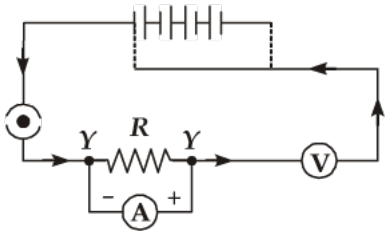
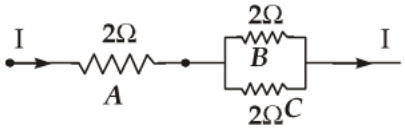
Date: 25/9/2021

Q1. A child has drawn the electric circuit to study Ohm's law as shown in figure. His teacher told that the circuit diagram needs correction. Study the circuit diagram and redraw it after making all corrections.

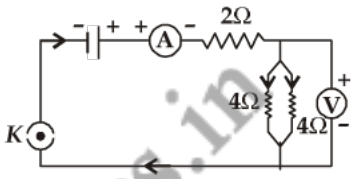


Q2. Three 2 Ω resistors. *A*, *B* and *C*, are connected as shown in figure. Each of them dissipates energy and can withstand a maximum power of 18 W without melting. Find the maximum current that can flow through the three resistors?



Q3. Should the resistance of an ammeter be low or high? Give reason.

Q4. Draw a circuit diagram of an electric circuit containing a cell, a key, an ammeter, a resistor of 2 Ω in series with a combination of two resistors (4 Ω each) in parallel and a voltmeter across the parallel combination. Will the potential difference across the 2 Ω resistor be the same as that across the parallel combination of 4 Ω resistors? Give reason

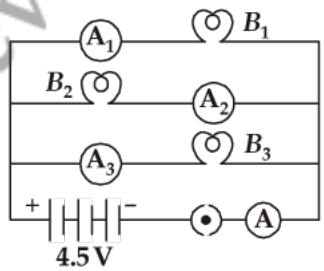


Q5. B_1, B_2 and B_3 are three identical bulbs connected as shown in figure. When all the three bulbs glow, a current of 3*A* is recorded by the ammeter *A*.

(a) What happens to the glow of the other two bulbs when the bulb B_1 gets fused?

(b) What happens to the reading of A_1, A_2, A_3 and *A* when the bulb B_2 gets fused?

(c) How much power is dissipated in the circuit when all the three bulbs glow together?



Q6. A current of 1 ampere flows in a series circuit containing an electric lamp and a conductor of 5 Ω when connected to a 10 V battery. Calculate the resistance of the electric lamp.

Now if a resistance of 10 Ω is connected in parallel with this series combination, what change (if any) in current flowing through 5 Ω conductor and potential difference across the lamp will take place? Give reason.

Q7. Why is parallel arrangement used in domestic wiring?

Q8. How does use of a fuse wire protect electrical appliances?

Q9. What is electrical resistivity? In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 5 A. The reading of the ammeter decreases to half when the length of the wire is doubled. Why?

Q10. What is the commercial unit of electrical energy? Represent it in terms of joules.

Q11. Three incandescent bulbs of 100 W each are connected in series in an electric circuit. In another circuit another set of three bulbs of the same wattage are connected in parallel to the same source.

(a) Will the bulb in the two circuits flow with the same brightness? Justify your answer.

(b) Now let one bulb in both the circuits get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason.

Q12. State Ohm's law? How can it be verified experimentally? Does it hold good under all conditions? Comment.

Q13. What is electrical resistivity of a material? What is its unit? Describe an experiment to study the factors on which the resistance of conducting wire depends.

Q14. How will you infer with the help of an experiment that the same current flows through every part of the circuit containing three resistance in series connected to a battery?

Q15. Find out the following in the electric circuit given in figure.

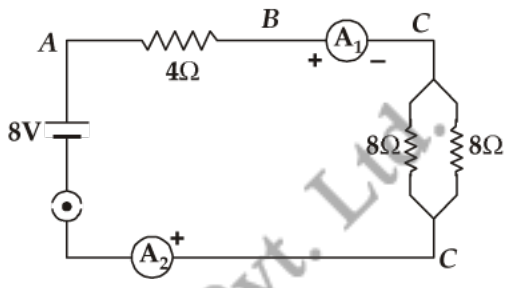
(a) Effective resistance of two 8 Ω resistors in the combination

(b) Current flowing through 4 Ω resistor

(c) Potential difference across 4 Ω resistance

(d) Power dissipated in 4 Ω resistor.

