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'O' Level Physics Formula Sheet

Measurements				
Base SI Units				
Kg	SI U	nit for mass: Kilogram		
m		nit for length: metre		
S		nit for time: second		
A		nit for current: Ampere		
K		nit for Temperature: Kelvin		
mol		nit for Amount of substance: molar		
Number Prefix				
n (10 ⁻⁹)	nanc)		
$\mu (10^{-6})$	micr	О		
$m(10^{-3})$	milli			
c (10 ⁻²)	cent	i		
$d(10^{-1})$	deci			
$K(10^3)$	Kilo			
$M(10^6)$	Meg	a		
Kinematics				
Average Speed		al distance travelled (area under		
$\mathbf{s} = \Delta \mathbf{d} / \Delta \mathbf{t}$		ne graph)		
		al displacement		
Average Velocity		al time taken		
$\mathbf{v} = \Delta \mathbf{x}/\Delta \mathbf{t}$		inge in velocity		
Acceleration	Velocity	(slope of displacement-time graph)		
$\mathbf{a} = \Delta \mathbf{v} / \Delta \mathbf{t}$		ation (slope of velocity-time graph)		
$\mathbf{v} = \mathbf{u} + \mathbf{at}$		al velocity		
$x = ut + \frac{1}{2} at^2$		velocity		
$\mathbf{v^2} = \mathbf{u}^2 + 2\mathbf{a}\mathbf{x}$	t = time			
	a = acce			
		lacement		
$\mathbf{v}_{\mathbf{free\ fall}} = \sqrt{2gh}$	h = heig			
		itational constant = 9.81 m/s ²		
Noveton's First I	Dynamics			
Newton's First Law		A hody continues to stay in its state		
		A body continues to stay in its state		
$\sum \vec{F} = 0$ at equilibri	um (of rest or uniform motion in a		
	um c	of rest or uniform motion in a straight line as long as there is no		
	um c s	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the		
$\sum \vec{F} = 0$ at equilibri	um s	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body.		
$\sum \vec{F} = 0$ at equilibri	um c s r t Law 1	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is		
$\sum \vec{F} = 0$ at equilibri	um c s r t Law 7	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is lirectly proportional to the net force		
$\sum \vec{F} = 0$ at equilibri	um C S r t Law T	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely		
$\sum \vec{F} = 0$ at equilibri	um constant of the state of the	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is lirectly proportional to the net force acting on it and inversely proportional to its mass.		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma	um constant of the constant of	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma	um (c) s in the latest term (c) s in the lates	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma	um (c) s in the latest term (c) s in the lates	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma	um c s s r t t t t t t t t t t t t t t t t t	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third L	Law Taw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw I	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite orce on object A giving rise to Reaction/Normal Forces		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third L	Law Taw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw I	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is lirectly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite force on object A giving rise to Reaction/Normal Forces F _{vertical} Fr		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third L	Law Taw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw Iaw I	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite orce on object A giving rise to Reaction/Normal Forces		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third I Resolving forces $F_{\text{horizontal}} = F_{\text{r}} \cos F_{\text{vertical}} = F_{\text{r}} \sin \Theta$	aw I	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is lirectly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite force on object A giving rise to Reaction/Normal Forces F _{vertical} Fr		
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$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third L Resolving forces $F_{\text{horizontal}} = F_r \cos F_{\text{vertical}} = F_r \sin G$ Weight $\mathbf{W} = mg$	Law Aw Aw Aw Aw Aw Aw Aw Aw Aw	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite force on object A giving rise to the action/Normal Forces For every force object A giving rise to the action/Normal Forces Frentical Frequency Frequency Fermiontal Feight, Density We Weight m = mass g = gravitational field strength		
$\sum \vec{F} = 0$ at equilibri Newton's Second F = ma Newton's Third I Resolving forces $F_{\text{horizontal}} = F_r \cos F_{\text{vertical}} = F_r \sin \Theta$ Weight $\mathbf{w} = mg$	Law Law Aw Aw Aw Aw Aw Aw Aw Aw Aw	of rest or uniform motion in a straight line as long as there is no net force/moment acting on the body. The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. For every force object A acts on object B, object B will exert an equal and opposite force on object A giving rise to the action/Normal Forces For every force object A giving rise to the action/Normal Forces Frentical Frential F		
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Principle of Moment	For a body in rotational	
Σ Anticlockwise Moment	1 ,	
$=\Sigma$ Clockwise Moment	Sum of ACW Moment = sum of	
	CW Moment	
Pressure		
Pressure	P = Pressure	
$\mathbf{P} = \frac{\mathbf{F}}{\mathbf{F}}$	F = Force over area, A	
A A	A = Area	
Pressure of liquid	P = Pressure	
column	$\rho = density,$	
$\mathbf{P} = h\rho g$	h = height of liquid column	
	g = gravitational field strength.	
