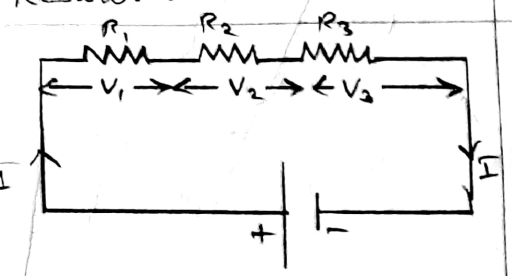
Resistor in Series



* I - same
* V - different

Ohm's law,

* $V = IR$

$\therefore V = V_1 + V_2 + V_3$

$V_1 = IR_1, V_2 = IR_2, V_3 = IR_3$

$V = IR_1 + IR_2 + IR_3$

* $V = I(R_1 + R_2 + R_3)$ — ①
* Effective Resistance (R_s)

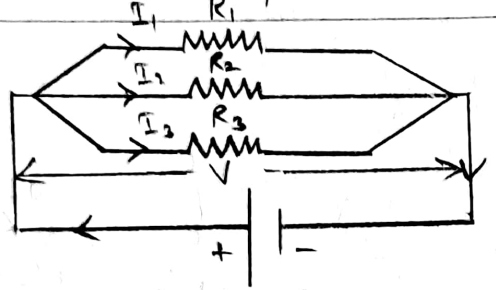
$V = IR_s$ — ②

② = ①

$IR_s = I(R_1 + R_2 + R_3)$

$$\boxed{R_s = R_1 + R_2 + R_3}$$

Resistor in parallel



* I - different
* V - same

Ohm's law, $V = IR$

$\therefore I = I_1 + I_2 + I_3$

$I = \frac{V}{R}$

$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}, I_3 = \frac{V}{R_3}$

$I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

$I = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$ — ①

* Effective resistance (R_p)

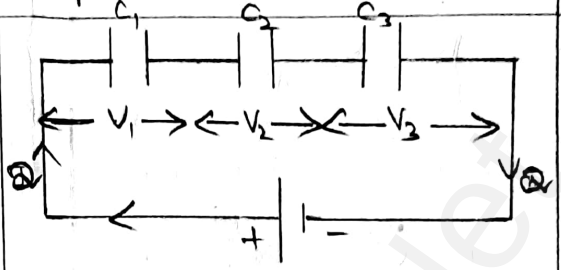
$I = \frac{V}{R_p}$ — ②

② = ①

$\frac{V}{R_p} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$

$$\boxed{\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

Capacitance in series



* Q - same
* V - difference
* Capacitance of a capacitor,

$C = \frac{Q}{V} \Rightarrow V = \frac{Q}{C}$

$\therefore V = V_1 + V_2 + V_3$

$V_1 = \frac{Q}{C_1}, V_2 = \frac{Q}{C_2}, V_3 = \frac{Q}{C_3}$

$V = \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3}$

$V = Q\left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right)$ — ①

* Effective capacitance (C_s)

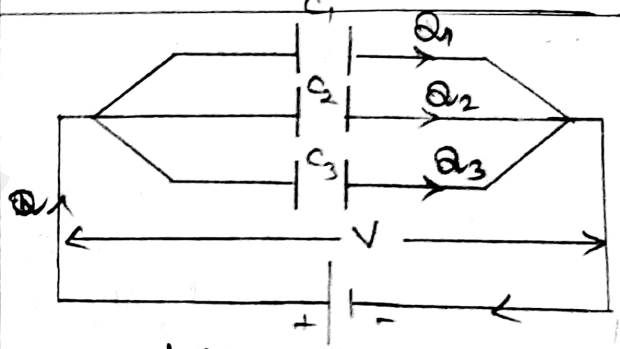
$V = \frac{Q}{C_s}$ — ②

② = ①

$\frac{Q}{C_s} = Q\left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}\right)$

$$\boxed{\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}}$$

Capacitance in parallel



* Q - different
* V - same
* Capacitance of a capacitor,

~~$Q = Q_1 + Q_2 + Q_3$~~

$C = \frac{Q}{V} \Rightarrow Q = CV$

$\therefore Q = Q_1 + Q_2 + Q_3$

$Q_1 = C_1V, Q_2 = C_2V, Q_3 = C_3V$

$Q = C_1V + C_2V + C_3V$

$$\boxed{Q = V(C_1 + C_2 + C_3)}$$ — ①

* Effective capacitance (C_p)

