Physics Equation List :Form 5

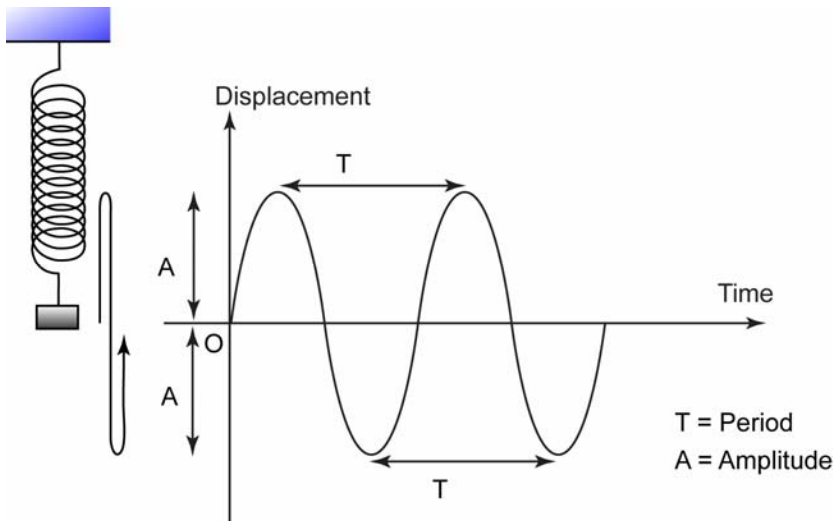
Wave

Oscillation

$$f = \frac{1}{T}$$

f = frequency *(Hz or s^{-1})*
T = Period *(s)*

Displacement-Time Graph



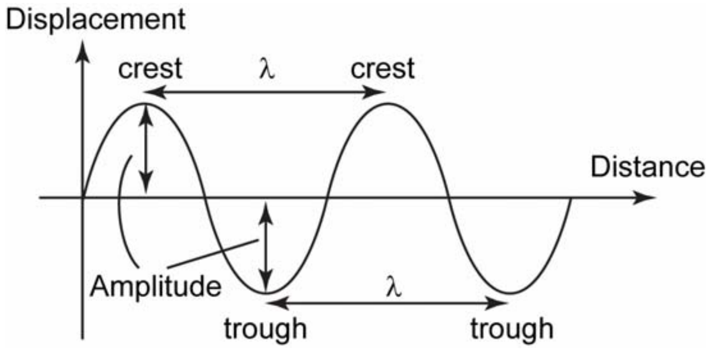
- Amplitude, Period and Frequency can be found from a Displacement-Time Graph

Wave

$$v = f\lambda$$

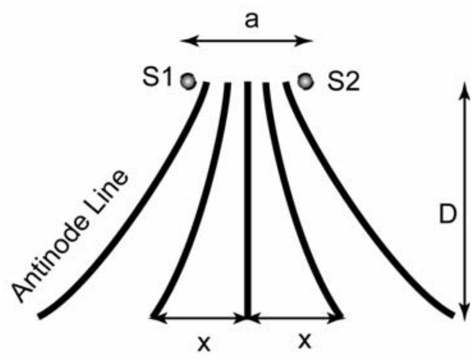
v = velocity *(ms^{-1})*
f = frequency *(Hz or s^{-1})*
λ = wavelength *(m)*