(e) Difference in ammeter readings, if any.



Q16. How will you conclude that the same potential difference (voltage) exists across three resistors connected in a parallel arrangement to a battery?

Q17. What is Joule's heating effect? How can it be demonstrated experimentally? List its four applications in daily life.

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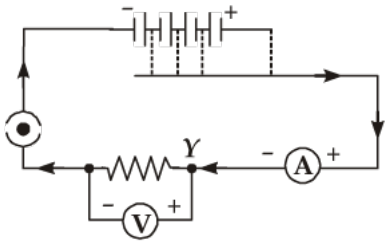
S1.



S2. Maximum current through resistor $A = \sqrt{\frac{18}{2}}\ \text{A} = 3\text{A}$.

Thus the maximum current through resistors B and C each $3 \times \frac{1}{2}\ \text{A} = 1.5\ \text{A}$.

S3. **Hint:** It should be as close to zero as possible. Ideally it should be zero ohm. If it is non-zero and substantial it will affect the true current.

S4. **Hint:** Yes. Total resistance of the parallel combination is also 2 ohm ($2\,\Omega$).

S5. **Hint:** (a) The glow of the bulbs B_2 and B_3 will remain the same.

(b) A_1 shows 1 ampere, A_2 shows zero, A_3 shows 1 ampere and a shows 2 ampere.

(c) $P = V \times I = 4.5 \times 3 = 13.5\,\text{W}$.

S6. (i) $5\,\Omega$.

(ii) **Hint:** Calculate the total resistance of the circuit. There will be no change in current flowing through $5\,\Omega$ conductor. Also, there will be no change in potential difference across the lamp either.

S7. **Hint:** Provide the same potential difference across each electrical appliance.

S8. **Hint:** If a current larger than a specified value flows in a circuit, temperature of fuse wire increases to its melting point. The fuse wire melts and the circuit breaks.

S9. **Hint:** Use the formula $R = \rho \frac{l}{A}$. Also, $V = RI$. R is doubled while V remains unchanged. Hence, current becomes $\frac{I}{2}$.

S10. kW h. $1\ \text{kW h} = 1000\ \text{W} \times 60 \times 60\text{s} = 3.6 \times 10^6\ \text{J}$.

S11. (a) No. The resistance of the bulbs in series will be three times the resistance of single bulb. Therefore, the current in the series combination will be one-third compared to current in each bulb in parallel combination. The parallel combination bulbs will glow more brightly.

(b) The bulbs in series combination will stop glowing as the circuit is broken and current is zero. However the bulbs in parallel combination shall continue to glow with the same brightness.

S12. **Hint:** Define Ohm;s law. Give details of experiment using a labelled circuit diagram. Support your answer giving relation between V and I and a graph depicting Ohm's law. Ohm's law does not hold under all conditions. Mention the conditions.

S13. **Hint:** Resistivity is numerically equal to the resistance of wire of unit area of cross-section. Its unit is ohm metre (Ωm). Mention the dependence of resistance on length and area of cross section of the wire giving details of experiment using a circuit diagram.

S14. **Hint:** Describe the experiment using a circuit diagram. Give details showing that same current flows through each component in a series circuit.

S15. (a) 4 Ω. **Hint:** $R = R_1 R_2/(R_1 + R_2) = \left(\frac{8 \times 8}{8+8}\right) = 4\,\Omega.$

(b) 1 A. **Hint:** $I = V/R = 8/4 + \left(\frac{8 \times 8}{8+8}\right) = 8/8 = 1\,\text{A}.$

(c) 4 V. **Hint:** $V = IR = 1 \times 4 = 4\,\text{V}.$

(d) 4 W. **Hint:** $P = I^2R = 1^2 \times 4 = 4\,\text{W}.$

(e) No difference.

Hint: Same current flows through each element in a series circuit.

S16. **Hint:** Describe the experiment using a circuit diagram. Give details showing that same potential difference exists across each resistance in a parallel circuit.

S17. **Hint:** Joule's heating effect, $H = I^2Rt$. Describe the experiment using a circuit diagram.

Applications: Electric heater, geyser, laundry iron, electric oven, bulb, toaster, kettle etc.