VideoPlato Academy

Mass and Weight

Equations:

Q=It **V=IR** **E=QV** **P=VI** **E=Pt**

1. What does the symbol "Q" represent in the equation Q=It?

Q is charge measured in coulombs

2. Define the term "current" in the context of electricity.

Current is the rate of flow of charge (the amount of charge passing a point each second)

3. If a current of 2A flows through a conductor for 5 seconds, what is the total charge that passes through?

$Q = I\,t$

$= 2 \times 5$

$= \mathbf{10\ C}$

4. Express Ohm's Law mathematically.

$V = I\,R$

Where: *V is potential difference in volts*

I is current in amps

R is resistance in ohms

5. What is the unit of resistance?

The unit of resistance is the ohm (Ω)

6. If a resistor has a resistance of 10 ohms and a current of 0.5A flows through it, what is the potential difference across the resistor?

$V = I R$

$= 0.5 \times 10$

$= \mathbf{5.0\ V}$

7. Calculate the resistance of a wire if a potential difference of 12 volts produces a current of 3A through it.

$R = V / I$

$= 12 / 3$

$= \mathbf{4.0\ \Omega}$

8. State the equation that relates power, current, and potential difference.

Power = potential difference x current

9. If a device operates at 6V and draws a current of 2A, what is the power consumed?

$P = V I$

$= 6 \times 2$

$= \mathbf{12\ W}$

10. A lamp has a power rating of 60W. What is the current flowing through it if it is connected to a 240V power supply?

$I = P / V$

$= 60 / 240$

$= \mathbf{0.25\ A}$

11. Calculate the energy transferred when a charge of 4C flows through a potential difference of 12V.

$E = Q\ V$

$= 4 \times 12$

$= \mathbf{48\ J}$

12. A battery supplies a current of 0.5A to a circuit for 2 hours. How much charge does it deliver?

$Q = I\ t$

$= 0.5 \times 2 \times 60 \times 60$ *(converting from hours to seconds)*

$= \mathbf{3600\ C}$

13. Calculate the energy consumed by a 100W bulb in 5 hours of operation.

$E = P\ t$

$= 100 \times 5 \times 60 \times 60$ *(converting from hours to seconds)*

$= 1{,}800{,}000\ W$ *or* $\mathbf{1.8\ MW}$

14. A resistor has a resistance of 20 ohms and a current of 0.5A flowing through it. What is the potential difference across the resistor?

$V = I R$

$= 0.5 \times 20$

$= \mathbf{10\ V}$

15. Calculate the power dissipated by a resistor with a resistance of 30 ohms when a current of 2A flows through it.

$V = I R = 2 \times 30 = 60\ V$

$P = V I = 60 \times 2 = \mathbf{120\ W}$

or $P = I^2 R$

$= 2^2 \times 30 = \mathbf{120W}$

16. A circuit has a potential difference of 6V and a current of 0.5A. What is the total resistance in the circuit?

$R = V / I$

$= 6 / 0.5$

$= \mathbf{12\ \Omega}$

17. A current of 3A flows through a resistor, dissipating 24W of power. Calculate the resistance of the resistor.

$V = P / I = 24 / 3 = 8.0\ V$

$R = V / I = 8 / 3 = \mathbf{2.7\ \Omega}$

or $R = P / I^2$

$= 24 / 3^2 = \mathbf{2.7\ \Omega}$

18. Explain why wires are often made of materials with low resistance.

$P = I^2 R$ so if the resistance is less then less power (energy per second) is lost in the wire.

19. Calculate the total charge passing through a circuit if a current of 0.2A flows for 10 seconds.

$Q = I t$

$= 0.2 \times 10$

$=$ ***2.0 C***

20. A resistor has a resistance of 50 ohms. What is the potential difference across it if a current of 0.4A flows through it?

$V = I R$

$= 0.4 \times 50$

$=$ ***20 V***

21. Define electric power and its unit.

Power is the rate of transfer of energy (energy transferred per second).

Power is measured in Watts.

[energy transferred is the same as work done so you could also give the answer power is the rate that work is done.]

22. If a battery supplies 12V to a circuit and a current of 2A flows through it, how much energy does it deliver in 30 minutes?

$P = V I = 12 \times 2 = 24W$

$E = P t = 24 \times 30 \times 60 = 43{,}200\ J$ or ***43.2 kJ***

23. A circuit has a resistance of 40 ohms and a current of 0.5A. What is the potential difference across the circuit?

$V = I R$

$= 0.5 \times 40$

$=$ ***20 V***

24. A resistor has a resistance of 20 ohms and a current of 2A flowing through it. Calculate the power dissipated by the resistor.

$V = I R = 2 \times 20 = 40\ V$

$P = I V = 40 \times 2 =$ ***80 W***

or $P = I^2 R$

$= 2^2 \times 20 =$ ***80 W***

25. Explain how doubling the current through a resistor affects the power dissipated by it.

$P = I^2 R$

So if R remains constant and I is doubled the power will be increased by four times.

[If I becomes 2I then $P = (2I)^2 R = 4I^2R$*]*

26. A circuit has a resistance of 30 ohms, and a potential difference of 12V is applied across it. Calculate the power dissipated.

I = V / R = 12 / 30 = 0.4 A *or P = V^2 / R*

P = V I = 12 x 0.4 = ***4.8 W*** *= 12^2 / 30 =* ***4.8W***

27. Discuss the relationship between power dissipation and resistance when the potential difference across a circuit is held constant.

P = V^2 / R so if V is constant and R increases, P will decrease.

If R decreases, P will increase.

[Furthermore, If R is doubled, P will be halved.]

28. If a resistor dissipates 64W of power when connected to a 16V power supply, what is its resistance?

I = P / V = 64 / 16 = 4 A *or R = V^2 / P*

R = V / I = 16 / 4 = ***4.0Ω*** *= 16^2 / 64 =* ***4.0Ω***