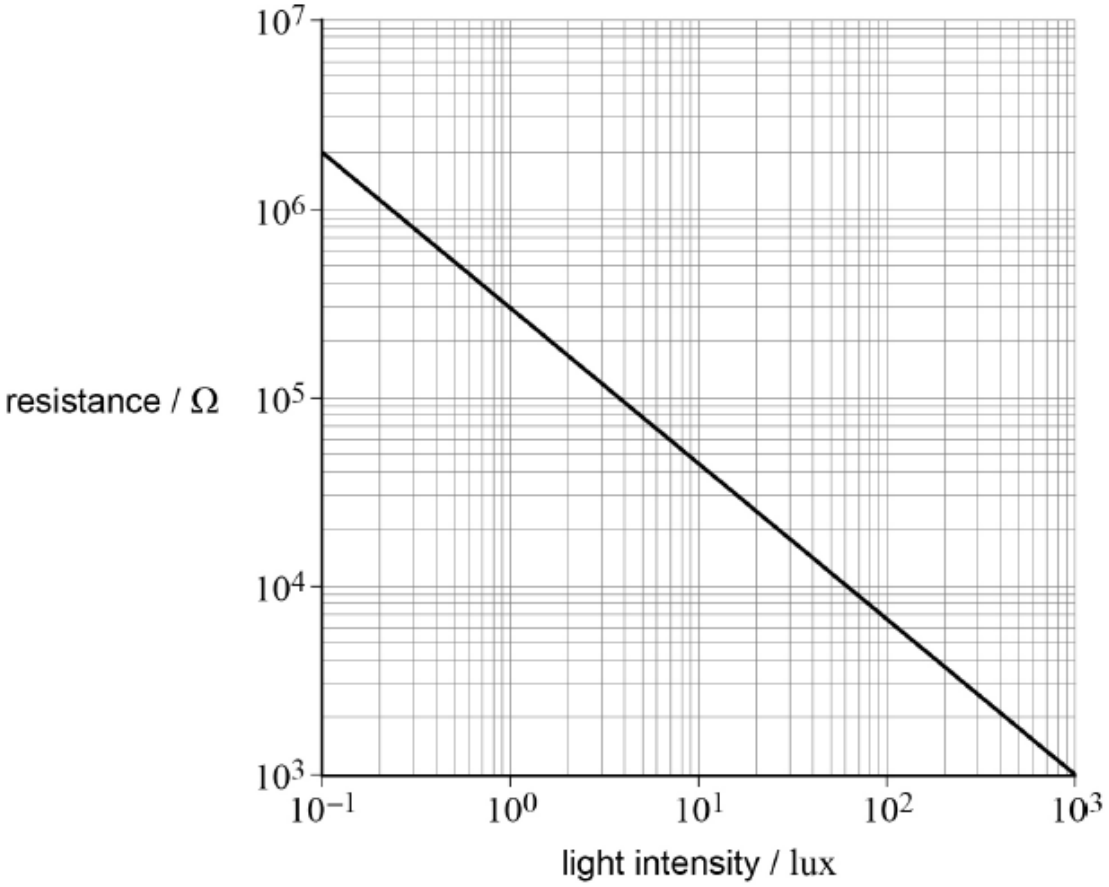
AQA – Electricity – A2 Physics P1

1. June/2021/Paper_7408_1/No.06

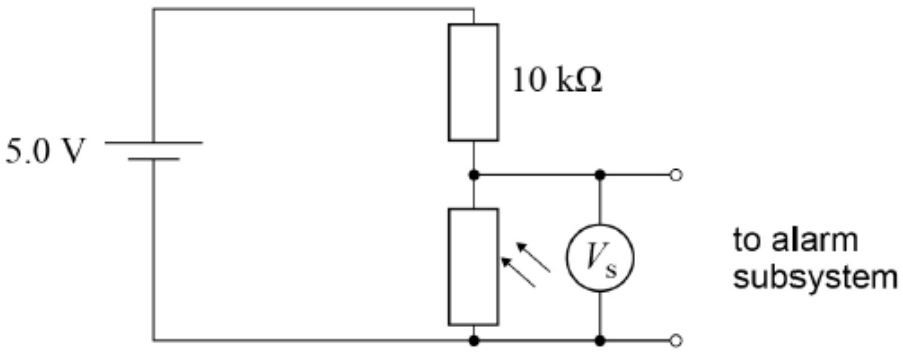
Figure 11 shows how the resistance of an LDR varies with light intensity.

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 $5.0\ \mathrm{V}$ 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.

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 μA.