Energy,		
Work Done	W = work done	
$\mathbf{W} = \mathbf{Fd}$	F= force	
	d= distance in direction of force	
Power	Work done per unit time, t	
P = W/t = Fv Kinetic Energy	E - Kingtic Energy	
	E_k = Kinetic Energy m = mass	
$\mathbf{E_k} = \frac{1}{2} \text{mv}^2$	v = velocity	
Gravitational Potential	g = gravity = 9.81 m/s	
Energy	h = height	
$\mathbf{E_p} = \mathrm{mgh}$	m = mass	
Conservation of Energy	E ₁ = Total Energy Before	
$E_1 = E_2$	E_2 = Total Energy After	
	Energy cannot be created or	
	destroyed. It can only be	
	transformed or converted into other	
	forms.	
	•	
Kinetic	Model of Matter	
Ideal Gas Law	Model of Matter P = pressure of fixed mass of gas	
	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass	
Ideal Gas Law	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass of gas	
Ideal Gas Law PV ∞ T	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass of gas T = Temperature of gas	
Ideal Gas Law	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass of gas T = Temperature of gas Subscript 1 = initial state	
Ideal Gas Law PV ∞ T $P_1V_1 = P_2V_2$	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass of gas T = Temperature of gas Subscript 1 = initial state Subscript 2 = final state	
Ideal Gas Law $PV \infty T$ $P_1V_1 = P_2V_2$ Thermal P	Model of Matter P = pressure of fixed mass of gas V = volume occupies by fixed mass of gas T = Temperature of gas Subscript 1 = initial state Subscript 2 = final state Properties of Matter	
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'O' Level Physics Formula Sheet

Light		
Law of Reflection	Normal ,	
$\Theta_i = \Theta_r$		
	$\Theta_{\rm i}$ $\Theta_{\rm r}$	
Θ_{i} = angle of incidence	\\	
$\Theta_{\rm r}^{\rm =}$ angle of reflection		
Snell's Law (refraction)	Normal	
$n_1 Sin \Theta_i = n2 Sin \Theta_r$	Θ_i $n_1 = \text{refractive index 1}$	
Θ_i = angle of incidence	Θ_{r}	
$\Theta_{\rm r}$ = angle of refraction	$n_2 = refractive index 2$	
Critical angle	<u> </u>	
CINIONI MILGIO	Normal	
$\sin \mathbf{\Theta_c} = \frac{n_2}{n_1}$	$n_1 = \text{refractive index 1}$	
$\frac{\sin \Theta_c - \frac{1}{n_1}}{n_1}$	Θ_{c}	
	\5	
(special case of Snell's		
law where $\Theta_r = 90^\circ$)	$n_2 = \text{refractive index 2}$	
Refractive Index	c = speed of light in vacuum.	
$\mathbf{n} = \frac{c}{v}$	v = speed of light in medium	
V	Higher reflective index of a	
(n of air ≈ 1)	medium means light travel slower	
Magnification	in the medium	
	M = magnification h = height	
$\mathbf{M} = \frac{\mathbf{h_i}}{\mathbf{h_o}} = \frac{\mathbf{d_i}}{\mathbf{d_o}}$	d = distance from lens	
u_0	Subscript i = image	
	Subscript o = object	
Current of Electricity		
Current	Current = rate of flow of charges	
$\mathbf{I} = \mathbf{Q} / \Delta \mathbf{t}$	Q = Charge	
01 1 7	t=time	
Ohm's Law	V = voltage,	
Dogistance		
Resistance P - V / I	R = resistance	
$\mathbf{R} = \mathbf{V} / \mathbf{I}$	R = resistance I = current	
R = V / I Resistance of a wire	R = resistance I = current ρ = resistivity	
$\mathbf{R} = \mathbf{V} / \mathbf{I}$	R = resistance I = current	
$\begin{aligned} \mathbf{R} &= \mathbf{V} \ / \ \mathbf{I} \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L / A \end{aligned}$	$R = resistance$ $I = current$ $\rho = resistivity$ $L = length of wire$	
$\begin{aligned} \mathbf{R} &= \mathbf{V} \ / \ \mathbf{I} \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L / A \end{aligned}$	R = resistance I = current p = resistivity L = length of wire A = cross sectional area C. Circuits	
$R = V / I$ Resistance of a wire $R = \rho L / A$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges.	