Displacement-Distance Graph



λ = Wavelength

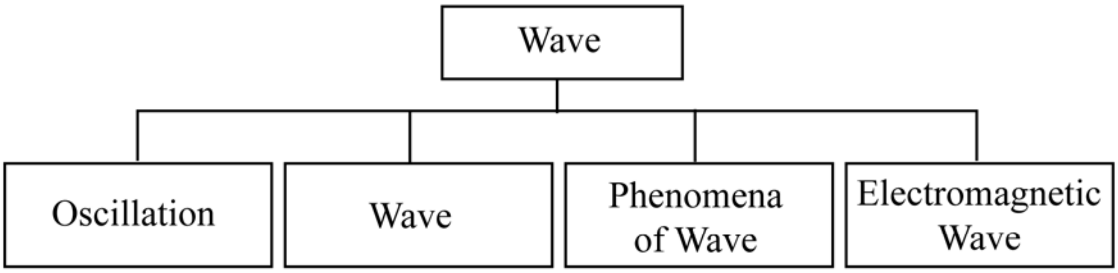
Interference



$$\lambda = \frac{ax}{D}$$

λ = Wavelength
a = Distance between the two wave sources
x = Distance between two successive anti-node lines or node lines
D = Distance from the wave sources to the plane where x is measured.

Summary



$$f = \frac{1}{T} \qquad v = f\lambda \qquad \lambda = \frac{ax}{D}$$

Electricity

Sum of charge

$$Q = ne$$

Q = Charge
n = number of charge particles
e = charge of 1 particle

Current

$$I = \frac{Q}{t}$$

Q = Charge
I = Current
t = time

Potential Difference

$$V = \frac{W}{Q}$$

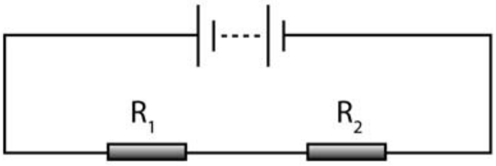
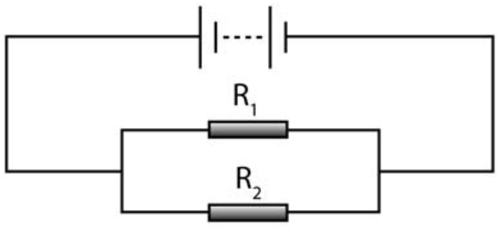
V = potential difference,	*(V or JC^{-1})*
W = energy	*(J)*
Q = charge	*(C)*

Ohm's Law and Resistance

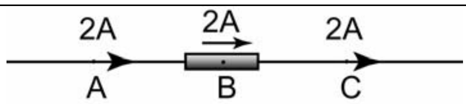
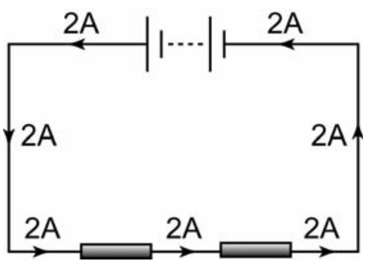
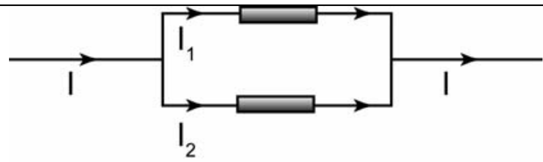
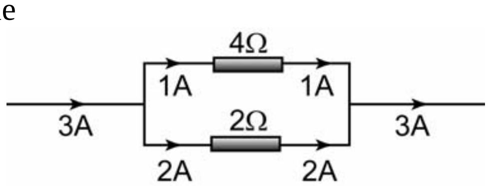
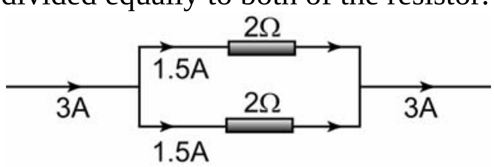
$$V = IR$$

V = potential difference,	*(V or JC^{-1})*
I = Current	*(A or Cs^{-1})*
R = Resistance	*(Ω)*

Resistance

	
$R = R_1 + R_2$	$R = (\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3})^{-1}$

Current

Series Circuit	Parallel Circuit
 The current flow into a resistor = the current flow inside the resistor = the current flows out from the resistor $I_A = I_B = I_C$  In a series circuit, the current at any points of the circuit is the same.	 The current flow into a parallel circuit is equal to the sum of the current in each branches of the circuit. $I = I_1 + I_2$ Example  If the resistance of the 2 resistors is the same, current will be divided equally to both of the resistor. 

