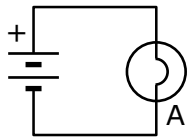


Circuits

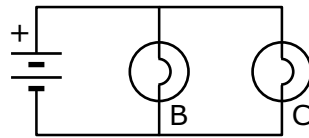
Name & Set

The best way to tackle these questions is to set up the circuits using bulbs and batteries. Alternatively, use a circuit simulator such as Crocodile Clips.

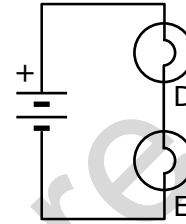
- 1 In the circuits shown in the diagram 1, identical bulbs are joined in different ways to identical, ideal batteries. Ideal batteries have zero internal resistance and there is no drop in potential difference across their terminals when an external load is connected.



Circuit 1



Circuit 2



Circuit 3

Diagram 1

- (a) Rank the five bulbs (A, B, C, D, E) in order of decreasing brightness, indicating equal brightness when such is the case. Explain your reasoning.

[3]

- (b) Rank the three circuits in order of increasing current drawn from the battery. Explain your reasoning.

[3]

- (c) How does the situation in the diagram 2 compare with that in part (a)? Is it the same or different? If there are differences, describe them. Be sure to explain your reasoning.

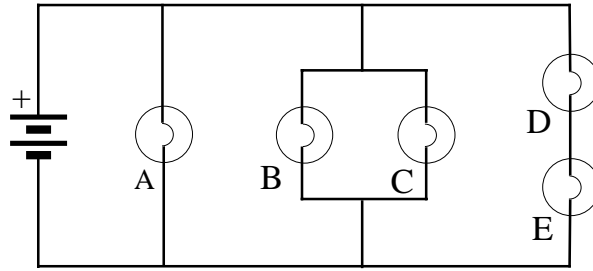


Diagram 2

- 2 In the circuit shown in diagram 3, the battery maintains a constant potential difference across its terminals as various changes are made in the circuit containing the three identical bulbs (A, B, and C). You are asked to predict what will happen as the various changes are made.

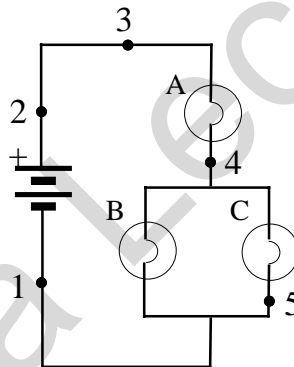


Diagram 3

- (a) To begin with: How does the brightness of the three bulbs compare with each other in the initial condition as sketched? Explain your reasoning.

[3]

- (b) Suppose bulb C is removed from its socket. Will the brightness of bulbs A and B change? If so, how? What will happen to the current at point 3? Explain your reasoning

[3]

- (c) Return to the initial condition in the diagram. Suppose a wire is connected between points 3 and 4 in the circuit. What will happen to the brightness of each bulb? What will happen to the current at point 2? What will happen to the potential difference between points 2 and 4? To the potential difference between points 4 and 5? What will happen to the current at point 5? Explain your reasoning.

[3]

- (d) Return to the initial condition. Suppose a wire is connected between points 4 and 5. Answer the same questions as those asked in part (c). Explain your reasoning.

[3]

- (e) Return to the initial condition. Suppose a third bulb, D, is added to the circuit by being placed in parallel with B and C. Answer the same questions asked in part (c). Explain your reasoning.

[3]

- (f) Return to the initial condition in the diagram. Suppose a wire is connected between points 1 and 5 in the circuit. What will happen to the brightness of each bulb? To the current at point 3? To the potential difference between points 3 and 4? Explain your reasoning.

[3]

- 3 The circuit in diagram 4 contains two identical flashlight bulbs A and B and three identical resistors R. The battery maintains a constant potential difference across the circuit regardless of the various changes proposed in the questions. Be sure to explain your reasoning in each case. Where necessary redraw the circuit to represent the new situation brought about by each of the proposed changes.

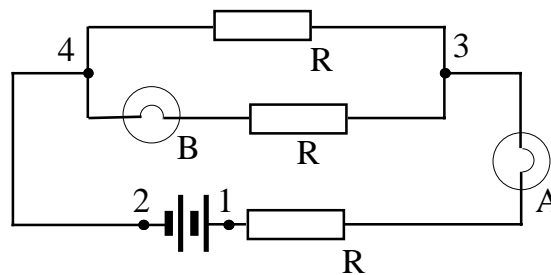


Diagram 4

(a) How do the brightnesses of bulbs A and B compare initially?

[3]

(b) Bulb A is removed. What happens to the brightness of B?

[3]

(c) Bulb A is replaced, and then B is removed. What happens to the brightness of A?

[3]

(d) Bulb B is replaced. A wire is connected from point 1 to point 3. What happens to the brightness of each bulb? What happens to the potential difference between points 3 and 2?

[3]

(e) Return to the initial situation. A wire is connected from point 3 to point 4. What happens to the brightness of each bulb? What happens to the potential difference between points 2 and 3? To the potential difference between points 1 and 3?

[3]

(f) Return to the initial condition. A wire is connected from point 2 to point 4. What happens to the brightness of each bulb and to the potential difference between points 1 and 4?

[3]

(g) Return to the initial condition. A fourth resistor, identical to the other three, is connected between points 3 and 4. What happens to the brightness of each bulb and to the potential difference between points 3 and 4?

[3]