$R = V / I$ Resistance of a wire $R = \rho L / A$ D. Kirchoff's 1 st Law	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline \textit{C. Circuits} \\ \hline Conservation of charges. \\ \sum I_{in} = Sum of current going into a junction \\ \hline$	
$R = V / I$ Resistance of a wire $R = \rho L / A$	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline \textbf{\textit{C. Circuits}} \\ Conservation of charges. \\ \sum I_{in} = Sum of current going into a junction \\ \sum I_{out} = Sum of current going out$	
$\begin{aligned} \mathbf{R} &= V \ / \ I \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L \ / A \end{aligned}$ $\qquad \qquad \qquad$	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline{\textbf{C. Circuits}} \\ \hline Conservation of charges. \\ \hline{\Sigma I_{in}} = Sum of current going into a junction \\ \hline{\Sigma I_{out}} = Sum of current going out of a junction \\ \hline$	
$R = V / I$ Resistance of a wire $R = \rho L / A$ D. Kirchoff's 1 st Law	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline{\textbf{C. Circuits}} \\ Conservation of charges. \\ \sum I_{in} = Sum of current going into a junction \\ \sum I_{out} = Sum of current going out of a junction \\ \sum V = Sum of potential difference V$	
$R = V / I$ $Resistance of a wire$ $R = \rho L / A$ $D.$ $Kirchoff's 1^{st} Law$ $\sum I_{in} = \sum I_{out}$ $Kirchoff's 2^{nd} Law$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V$ = Sum of potential difference V across all components in a circuit	
$R = V / I$ $Resistance of a wire$ $R = \rho L / A$ $D.$ $Kirchoff's 1^{st} Law$ $\sum I_{in} = \sum I_{out}$ $Kirchoff's 2^{nd} Law$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V$ = Sum of potential difference V across all components in a circuit E.M.F = Voltage supplied by the	
$R = V / I$ $Resistance of a wire$ $R = \rho L / A$ $D.$ $Kirchoff's 1^{st} Law$ $\sum I_{in} = \sum I_{out}$ $Kirchoff's 2^{nd} Law$ $\sum V = E. M. F$	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline{\textbf{C. Circuits}} \\ \hline{Conservation of charges.} \\ \hline{\sum I_{in} = Sum of current going into a junction} \\ \hline{\sum I_{out} = Sum of current going out of a junction} \\ \hline{\sum V = Sum of potential difference V across all components in a circuit } \\ \hline{E.M.F} = Voltage supplied by the power supply.}$	
$R = V / I$ $Resistance of a wire$ $R = \rho L / A$ $D.$ $Kirchoff's 1^{st} Law$ $\sum I_{in} = \sum I_{out}$ $Kirchoff's 2^{nd} Law$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V$ = Sum of potential difference V across all components in a circuit E.M.F = Voltage supplied by the	
$\begin{split} \textbf{R} &= V / I \\ \textbf{Resistance of a wire} \\ \textbf{R} &= \rho L / A \\ \hline & \textbf{\textit{D.}} \\ \textbf{Kirchoff's 1}^{st} \textbf{\textit{Law}} \\ \hline & \sum I_{in} = \sum I_{out} \\ \textbf{Kirchoff's 2}^{nd} \textbf{\textit{Law}} \\ \hline & \sum V = E. M. F \\ \textbf{Resistance in Series} \\ R_{total} &= R_1 + R_2 + R_3 \end{split}$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V = \text{Sum of potential difference V}$ across all components in a circuit E.M.F = Voltage supplied by the power supply.	
$R = V / I$ $Resistance of a wire$ $R = \rho L / A$ $D.$ $Kirchoff's 1^{st} Law$ $\sum I_{in} = \sum I_{out}$ $Kirchoff's 2^{nd} Law$ $\sum V = E. M. F$ $Resistance in Series$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in} = \text{Sum of current going into a junction}$ $\sum I_{out} = \text{Sum of current going out of a junction}$ $\sum V = \text{Sum of potential difference V across all components in a circuit E.M.F = Voltage supplied by the power supply.} I R1 R2 R3$	
$\begin{aligned} \mathbf{R} &= V / I \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L / A \end{aligned}$ $D.$ $\mathbf{Kirchoff's 1^{st} Law} \\ \sum I_{in} &= \sum I_{out} \\ \mathbf{Kirchoff's 2^{nd} Law} \\ \sum V &= E.M.F \\ \mathbf{Resistance in Series} \\ R_{total} &= R_1 + R_2 + R_3 \\ \mathbf{Resistance in Parallel} \end{aligned}$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V = \text{Sum of potential difference V}$ across all components in a circuit E.M.F = Voltage supplied by the power supply.	