Potential and Potential Difference

<table>
<tr><th>Series Circuit</th><th>Parallel Circuit</th></tr>
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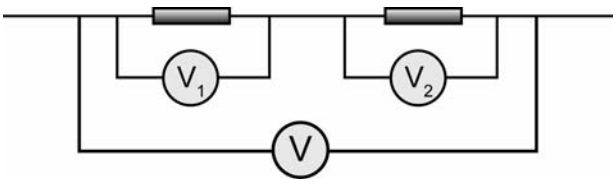
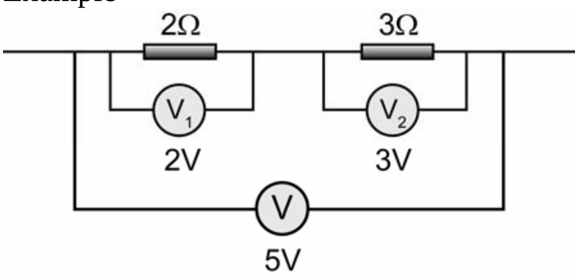


The sum of the potential difference across individual resistor in between 2 points in a series circuit is equal to the potential difference across the two point.

$$V = V_1 + V_2$$

Example



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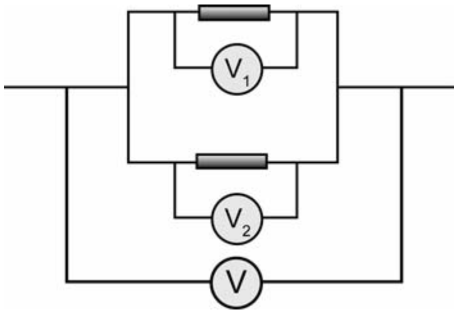
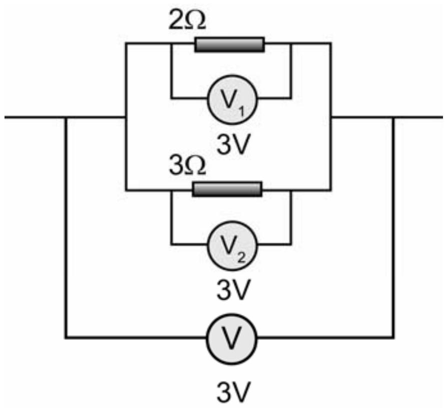


The potential difference across all the resistor in a parallel circuit is the same.

$$V = V_1 = V_2$$

Example



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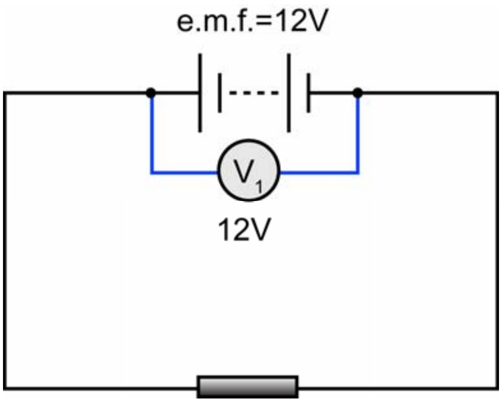
Potential Difference and Electromotive Force



If we assume that there is no internal resistance in the cell, the potential difference across the cell is equal to the e.m.f. of the cell.

