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www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

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Class: 12
Subject: Physics
Topic: Current electricity
No. of Questions: 30

1. The storage battery of a car has an emf of 12 V. If the internal resistance of the battery is 04Ω, what is the maximum current that can be drawn from the battery?

2. A battery of emf 10 V and internal resistance 3 Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?

3. Three resistors 2 Ω, 4 Ω and 5 Ω are combined in parallel. What is the total resistance of the combination?
   If the combination is connected to a battery of emf 20 V and negligible internal resistance, determine the current through each resistor, and the total current drawn from the battery.

4. A silver wire has a resistance of 2.1 Ω at 27.5 ^{o}C, and a resistance of 2.7 Ω at 100 ^{o}C. Determine the temperature coefficient of resistivity of silver.

5. In a metre bridge [Fig. 3.27], the balance pint is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5 Ω. Determine the resistance of X. Why are the connections between resistors in a Wheatstone or meter bridge made of thick copper strips?
   Determine the balance point of the bridge above if X and Y are interchanged.
   What happens if the galvanometer and cell are interchanged at the balance point of the bridge? Would the galvanometer show any current?

6. c supply using a series resistor of 15.5 Ω. What is the terminal voltage of the battery during charging? What is the purpose of having a series resistor in the charging circuit?

7. In a potentiometer arrangement, a cell of emf 1.55 V gives a balance point at 35.0 cm length of the wire. If the cell is replaced by another cell and the balance point shifts to 63.0 cm, what is the emf of the second cell?

8. The number density of free electrons in a copper conductor estimated in Example 3.1 is 8.5×10^{28} m^{-3}. How long does an electron take to drift from one end of a wire 3.0 m long to its other end? The area of cross-section of the wire is 2.0×10^{-6} m^{2} and it is carrying a current of 3.0 A.

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9. Answer the following questions:
   A steady current flows in a metallic conductor of non-uniform cross-section. Which of these quantities is constant along the conductor: current, current density, electric field, drift speed?
   Is Ohm's law universally applicable for all conducting elements?
   If not, give examples of elements which do not obey Ohm's law.

10. A low voltage supply from which one needs high currents must have very low internal resistance. Why?
    A high tension (HT) supply of, say, 6 kV must have a very large internal resistance. Why?

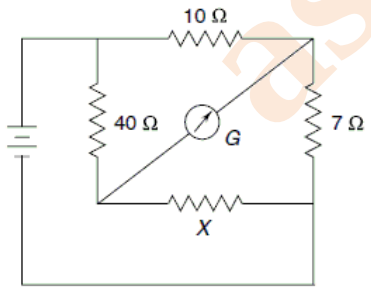
11. The deflection in a moving coil galvanometer falls from 50 to 10 divisions when a shunt of 12 Ω is connected across it. The resistance of the galvanometer coil is

    A. 24 Ω
    B. 36 Ω
    C. 48 Ω
    D. 60 Ω

12. An electric bulb has a rating of 500 W, 100 V. It is used in a circuit having a 200 V supply. What resistance must be connected in series with the bulb so that it delivers 500 W?

    A. 10 Ω
    B. 20 Ω
    C. 30 Ω
    D. 40 Ω

13. In figure, the galvanometer shows no deflection. What is the resistance X?



    A. 7 Ω
    B. 14 Ω
    C. 21 Ω
    D. 28 Ω

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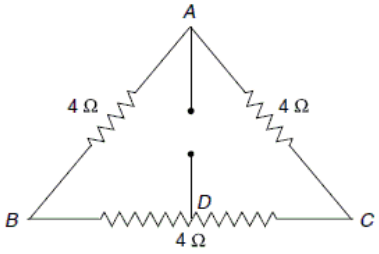
14. Three resistances of 4 Ω each are connected as shown in figure. If the point D divides the resistance into two equal halves, the resistance between points A and D will be



A. 12 Ω
B. 6 Ω
C. 3 Ω
D. $\frac{1}{3}$ Ω

15. A copper wire of length 50 cm and area of cross- section 10^{-6} m^2 carries a current of 0.5 A. If the resistivity of copper is 1.8 × 10^{-8} Ω m, the electric field across the wire is

A. 9 Vm^{-1}
B. 0.9 Vm^{-1}
C. 0.09 Vm^{-1}
D. 0.009 Vm^{-1}

16. An electric bulb has a rating of 100 W, 200 V. If the supply voltage drops to 100 V, then what is the total heat and light energy produced by the bulb in 20 minutes?