$\begin{aligned} \mathbf{R} &= V / I \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L / A \end{aligned}$ $D.$ $\mathbf{Kirchoff's 1^{st} Law} \\ \sum I_{in} &= \sum I_{out} \\ \mathbf{Kirchoff's 2^{nd} Law} \\ \sum V &= E.M.F \\ \mathbf{Resistance in Series} \\ R_{total} &= R_1 + R_2 + R_3 \\ \mathbf{Resistance in Parallel} \end{aligned}$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in} = \text{Sum of current going into a junction}$ $\sum I_{out} = \text{Sum of current going out of a junction}$ $\sum V = \text{Sum of potential difference V across all components in a circuit E.M.F = Voltage supplied by the power supply.} I R1 R2 R3$	
$\begin{split} \textbf{R} &= V / I \\ \textbf{Resistance of a wire} \\ \textbf{R} &= \rho L / A \\ \hline & \textbf{\textit{D.}} \\ \textbf{Kirchoff's 1}^{st} \textbf{\textit{Law}} \\ \hline & \sum I_{in} = \sum I_{out} \\ \textbf{Kirchoff's 2}^{nd} \textbf{\textit{Law}} \\ \hline & \sum V = E. M. F \\ \textbf{Resistance in Series} \\ R_{total} &= R_1 + R_2 + R_3 \end{split}$	$R = resistance \\ I = current \\ \rho = resistivity \\ L = length of wire \\ A = cross sectional area \\ \hline{\textbf{C. Circuits}} \\ \hline{\textbf{Conservation of charges.}} \\ \hline{\textbf{S} I_{in}} = Sum of current going into a junction} \\ \hline{\textbf{\Sigma} I_{out}} = Sum of current going out of a junction} \\ \hline{\textbf{\Sigma} V} = Sum of potential difference V across all components in a circuit E.M.F = Voltage supplied by the power supply.} \\ \hline{\textbf{V}} \\ \hline{\textbf{R}_1} \\ \hline{\textbf{R}_2} \\ \hline{\textbf{R}_2} \\ \hline$	
$\begin{aligned} \mathbf{R} &= V \ / \ I \\ \mathbf{Resistance of a wire} \\ \mathbf{R} &= \rho L / A \end{aligned}$ $D.$ $\mathbf{Kirchoff's 1^{st} Law}$ $\sum I_{in} &= \sum I_{out}$ $\mathbf{Kirchoff's 2^{nd} Law}$ $\sum V &= E. M. F$ $\mathbf{Resistance in Series}$ $R_{total} &= R_1 \ + R_2 + R_3$ $\mathbf{Resistance in Parallel}$	R = resistance I = current ρ = resistivity L = length of wire A = cross sectional area C. Circuits Conservation of charges. $\sum I_{in}$ = Sum of current going into a junction $\sum I_{out}$ = Sum of current going out of a junction $\sum V = \text{Sum of potential difference V}$ across all components in a circuit E.M.F = Voltage supplied by the power supply.	

Practical Electricity		
Electric Power	P = Power	
	V = voltage	
$\mathbf{P} = \mathbf{V}\mathbf{I} = \mathbf{V}^2/\mathbf{R} = \mathbf{I}^2\mathbf{R}$	R = resistance	
	I = current	
Electrical Energy	E = energy output	
$\mathbf{E} = \mathbf{P}\mathbf{t} = (\mathbf{V}\mathbf{I})\mathbf{t}$	P = power	
	t = time	
	V = voltage	
	I = current	
Electromagnetism		
Transformer	V = voltage	
$\frac{V_p}{V_r} = \frac{N_p}{V_r}$	N = number of coils	
$\frac{s}{V_S} = \frac{s}{N_S}$	I = current	
(ideal transformer)	Subscript p = primary coil	
	Subscript s = secondary coil	
$\begin{aligned} \mathbf{V}_{P}\mathbf{I}_{P} &= \mathbf{V}_{s}\mathbf{I}_{s} \\ \textbf{Right hand grip} \end{aligned}$		
	current direction	
Fleming's Right Hand Rule	motion or force F magnetic field B	
Fleming's Left Hand Rule	reagnetic field 8	