$Q = C_pV$ — ②

② = ①

$C_pV = V(C_1 + C_2 + C_3)$

$$\boxed{C_p = C_1 + C_2 + C_3}$$

Properties	ELECTROMAGNETICS WAVES	CATHODE RAYS	X-RAYS	Neutron	Neutrino
Charge	Neutral = 0 (Photons)	Negative = -e (electrons)	Neutral = 0 (Photons)	Neutral	Zero charge
Required any medium	No	No	No	Slow - 0 to 1000 eV fast - 0.5 MeV to 10 MeV	It has anti particle - Anti-neutrino
Nature	Transverse	Transverse	Transverse	Greater the mass of proton	Neutrino has Small mass
speed of light	EMW = speed of light in air (or) vacuum $c = 3 \times 10^8 ms^{-1}$	Straight line with high speed of the order of $10^7 ms^{-1}$	Straight line ~~also~~ with speed of light	Average energy 0.025 eV at 298K Thermal energy ~ 0.025eV	It Intracts very weakly with the matter.
deflected by Electric and magnetic field	Not deflected	Deflected by both fields	Not deflected	Not deflected	Not affected Electromagnetic waves
Wave can exhibit	Interference, Diffraction Polarization	X-ray, fluores-cence produced.	production by electron	-	-
Penerating Power	very high	high	Very high	Neutron is greater than gamma	high
Ionization pow	Very low	low	low	low	Do not induced the ionization of matter.
~~Power~~ They carry	Energy, Momentum	Energy, momentum	-	Magnetic dipole moment, Energy	-

	Radio waves	Microwaves	Infrared radiation	Visible light	Ultraviolet radiation	X-rays	Gamma radiation
Source	It is produced by accelerated motion of charge.	It is produced by special vacuum tube-like- Klystron, Magnetron and gunndiode	It is produced hot bodies and when molecules undergoing rotational and vibration	It is produced by incandescent bodies and Radiated by excited atoms in gas	It is produced by sun, arc and ionized gas.	-" when there is sudden stopping of high speed electrons at high-atomic number target.	It is produced by transitions of radioactive nuclei and decay of certain elementary particles.
Frequency Range	Few Hz to 10^9 Hz	10^9 Hz to 10^{11} Hz	10^{11} Hz to 4×10^{14} Hz	4×10^{14} Hz to 8×10^{14} Hz	8×10^{14} Hz to 10^{17} Hz	10^{17} Hz to 10^{19} Hz	10^{18} Hz and above
obeys laws	Reflection and diffraction	Reflection and polarised		Reflection, Refraction, Interference, diffraction, Polarization	Less penerating Power	more Penerating Power	* Higher Penerating Power than X-ray * Diffraction * Ionization * Fluorescence
Uses	i) Radio ii) TV communication system. iii) cellular phones.	i) Radar system for aircraft navigation. ii) speed of the vechile. iii) microwave oven.	i) Dehydrated fruits ii) Heat theraphy for muscular pain iii) TV remote as a signal carrier. iv) Night vision (or IR Photography.	i) study of structure of molecules. ii) Arrangement of electron in external shells of atom iii) causes sensation of vision	i) It is destroy bacteria in sterilizing the surgical instruments ii) Finger print iii) Burglar alarm iv) Detect the invisible writing.	i) study of crystal structure ii) Detecting fractures. iii) and diseased organs iv) Formation of bones and stones	i) Radio theraph for the treat-ment of cancer and tumour. ii) In food industry to ki Pathogenic micro-organism