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Exercise - V

1. An electrical circuit is shown in the figure. Calculate the potential difference across the resistance of 400 ohm, as will be measured by the voltmeter V of resistance 400 ohm, either by applying Kirchhoff's rules or otherwise. [JEE-96]



2. (i) A steady current flows in a metallic conductor of nonuniform cross-section. The quantity/quantities constant along the length of the conductor is / are : [JEE,97]

- (A) current, electric field and drift speed
- (B) drift speed only
- (C) current and drift speed
- (D) current only

(ii) The dimension of electricity conductivity is

(iii) Find the emf (E) & internal resistance (r) of a single battery which is equivalent to a parallel combination of two batteries of emfs $V_1 \& V_2 \&$ internal resistances $r_1 \& r_2$ respectively with their similar polarity connected to each other

3. In the circuit shown in the figure, the current through



(A) the 3Ω resistor is 0.50 A

- (B) the 3Ω resistor is 0.25 A
- (C) 4Ω resistor is 0.50 A
- (D) the 4Ω resistor is 0.25 A

4. In the circuit shown, $P \neq R$, the reading of the galvanometer is same with switch S open or closed. Then [JEE' 99]



JEE-Problems

(A) $I_R = I_G$

5. The effective resistance between the points P and O of the electrical circuit shown in the figure is

§2R [JEE 2002] 2R ~~~ ~~~~ (A) 2 Rr / (R + r)(B) 8R(R + r)/(3R + r)(C) 2r + 4R (D) 5R/2 + 2r

6. A 100 W bulb B₁, and two 60 W bulbs B₂ and B₃, are connected to a 250 V source, as shown in the figure. Now W_1 , W_2 and W_3 are the output powers of the bulbs B_1 , B_2 and B_3 respectively. Then



7. A thin uniform wire AB of length 1m, an unknown resistance X and a resistance of 12Ω are connected by thick conducting strips, as shown in figure. A battery and a galvanometer (with a sliding jockey connected to it) are also available. Connections are to be made to measure the unknown resistance X using the principle of Wheatstone bridge. Answer the following question.



(A) Are there positive and negative terminals on the galvanometer?

(B) Copy the figure in your answer book and show the battery and the galvanometer (with jockey) connected at appropriate points.

(C) After appropriate connections are made, it is found that no deflection takes place in the galvanometer when the sliding jockey touches the wire at a distance of 60 cm from A. Obtain the value of resistance X. [JEE-2002]



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[JEE'98]

8. Arrange the order of power dissipated in the given circuits, if the same current is passing through all circuit and each resistor is r'



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(A) $P_2 > P_3 > P_4 > P_1$	(B) $P_3 > P_2 > P_4 > P_1$
(C) $P_4 > P_3 > P_2 > P_1$	(D) $P_1 > P_2 > P_3 > P_4$

9. In the given circuit, no current is passing through the galvanometer. If the cross-sectional diameter of AB is doubled the for null point of galvanometer the value of AC would



10. How a battery is to be connected so that shown rheostat will behave like a potential divider ? Also indicate the points about which output can be taken.

[JEE-2003]



11. Six equal resistances are connected between points P, Q and R as shown in the figure. Then the net resistance will be maximum between



12. For the post office box arrangement to determine the value of unknown resistance, the unknown resistance should be connected between



13. Draw the circuit for experimental verification of Ohm's law using a source of variable D.C. voltage, a main resistance of 100Ω , two galvanometers and two resistances of values $10^6 \Omega$ and $10^{-3} \Omega$ respectively. Clearly show the positions of the voltmeter and the ammeter.

[JEE-2004]

14. In the figure shown the current through 2Ω resistor is



15. A galvanometer has resistance 100Ω and it requires current $100\mu A$ for full scale deflection. A resistor 0.1Ω is connected to make it an ammeter. The

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smallest current required in the circuit to produce the full scale deflection is

	[JEE-2005
(A) 1000.1 mA	(B) 1.1 mA
(C) 10.1 mA	(D) 100.1 mA

16. An unknown resistance X is to be determined using resistances R_1 , R_2 or R_3 . Their corresponding null points are A, B and C. Find which of the above will give the most accurate reading and why ?