[2 marks]

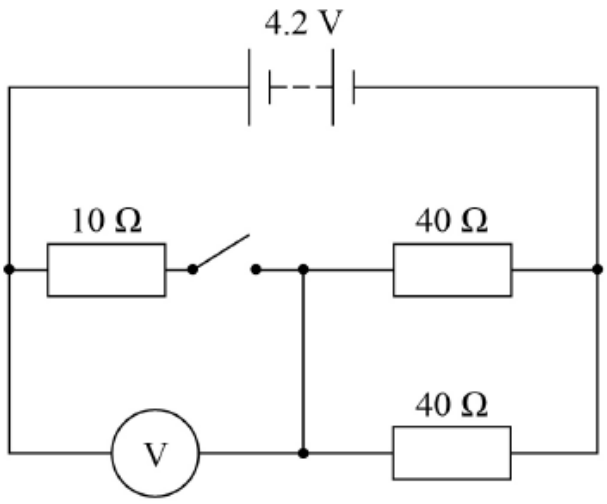
0 6 . 2 The alarm sounds when the potential difference V_S across the LDR changes by more than 25% of the power supply emf.

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

[3 marks]

2. June/2021/Paper_7408_1/No.27

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



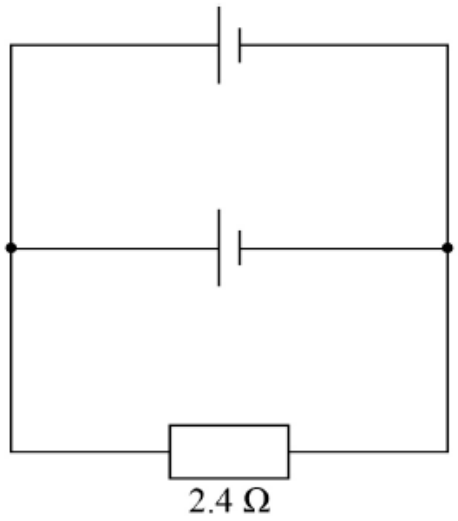
What are the readings on the voltmeter when the switch is open (off) and when the switch is closed (on)?

[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	⬭

3. June/2021/Paper_7408_1/No.28

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



What is the current in the 2.4 Ω resistor?

[1 mark]

A 0.38 A ⬭

B 0.47 A ⬭

C 0.75 A ⬭

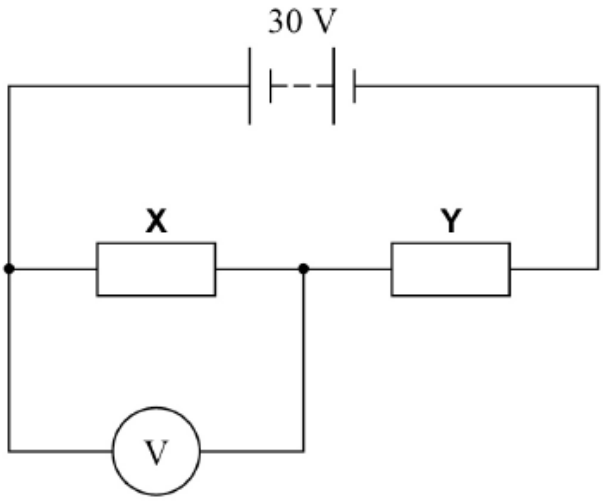
D 0.94 A ⬭

4. June/2021/Paper_7408_1/No.29

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 ⬭

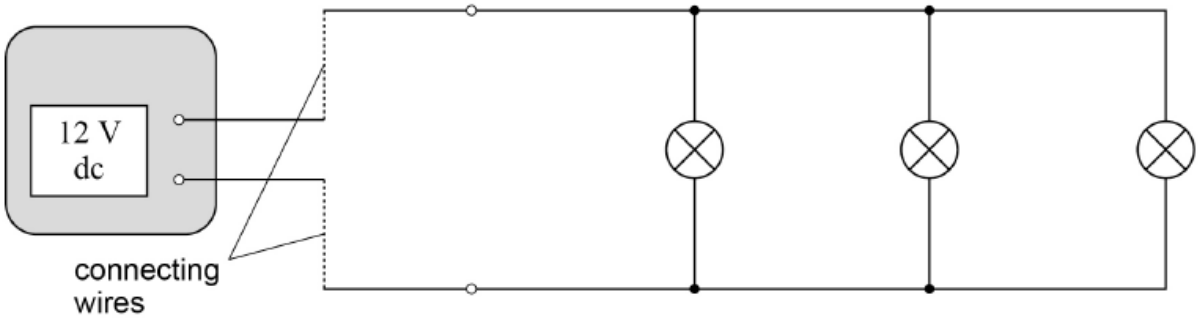
C 20 V ⬭

D 24 V ⬭

5. June/2020/Paper_7408_1/No.05

0 5 **Figure 9** shows some of the apparatus used in a demonstration of electrical power transmission using a dc power supply.

Figure 9



A power supply of emf 12 V and negligible internal resistance is connected to three identical 12 V, 1.5 W lamps in parallel.

