



GCE PHYSICS

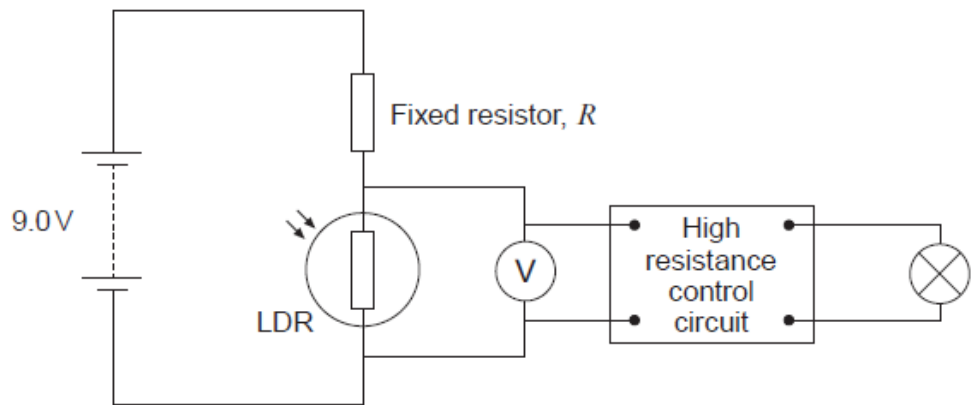
S21-A420QS

Assessment Resource number 10

Electricity and the Universe Resource A

1.

(a) An engineer investigates the use of a light dependent resistor (LDR) as a light sensor in a potential divider circuit. He designs the following sensing circuit to operate a 230 V lamp in the dark.



The control circuit draws a negligible current. During his research, the engineer determines the following facts:

The control circuit requires at least 4.0 V to activate.
The LDR the engineer intends to use has a resistance of 2.4 k Ω at the light intensity required to switch the lamp on.

- (i) Explain how the current in the LDR changes as the light intensity decreases. [2]
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- (ii) Determine a suitable value for the fixed resistor R , which would allow the lamp to be switched on. [3]

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- (b) When installing the circuit, the engineer made the mistake of placing the lamp near to the LDR. The engineer noted that, when in the dark, the lamp kept turning on and off repeatedly rather than staying on. Explain why this was the case. [2]

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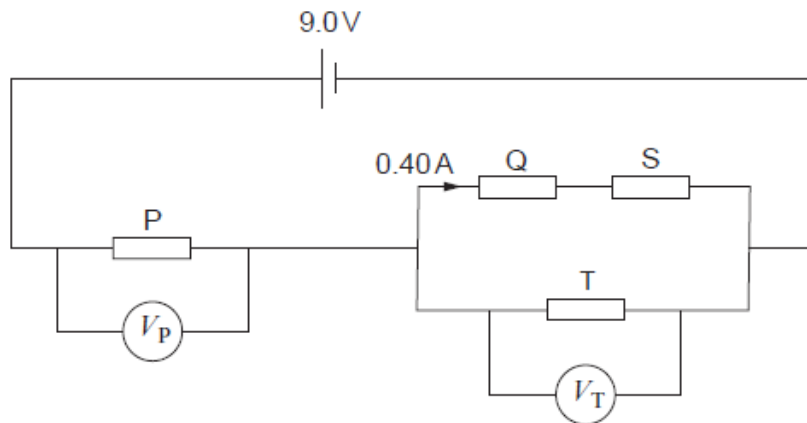
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- (a) (i) State what is meant by *electric current*. [1]

- (ii) Show that the unit of resistance, the ohm (Ω), can be expressed as: [2]

$$\text{Js C}^{-2}$$

- (b) The following circuit shows an arrangement of **identical resistors** labelled P, Q, S and T connected to a fixed pd of 9.0V. V_P and V_T are the pds across P and T respectively. There is a current of 0.40A in Q and S.



- (i) Show that $V_P = 1.5 V_T$. [2]

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- (ii) Hence or otherwise show that the values given in the diagram are consistent with the resistance of each resistor being 4.5Ω . [3]

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- (c) Show that the total energy dissipated per second in the whole circuit is 15 times more than the energy dissipated per second in resistor Q. [3]

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- (d) Resistor T is now removed from the circuit. Explain the effect this will have on the ratio calculated in part (c). [3]

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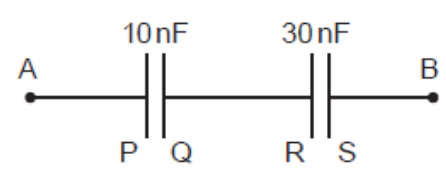
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(a) Define the *capacitance* of a capacitor. [1]

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(b) Two capacitors, initially uncharged, are arranged in series as shown. When a battery is connected across A and B, the charge on plate P is found to be +75 nC.



(i) Write down the charges on each of the plates Q, R and S. Give a reason for your answer to the charge on plate S. [3]

Charge on Q:

Charge on R:

Charge on S:

Reason:

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(ii) Calculate the pd across A and B. [2]

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