17. Consider a cylindrical element as shown in the figure. Current flowing the through element is I and resistivity of material of the cylinder is ρ . Choose the correct option out the following **[JEE-2006]**



(A) Power loss in second half is four times the power loss in first half

(B) Voltage drop in first half is twice of voltage drop in second half

(C) Current density in both halves are equal

(D) Electric field in both halves is equal

18. A resistance of 2Ω is connected across one gap of a metre-bridge (the length of the wire is 100 cm) and an unknown resistance, greater than 2Ω , is connected across the other gap. When these resistances are interchanged, the balance point shifts by 20 cm. Neglecting any corrections, the unknown resistance is

		[JEE-2007]
(A) 3 Ω	(B) 4 Ω	
(C) 5 Ω	(D) 6 Ω	

19. Figure shows three resistor configurations R1, R2 and R3 connected to 3V battery. If the power dissipated by the configuration R1, R2 and R3 is P1, P2 and P3, respectively, then



20. STATEMENT-1

In a Meter Bridge experiment, null point for an unknown resistance is measured. Now, the unknown resistance is put inside an enclosure maintained at a higher temperature. The null point can be obtained at the same point as before by decreasing the value of the standard resistance. and

STATEMENT-2

Resistance of a metal increases with increase in temperature.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 **is** a correct explanation for STATEMENT-1

(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 **is NOT** a correct explanation for STATE-MENT-1

(C) STATEMENT-1 is True, STATEMENT-2 is False

(D) STATEMENT-1 is False, STATEMENT-2 is True

[JEE - 2008]





(A) the current *I* through the battery is 7.5 mA (B) the potential difference across R_{L} is 18 V (C) ratio of powers dissipated in R_{1} and R_{2} is 3 (D) if R_{1} and R_{2} are interchanged, magni tude of the power dissipated in R_{L} will de crease by a factor of 9 [JEE - 2009]

22. Consider a thin square sheet of side L and thickness t, made of a material of resistivity ρ . The resistance between two opposite faces shown by the

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CURRENT ELECTRICITY





[JEE 2010]

(A) directly proportional to L

- (B) directly proportional to t
- (C) independent of L
- (D) independent of t

23. Incandenscent bulbs are designed by keeping in mind that the resitance of their filament increases with the increase in temperature. If at room temperature, 100 W, 60 W and 40 W bulbs have filament resistances R_{100} , R_{60} and R_{40} , respectively, the relation between these resistance is **[JEE 2010]**

(A)
$$\frac{1}{R_{100}} = \frac{1}{R_{40}} + \frac{1}{R_{60}}$$
 (B) $R_{100} = R_{40} + R_{60}$
(C) $R_{100} > R_{60} > R_{40}$ (D) $\frac{1}{R_{100}} > \frac{1}{R_{60}} > \frac{1}{R_{40}}$

24. To verify Ohm's law, a student is provided with a test resistor R_T . a high resistance R_1 , a small resistance R_2 , two identical galvanometers G_1 and G_2 and a variable voltage source V. the correct circuit to carry out the experiment is :[**JEE 2010**]





25. When two identical batteries of internal resistance 1 Ω each are connected in series across a resistor R, the rate of heat produced in R is J₁. When the same batteries are connected in parallel across R, the rate is J₂. If J₁ = 2.25 J₂ then the value of R in Ω is

[JEE 2010]

26. A meter bridge is set-up as shown, to determine an unknown resistance 'X' using a standard 10 ohm resistor. The galvanometer shows null point when tapping-key is at 52 cm mark. The end-corrections are 1 cm and 2 cm respectively for the ends A and B. The determined value of 'X' is [JEE 2011]



(A) 10.2 ohm (B) 10.6 ohm (C) 10.8 ohm (D) 11.1 ohm

27. Two batteries of different emfs and different internal resistances are connected as shown. The voltage across AB in volts is [JEE 2011]



28. For the resistance network 2 shown in the figure, choose the correct option(s).



- (A) The current through PQ is zero
- (B) $I_1 = 3A$
- (C) The potential at S is less than that at Q
- (D) $I_2 = 2A$

[JEE 2012]

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