0 5 . 1 Show that the resistance of one of the lamps when it is operating at 12 V is about 100 Ω.

[1 mark]

0 5 . 2 Initially the power supply is connected to the lamps using two short copper wires of negligible resistance.

Calculate the current in the power supply.

[2 marks]

current = _____ A

0 5 . 3 The two short copper wires are replaced with two long constantan wires.

Show that the resistance of each length of constantan wire is about 50 Ω.

length of each constantan wire	$= 2.8\ \text{m}$
diameter of constantan wires	$= 0.19\ \text{mm}$
resistivity of constantan	$= 4.9 \times 10^{-7}\ \Omega\ \text{m}$

[3 marks]

0 5 . 4 The demonstration is intended to show that the lamps are significantly dimmer when connected using the long constantan wires than when using the short copper wires.

Discuss whether the demonstration achieves this.
Support your answer with suitable calculations.

[4 marks]

0 5 . 5 Scientists and engineers are investigating the use of superconductors in electrical transmission.

Discuss **one** advantage and **one** difficulty when using superconductors in electrical transmission over long distances.

[3 marks]

Advantage _____

_____

_____

_____

Difficulty _____

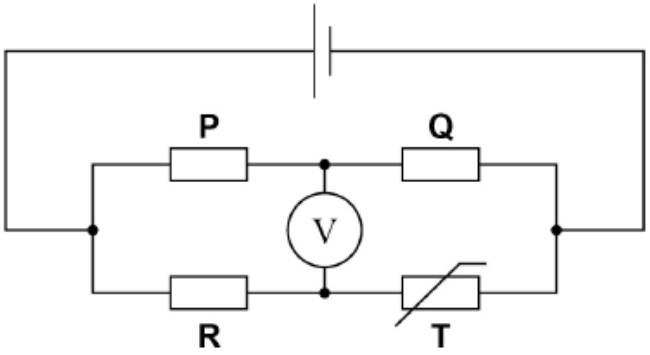
_____

_____

_____

6. June/2020/Paper_7408_1/No.27

In the circuit below, the voltmeter reading is zero.



When the temperature of the thermistor **T** is increased, the voltmeter reading changes.

Which change to the circuit will restore the voltmeter to zero?

[1 mark]

A a reduction in the emf of the cell ⬭

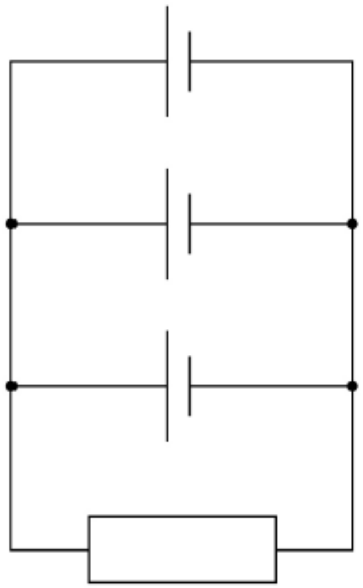
B a reduction in the resistance of **P** ⬭

C an increase in the resistance of **Q** ⬭

D a reduction in the resistance of **R** ⬭

7. June/2020/Paper_7408_1/No.28

A resistor of resistance R and three identical cells of emf E and internal resistance r are connected as shown.



What is the current in the resistor?

[1 mark]

A $\frac{3E}{(3R+r)}$ ⬭

B $\frac{9E}{(3R+r)}$ ⬭

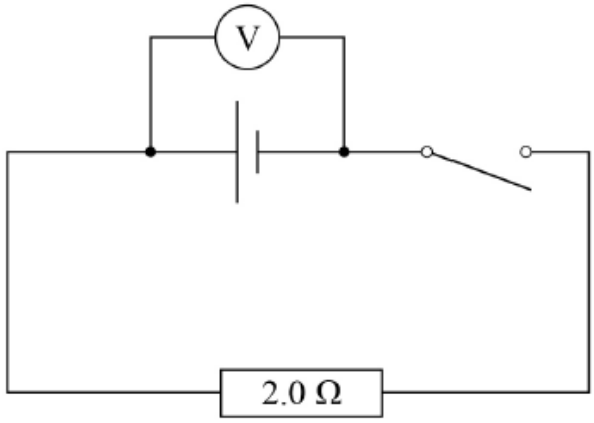
C $\frac{E}{R}$ ⬭

D $\frac{3E}{R}$ ⬭

8. June/2020/Paper_7408_1/No.29

In the circuit, the reading of the voltmeter is V.

When the switch is closed the reading becomes $\frac{V}{3}$.



What is the internal resistance of the cell?

[1 mark]

A 0.33 Ω ⬭

B 0.67 Ω ⬭

C 4.0 Ω ⬭

D 6.0 Ω ⬭