A. 10 kJ
B. 20 kJ
C. 30 kJ
D. 40 kJ

17. The current through a bulb is increased by 1%. Assuming that the resistance of the filament remains unchanged, the power of the bulb (i.e. its wattage) will

A. increase by 1%
B. decrease by 1%
C. increase by 2%
D. decrease by 2%

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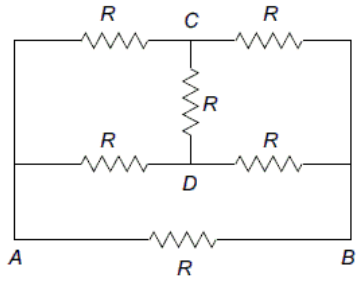
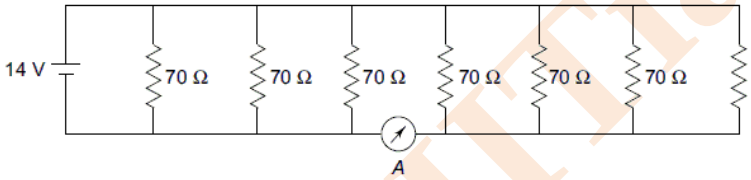
18. In the circuit shown in figure, the effective resistance between A and B is



A. $\frac{R}{2}$
B. R
C. 2 R
D. 4 R

19. The reading of the ammeter in the given circuit is



A. $\frac{3}{5}$ A
B. $\frac{4}{5}$ A
C. $\frac{6}{5}$ A
D. $\frac{7}{5}$ A

20. A piece of copper and another of germanium are cooled from room temperature to 40 K. The resistance of

A. each of them decreases
B. each of them increases
C. copper increases and of germanium decreases
D. copper decreases and of germanium increases

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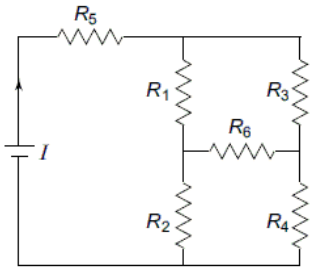
21. In the given circuit it is observed that the current I is independent of the value of the resistance R_6. Then the resistance values must satisfy



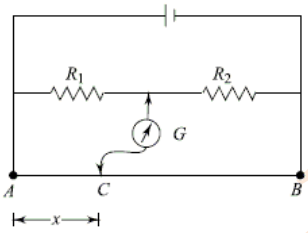
A. $R_1 R_2 R_5 = R_3 R_4 R_6$

B. $\frac{1}{R_5} + \frac{1}{R_6} = \frac{1}{R_1 + R_2} + \frac{1}{R_3 + R_4}$

C. $R_1 R_4 = R_2 R_3$

D. $R_1 R_3 = R_2 R_4 = R_5 R_6$

22. In the meter bridge experiment shown in figure, the balance length AC corresponding to null deflection of the galvanometers is x. What would be the balance length, if the radius of the wire AB is doubled?



A. $\frac{x}{2}$

B. x

C. 2x

D. 4x

23. A conductor of resistance 3 Ω is stretched uniformly till its length is doubled. The wire is now bent in the form of an equilateral triangle. The effective resistance between the ends of any side of the triangle (in ohms) is

A. $\frac{9}{2}$

B. $\frac{8}{3}$

C. 2

D. 1

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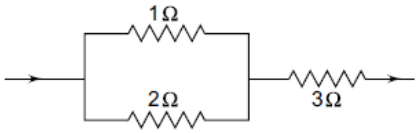
24. If a wire is stretched to make it 0.1% longer, its resistance will

A. increase by 0.05%
B. increase by 0.2%
C. decrease by 0.2%
D. remain unchanged

25. Two electric bulbs are designed to operate with a power of 500 W in a 200 V supply line. They are connected in series to a 100 V supply line. The power generated in each bulb is

A. 31.0 W
B. 31.25 W
C. 31.5 W
D. 31.75 W

26. In the circuit shown in figure, the current in the 1 Ω resistor is 2 A. The power developed in the 3 Ω resistor is



A. 3 W
B. 9 W
C. 27 W
D. 81 W

27. A battery of emf E and internal resistance r is connected to a resistor of resistance r_1 and Q joules of heat is produced in a certain time t. When the same battery is connected to another resistor of resistance r_2, the same quantity of heat is produced in the same time t, the value of r is

A. $\frac{r_1^2}{r_2}$
B. $\frac{r_2^2}{r_1}$
C. $\frac{1}{2}(r_1 + r_2)$
D. $\sqrt{r_1 r_2}$

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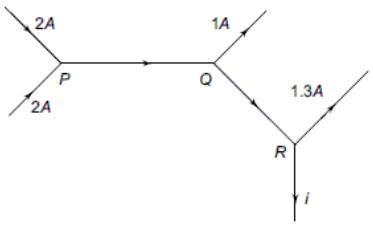
28. Figure shows currents in a part of an electrical circuit. The current i is



A. 1 A
B. 1.3 A
C. 1.7 A
D. 3.7 A

29. A battery of emf E and internal resistance r is connected across a pure resistive device (such as an electric heater) of resistance R. The power output of the device will be maximum if

A. R = r
B. R = $\sqrt{2}$ r
C. R = 2r
D. R = 4r

30. A constant voltage is applied between the two ends of a metallic wire. Some heat is developed in it. The heat developed is doubled if

A. both the length and the radius of the wire are halved
B. both the length and the radius of the wire are doubled
C. the radius of the wire is halved
D. the length of the wire is doubled