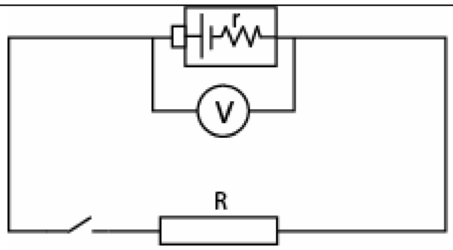
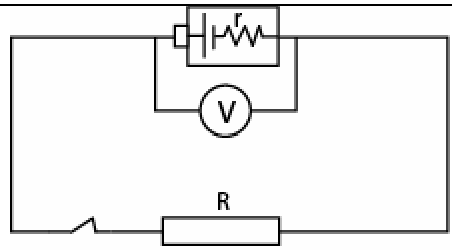
Electromotive Force and Internal Resistance

$$E = I(R + r) \quad \text{or} \quad E = V + Ir$$

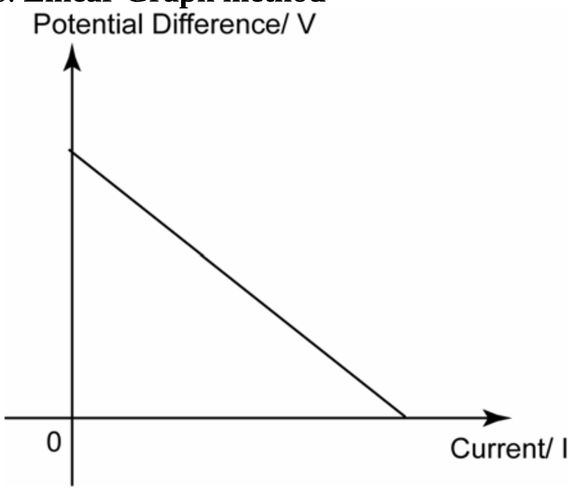
E = Electromotive Force	*(V)*
r = internal resistance	*(Ω)*
V = potential difference,	*(V or JC^{-1})*
I = Current	*(A or Cs^{-1})*
R = Resistance	*(Ω)*

2 methods to find the internal resistance and electromotive force

a. **Open Circuit – Close Circuit method**

Open Circuit	**Close Circuit**
	
In open circuit (when the switch is off), the voltmeter shows the reading of the e.m.f.	In close circuit (when the switch is on), the voltmeter shows the reading of the potential difference across the cell.
• With the presence of internal resistance, the potential difference across the cell is always less than the e.m.f..	

b. **Linear Graph method**



From the equation,

E = V + Ir

Therefore

V = -rI + E

Gradient od the grapf, m

= -internal resistance

Y intercept of the graph, c

= electromotive force

Electrical Energy

$$E = QV$$

E = Electrical Energy	*(J)*
Q = charge	*(C)*
V = potential difference	*(V or JC^{-1})*

Electrical Power

$$P = \frac{W}{t} \qquad P = IV \qquad P = I^2 R \qquad P = \frac{V^2}{R}$$

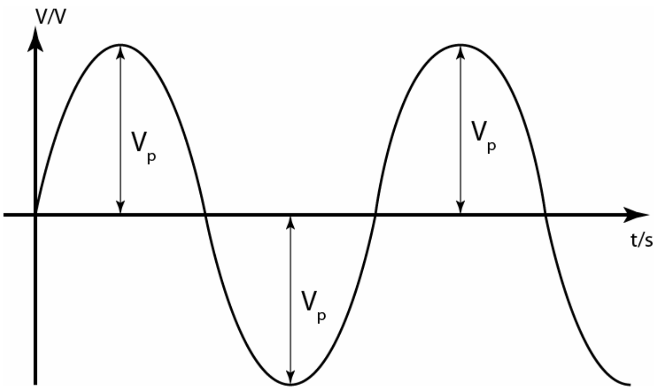
P = Power	*(W or Js^{-1})*
W = Work done/Energy change	*(J)*
t = Time	*(s)*
I = Current	*(A)*
V = Potential difference	*(V)*
R = Resistance	*(Ω)*

Efficiency

$$\text{Electrical efficiency} = \frac{\text{output power}}{\text{input power}} \times 100\%$$

