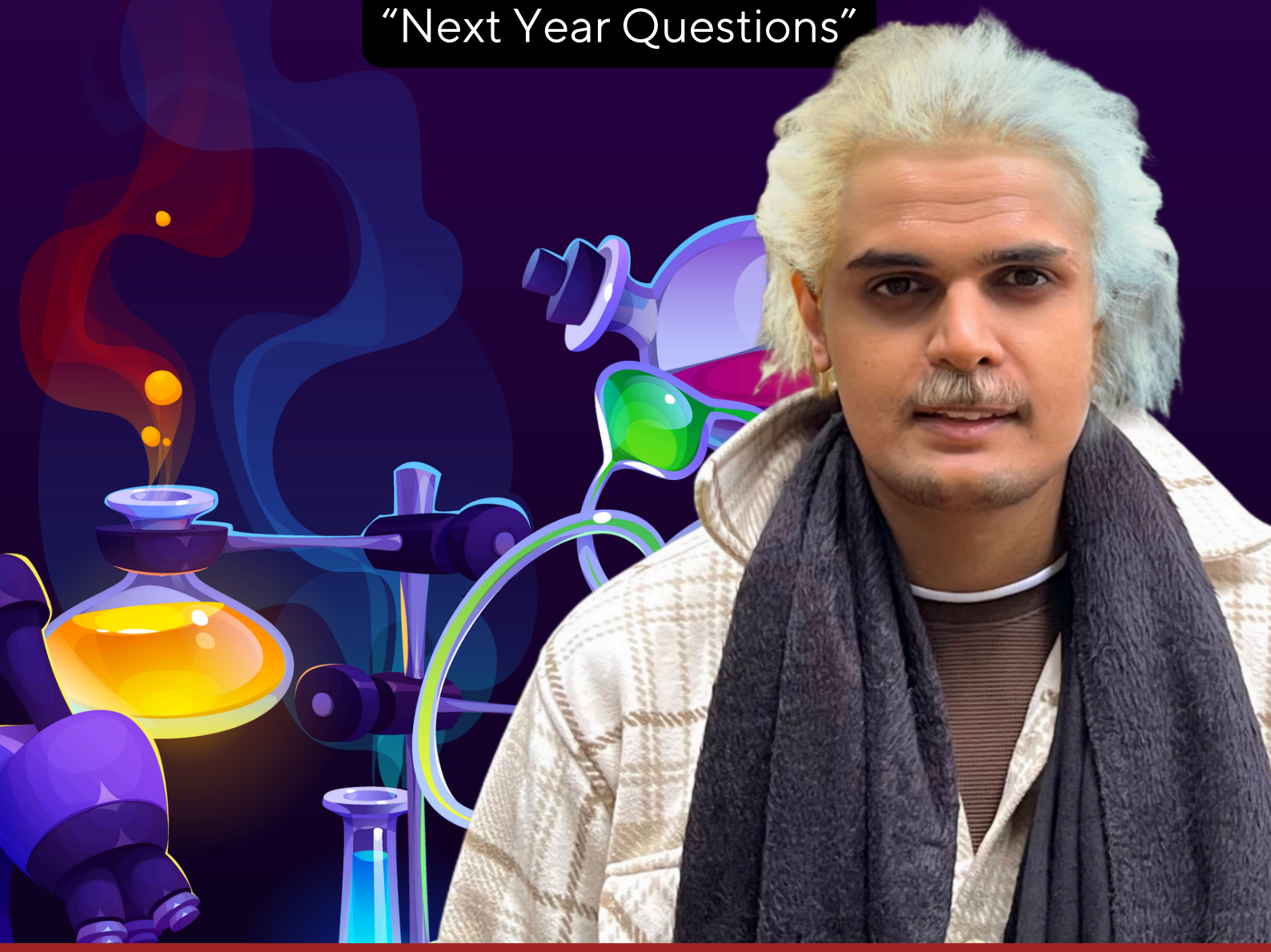
Next Toppers

Class X

अभय

NYQs

"Next Year Questions"



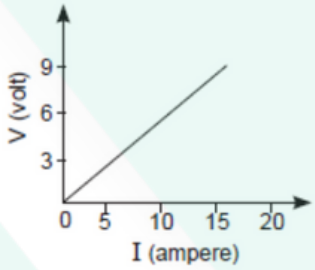
Electricity

PRASHANT KIRAD

Electricity

Q1. Electrical resistivity of a given metallic wire depends upon
(a) Its length
(b) Its thickness
(c) Its shape
(d) Nature of the material

