

- 6 A filament lamp is rated at 0.60 W, 3.0 V. In order to obtain a potential difference of about 3.0 V, a student connected a circuit as shown in Fig. 6.1. He used a d.c source of emf 12 V with negligible internal resistance and a voltmeter of resistance 11.0 k Ω in the setup. The resistance wire CD has length 1.000 m and a total resistance of 1000 Ω .

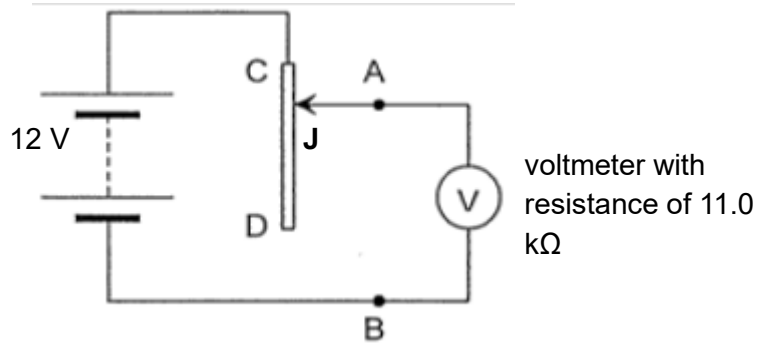


Fig. 6.1

When the sliding contact, J, is at point C, the voltmeter reads 12 V. The contact J is then moved to point D.

- (a) Determine the reading of the voltmeter when the contact J is at point D.

voltmeter reading = V [2]

- (b) The student then modified the circuit to that shown in Fig. 6.2. He is now able to adjust the sliding contact J to obtain a voltmeter reading of 3.0 V.

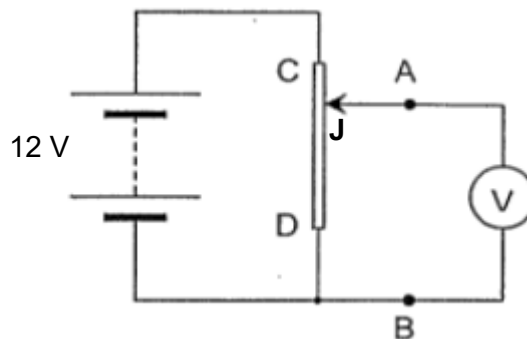


Fig. 6.2

- (i) Calculate the current flowing through the voltmeter when it gives a reading of 3.0 V.

current = A [1]

- (ii) Assuming this current is negligible compared with the current flowing through the resistance wire, calculate the distance from C that the sliding contact J would be at when the voltmeter reads 3.0 V.

distance from C = m [1]

- (iii) Calculate the resistance of the filament lamp.

$R =$ Ω [2]

- (c) The student then replaced the voltmeter with the filament lamp across AB. The lamp is not defective, however, it did not light up. Explain why.

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

- (d) Light-emitting diodes (LEDs) are often used instead of filament lamps because they need less power for the same brightness of light.

When the p.d. across the LED is less than a pre-set value, the LED is off and when the p.d. across the LED is more than the pre-set value, the LED is at full brightness.

Design a potential divider circuit using a battery, a fixed resistance resistor, an LED and a light-dependent resistor (LDR).

The LED in the circuit must switch on when the intensity of the light falling on the LDR decreases below a certain level.