Electromagnetism

Root mean Square Value



$$V_{rms} = \frac{V_p}{\sqrt{2}}$$

V_{rms} = root mean square voltage	*(V)*
V_p = peak voltage	*(V)*

$$I_{rms} = \frac{I_p}{\sqrt{2}}$$

I_{rms} = root mean square current	*(A)*
I_p = peak current	*(A)*

Transformer

Input And Output Of A Transformer

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

V_p = input (primary) potential difference (V)
V_s = output (secondary) potential difference (V)
N_p = number of turns in primary coil
N_s = number of turns in secondary coil

Power In A Transformer

Ideal Transformer

$$V_p \times I_p = V_s \times I_s$$

V_p = input (primary) potential difference (V)
V_s = output (secondary) potential difference (V)
I_p = input (primary) current (A)
I_s = output (secondary) current (A)

Non-ideal transformer

$$Efficiency = \frac{V_s I_s}{V_p I_p} \times 100\%$$

Power Transmission

2Steps to find the energy/power loss in the cable

a. Find the current in the cable by the equation $P=IV$
b. Find the Power lost in the cable by the equation $P=I^2R$.

Electronic

Energy change of electron in an electron gun

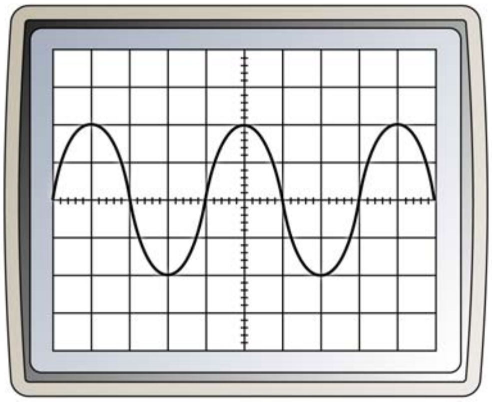
Kinetic energy gain = electrical potential energy

$$\frac{1}{2}mv^2 = eV$$

$$v = \sqrt{\frac{2eV}{m}}$$

v = speed of electron (m^{s-1})
V = potential difference across the electron gun (V)
e = charge of 1 electron (C)
m = mass of 1 electron (kg)

Cathode Ray Oscilloscope



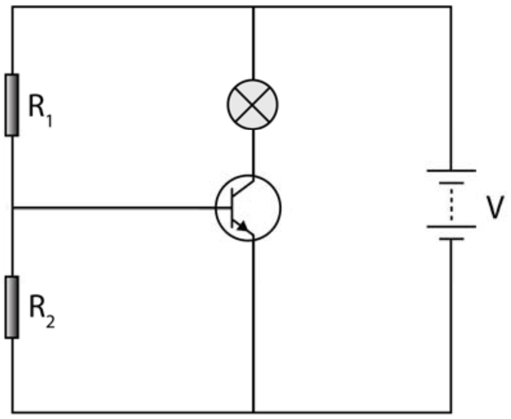
Vertical scale = Y-gain control

Horizontal scale = Time base

Period = Time for 1 complete Oscillation

Frequency, $f = \frac{1}{T}$

Transistor - Potential Divider



Potential difference across resistor R_1

$$= \frac{R_1}{R_1 + R_2} \times V$$

Potential difference across resistor R_2

$$= \frac{R_2}{R_1 + R_2} \times V$$

Radioactivity

Alpha decay

$$^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$$

Beta decay

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e$$

$$^{1}_{0}n \rightarrow {}^{1}_{1}p + {}^{0}_{-1}e$$

Gamma emission

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z}X + \gamma$$

A = nucleon number
Z = proton number

Half-life

$$N = (\frac{1}{2})^{n} N_0$$

N = Amount of radioisotope particles after nth half life.
N_0 = Initial amount of radioisotope particles.
n = number of half life

Nuclear Energy - Einstein Formula

$$E = mc^2$$

m = mass change	(kg)
c = speed of light	($m\ s^{-1}$)
E = energy changed	(J)