Q2.The resistance whose V – I graph is given below is



(a) 5/3 Ω
(b) 3/5 Ω
(c) 5/2 Ω
(d) 2/5 Ω

Q3.How much more heat is produced if the current is doubled?
(a) Twice the original amount
(b) Thrice the original amount
(c) Four times the original amount
(d) Five times the original amount

Q4.In an electrical circuit, two resistors of 2 Ω and 4 Ω, respectively, are connected in series to a 6 V battery. The heat dissipated by the 4 Ω resistor in 5 s will be
(a) 5 J
(b) 10 J
(c) 20 J
(d) 30 J

Q5. If n resistors each of resistance R are connected in parallel combination, then their equivalent resistance is
(a) R/n^2
(b) n^2/R

(c) n/R
(d) R/n

Q6.State and explain Ohm's law. Define resistance and give its SI unit. What is meant by 1 ohm resistance? Draw V-I graph for an ohmic conductor and list its two important features

Q7. Three resistors of 10 Ω, 15 Ω and 5 Ω are connected in parallel. Find their equivalent resistance.

Q8.Draw a schematic diagram of a circuit consisting of a battery of 3 cells of 2 V each, a combination of three resistors of 10 Ω, 20 Ω and 30 Ω connected in parallel, a plug key and an ammeter, all connected in series. Use this circuit to find the value of the following :
(a) Current through each resistor
(b) Total current in the circuit
(c) Total effective resistance of the circuit.

Q9.An electric lamp of 100 Ω, a toaster of resistance 50 Ω and a water filter of resistance 500 Ω resistances are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same source that takes as much current as all three appliances, and what is the current that flows through it?

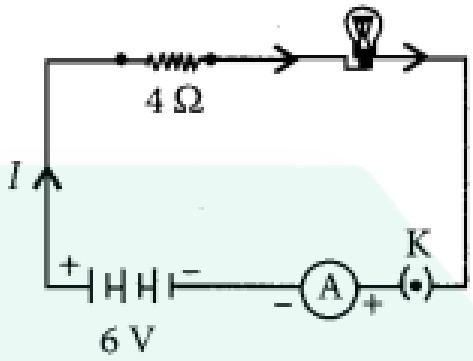
Q10. Explain two disadvantages of series arrangement for a household circuit.

Q11.What is meant by the saying that the potential difference between two points is 1 V?

Q12.If the radius of a current carrying conductor is halved, how does current through it change?

Q13. A current of 10 A flows through a conductor for two minutes.
(i) Calculate the amount of charge passed through any area of cross section of the conductor.
(ii) If the charge of an electron is 1.6×10^{-19} C, then calculate the total number of electrons flowing.

Q14.An electric lamp of resistance 20 Ω and a conductor of resistance 4 Ω. are connected to a 6 V battery as shown in the circuit. Calculate.



(a) the total resistance of the circuit
(b) the current through the circuit,
(c) the potential difference across the (i) electric lamp and (ii) conductor, and
(d) power of the lamp.

Q15.An electric iron of resistance 20 Ω draws a current of 5 A. Calculate the heat developed in 30 s.

SOLUTION

Ans1. d

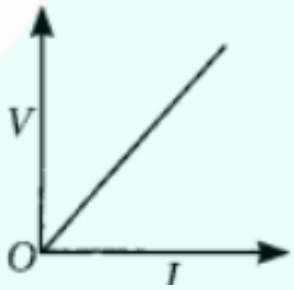
Ans2. b

Ans3. c

Ans4. c

Ans5. d

Ans6.It states that the potential difference V, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same.
Mathematically,
$V \propto I$
$V = RI$
where R is resistance of the conductor.
Resistance : It is the property of a conductor to resist the How of charges through it.
Its SI unit is ohm (Ω). If the potential difference across the two ends of a conductor is 1 V and the current through it is 1 A, then the resistance R, of the conductor is 1 ohm (1 Ω).
1 ohm = 1volt/1ampere



Important feature of V-I graph are:
(i) It is a straight line passing through origin.
(ii) Slope of V-I graph gives the value of resistance of conductor slope = R = V/I

Ans7.

Answer:

Here, R1 = 10 Ω, R2 =15 Ω, R3 = 5 Ω.

