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Note Card Substitute

Write in the space below only.

Put your name on the back of the sheet.

GR 1

Circle
$A = \pi r^2$
$C = 2\pi r$

Sphere
$A = 4\pi r^2$
$V = \frac{4}{3}\pi r^3$

Constants
$Volts = \frac{J}{C}$
$J = \frac{kg\, m^2}{s^2}$
$N = \frac{kg\, m}{s^2}$

$G = 6.67 \times 10^{-11}\ Nm^2/kg^2$
$m_p = 1.67 \times 10^{-27} kg$
$m_e = 9.11 \times 10^{-31}\ kg$
$K = \frac{1}{4\pi \varepsilon_0} = 8.99 \times 10^9\ \frac{Nm^2}{c^2}$
$\varepsilon_0 = 8.85 \times 10^{-12}\ \frac{c^2}{Nm^2}$
$e = 1.60 \times 10^{-19}\ c$

nano 10^{-9}
micro 10^{-6}

Kinematics
$V_f = V_i + at$
$Y_f - Y_i = V_{oy}t + \frac{1}{2}a_y t^2$
$V_f^2 = v_i^2 + 2ad$
$d = \frac{1}{2}at^2 + V_i t$

Newton's Law of Gravitation
$\boxed{\vec{F_g} = \frac{-GMm}{r^2}}$

Coulombs Law
$\boxed{\vec{F}_{1\to 2} = \vec{F}_{2\to 1} = \frac{K|q_1||q_2|}{r^2}\hat{r}} = N$

$\vec{E} = \frac{\vec{F}}{q} = \frac{N}{c}$
electric field
↑ test or probe charge

$\boxed{\vec{E} = \frac{kq_1}{r^2}\hat{r}}$

$\vec{E}_{total} = \vec{E}_{1\to Test} + \vec{E}_{2\to test} + \vec{E}_{3\to test} \dots$

$\int dE = \int \frac{k\,dq}{r^2}$

$\vec{E}_{net_x} = r\cos\theta = \int \frac{k\,dq}{r^2}\cos\theta$

$r^2 = x^2 + y^2$
$\cos\theta = \frac{x}{r}$

$\lambda = \frac{Q}{L} = \frac{dq}{dy}$
charge density

$\boxed{dq = \lambda\, dy}$

Capacitors
$\boxed{E_{cap.} = \frac{Q}{\varepsilon_0 A}}$ ← amount of charge (c)
= N/C
← Area of plate (m^2)

$F = ma$

$\boxed{a = \frac{q\vec{E}}{m}}$
For a charged particle in a uniform electric field

Gauss's Law (Flux)
$\boxed{\Phi_E = \vec{E} \cdot \vec{A}} = \frac{Nm^2}{c}$

$\boxed{\Phi_E = \vec{E} \cdot \vec{A} = EA\cos\theta = \frac{q_{enclosed}}{\varepsilon_0}}$

Flux into surface = −
out of = +

$\boxed{\Phi_E = EA = \frac{q_{encl.}}{\varepsilon_0}}$

$q_{encl.} = \lambda_{encl.}\,\ell = \eta_{encl.}\,A = \rho_{encl.}\,V$

$\lambda = \frac{q}{\ell}$
$\eta = \frac{q}{A}$
$\rho = \frac{q}{V}$

$E_{sphere} = \frac{q_{inside}}{4\pi r^2 \varepsilon_0} = \frac{kq}{r^2}$

$E_{wire} = \frac{\lambda}{\varepsilon_0\, 2\pi r}$

$E_{plane} = \frac{\eta}{2\varepsilon_0}$

uncertainty in Lab
$\delta = \frac{E_{max} - E_{min}}{2}$

$E_{best} \pm \delta$