Solved Electricity numerical for class 10

1. Question: Two bulbs have ratings 100 W, 220 V and 60 W, 220 V respectively. Which one has a greater resistance?

Answer: $P=VI= V^2/R$ For the same V, R is inversely proportional to P.

Therefore, the bulb 60 W, 220 V has a greater resistance.

2. Question: A torch bulb has a resistance of 1 Ω when cold. It draws a current of 0.2 A from a source of 2 V and glows. Calculate

(i) the resistance of the bulb when glowing and

(ii) explain the reason for the difference in resistance.

Answer:

(i) When the bulb glows:

V = I R ---- Ohm's law R = V/I = 2/.2 =10 Ω

(ii) Resistance of the filament of the bulb increases with increase in temperature. Hence when it glows its resistances is greater than when it is cold.

3. Question: Calculate the resistance of 1 km long copper wire of radius 1 mm. (Resistivity of copper = 1.72 x 1 0^{-8}

Answer: L = 1 km = 1000 m

R = 1 mm = 1 x 1 0^{-3}

p = 1.72 x 1 0-8 W m

Area of cross section = p r^2 = 3.14 x 1 0^{-3} x 1 0^{-3} = 3.14 x 1 0^{-6}

R = pl/A = (1.72 x 1 0^{-8} x 1000) / 3.14 x 1 0^{-6} = 5.5 W

4. Question: When a potential difference of 2 V is applied across the ends of a wire of 5 m length, a current of 1 A is found to flow through it. Calculate:

(i) The resistance per unit length of the wire (ii) the resistance of 2 m length of this wire

(iii) The resistance across the ends of the wire if it is doubled on itself.

Answer: (i) V = I R ----- Ohm's law R=V/I=2/1= 2 Ohm

Resistance per unit length: 2/5= 0.4 Ohm/m

(ii) Resistance of 2 m length of the wire = 0.4 x 2=0.8 ohm

(iii) When the wire is doubled on itself:

(a) the area of cross-section is doubled. If A is the original C.S. area, now it is 2 A.

(b) The length becomes half i.e.L/2

Resistance of this wire =R' = p (l/2)/(2A) = 1/4(p(L/A)

But ρ (L/A) = 2 ohm

R' = 1/4 x 2=0.5 Ohm

5. How much work is done in moving 4 C across two point having pd. 10 v

Solution : W = VQ = 10 x 4 = 40J

6. How much energy is given to each coulomb of charge passing through a 9 v battery?

Solution: Potential difference = Work done = Potential difference × charge

Where, Charge = 1 C and Potential difference = 6 V

Work done = 9×1 = 9 Joule.

7. 100 j of work is done in moving a charge of 5 C from one terminal of battery to another . What is the potential difference of battery?

Solution: V = W/Q = 100j/5C = 20 V

8. If 4 x 10^{-3} J of work is done in moving a particles carrying a charge of 16 x 10^{-6} C from infinity to point P .What will be the potential at a point?

Solution: the potential at a point is work done to carry unit from one point to another

= (4 x 10^{-3}) /(16 x 10^{-6} C) = 250 V

9. Calculate the current and resistance of a 100 W ,200V electric bulb.

Solution: Power,P = 100W and Voltage,V = 200V

Power P = VI

So, Current I = P/v = 100/200 = 0.5A

Resistance R = V/I = 200/0.5 = 400W.

10.Calculate the power rating of the heater coil when used on 220V supply taking 5 Amps.

Solution: Voltage ,V = 220V and Current ,I = 5A,

Power, P = VI = 220 × 5 = 1100W = 1.1 KW.

11.A lamp can work on a 50 volt mains taking 2 amps.What value of the resistance must be connected in series with it so that it can be operated from 200 volt mains giving the same power.

Solution: Lamp voltage ,V = 50V and Current ,I = 2 amps.

Resistance of the lamp = V/I = 50 / 2 = 25 Ω

Resistance connected in series with lamp = r.