In parallel combination, equivalent resistance, (Req) is given by

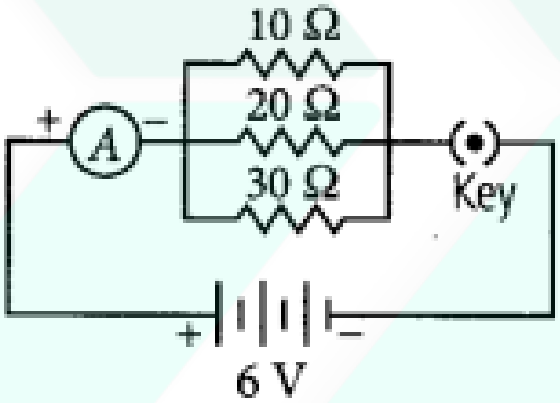
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\text{So, } \frac{1}{R_{eq}} = \frac{1}{10} + \frac{1}{15} + \frac{1}{5}$$

$$\frac{1}{R_{eq}} = \frac{3+2+6}{30} = \frac{11}{30}$$

$$\therefore \quad R_{eq} = \frac{30}{11}\Omega = 2.73\,\Omega$$

Ans8.



(a) Given: Voltage of the battery = 2V + 2V + 2V = 6V

Current through 10Ω resistance:

I_{10} = V/R = 6/10 = 0.6A

Current through 20Ω resistance:

I_{20} = V/R = 6/20 = 0.3A

Current through 30Ω resistance:

I_{30} = V/R = 6/30 = 0.2A

(b) Total current in the circuit:

$I_{total} = I_{10} + I_{20} + I_{30}$

I_{total} = 0.6 + 0.3 + 0.2 = 1.1A

(c) Total resistance of the circuit:

$1/R_p = 1/10 + 1/20 + 1/30 = 11/60$

$R_p = 60/11 \approx 5.45\Omega$

Ans9. $R_1 = 100$, $R_2 = 50$, $R_3 = 500$
All the devices are in parallel, so:
$1/R = 1/R_1 + 1/R_2 + 1/R_3$
$1/R = 1/100 + 1/50 + 1/500 = (5 + 10 + 1)/500 = 16/500$
$R = 500/16 = 31.25\Omega$
Current through all the appliances:
$I = V/R = 220/31.25 = 7.04A$
Now, if only the electric iron is connected to the same source such that it takes as much current as all three appliances ($I = 7.04A$), its resistance should be:
$R = 31.25\Omega$

Ans10.The two drawbacks of series circuits for household wiring are:

- If one electrical appliance in a series circuit stops functioning for any reason, the entire circuit will break, and all other electrical appliances will also stop functioning.
- Because there is only one switch for every electrical device in a series circuit, they cannot be turned on or off independently.

Ans11.The potential difference between two points is 1V when 1 J of work is done to move a 1 C of Charge from one location to the other.

Ans12.If the radius of conductor is halved, the area of cross-section reduced to (1/4) of its previous value.
Since, $R \propto 1/A$, resistance will become four times
From Ohm's law, $V = IR$
For given V, $I \propto 1/R$
So, current will reduce to one-fourth of its previous value.

Ans13.Answer:
Given that: $I = 10$ A, $t = 2$ min $= 2 \times 60$ s $= 120$ s
(i) Amount of charge Q passed through any area of cross-section is given by
$I = Q/t$
or $Q = I \times t \therefore Q = (10 \times 120)$ A s $= 1200$ C
(ii) Since, $Q = ne$
where n is the total number of electrons flowing and e is the charge on one electron
$\therefore 1200 = n \times 1.6 \times 10$
or $n = 1200/1.6 \times 10^{-19} = 7.5 \times 10^{21}$

Ans14.Resistance of the lamp = 20 Ω
External resistance = 4 Ω
(a) As both the lamp and external resistance are connected in series, therefore the total resistance,
R = 20 + 4 = 24 Ω
(b) Current, I = V/R = 6/24 = 0.25 A
(c) (i) Potential difference across the electric lamp
Totalvoltage/Totalresistance × resistance of lamp
= 6/24 × 20 = 5 V

(ii) Potential difference across conductor
Totalvoltage/Totalresistance × resistance of conductor
= 6/24 × 4 = 1 V

(d) Power of the lamp
= (current)² × resistance of lamp
= (0.25)² × 20 = 1.25 W

Ans15.The Joule's law of heating, which is represented by the equation, can be used to determine how the heat is produced as follows:
H = VIt
Putting the data in the above equation, we get,
H = 100 × 5 × 30 = 15,000 J
The amount of heat produced by the electric iron in 30 s is 15,000 J.