Supply voltage = 200 volt. and Circuit current I = 2 A

Total resistance Rt= V/I = 200/2 = 100Ω

Rt = R + r => 100 = 25 + r => r = 75Ω

12. Calculate the work done in moving a charge of 5 coulombs from a point at a potential of 210 volts to another point at 240 volts

Solution: Potential difference = 210 - 240 = 30 V

So, W.= V x Q = 30V x 5C = 150 Joules

13. How many electrons pass through a lamp in one minute if the current be 200 mA?

Solution:

I = 220 mA = 0.22 A

I = Q/t

0.22 = Q/60

Q= 0.22 x 60 = 13.2 C

No of electron carry 1 C charge = 6×10^{18}

No of electron carry 13.2 C charge = $6 \times 10^{18} \times 13.2$ C = 79.2×10^{18}

14. Calculate the current supplied by a cell if the amount of charge passing through the cell in 4 seconds is 12 C ?

Solution: We know that I =Q/t => I = Q/t = 12/4 = 3A

15. A 2 Volt cell is connected to a 1 Ω resistor. How many electrons come out of the negative terminal of the cell in 2 minutes?

Solution: V = IR => I = V/R = 2/1 = 2 A

I = Q/t => Q = It = 2 x 2 x 20 = 80 C

No of electron carry 1 C charge = 6×10^{18}

No of electron carry 80 C charge = $6 \times 10^{18} \times 80$ C = 108×10^{18} = 1.08×10^{20}

16. (a) How much current will an electric bulb draw from a 220 V source, if the resistance of the bulb filament is 1200 Ω?

(b) How much current will an electric heater coil draw from a 220 V source, if the resistance of the heater coil is 100 Ω?

Solution (a) We are given V = 220 V; R = 1200 Ω.

we have the current I = V/R = 220 V/1200 Ω = 0.18 A.

(b) We are given, V = 220 V, R = 100 Ω.

we have the current I = V/R = 220 V/100 Ω = 2.2 A.

17. The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. What current will the heater draw if the potential difference is increased to 120 V?

Solution : We are given, potential difference V = 60 V, current I = 4 A.

According to Ohm's law, R = V/I = 60/4 =15Ω

When the potential difference is increased to 120 V

the current is given by current = V/R = 120V/15 = 8A

The current through the heater becomes 8 A.

18. A 4 Ω resistance wire is doubled on it. Calculate the new resistance of the wire.

Solution We are given, R = 4 Ω.

When a wire is doubled on it, its length would become half and area of cross-section would double. T

So, a wire of length l and area of cross-section A becomes of length l/2

And area of cross section 2A. we have R = ρ(l/A)

R1 = ρ((l/A) / 2A) where R1 is the new resistance.

Therefore, R1/R = ρ((l/A)/2A) / ρ(l/A) = 1/4

Or, R1 = R/4 = 4Ω/4 = 1Ω

The new resistance of the wire is 1 Ω.

19 . 3.A circuit is made of 0.4 Ω wire,a 150Ω bulb and a 120Ω rheostat connected inseries.Determine the total resistance of the resistance of the circuit.

Solution: Resistance of the wire = 0.4Ω Resistance of bulb = 150Ω Resistance of rheostat = 120Ω

In series, Total resistance ,R = 0.4 + 150 +120 = 270.4Ω

20. A current of 0.2 Ampere flows through a conductor of resistance 4.5 Ω. Calculate the potential difference at the ends of the conductor.

Solution: The potential difference at the ends of the conductor. = V = IR = 0.2 x 4.5 = 0.9 V

21. A lamp has a resistance of 96 ohms. How much current flows through the lamp when it is connected to 120 volts?

Solution: I = V/R = 120/96 = 1.25 A [V = IR]

The current through the lamp equals 1.25 A.'

22. The manufacturer specifies that a certain lamp will allow 0.8 ampere of current when 120 volts is applied to it. What is the resistance of the lamp?

Solution: V = IR So, R = V/I = 120/0.8 = 150 W

23. How much voltage is required to cause 1.6 amperes in a device that has 30 ohms of resistance?

Given: V = IR = 1.6 x 30 = 48 V

24. How much power is dissipated when 0.2 ampere of current flows through a 100-ohm resistor?

Ans: P = V I = IR x I = I2 R = 0.2 x 0.2 x 100 = 4 W

25. How much energy is converted by a device that draws 1.5 amperes from a 12-volt battery for 2 hours?

Solution: W = Pt, P = V I So, W = VIt = 12 x 1.5 x 2 = 36 Wh