Physics Formulae

1. Vectors
    - Seperating Vectors $\overrightarrow{A} + \overrightarrow{B} = \overrightarrow{A_x} + \overrightarrow{B_x} + \overrightarrow{A_y} + \overrightarrow{B_y}$
    - Unit vectors $\frac{\overrightarrow{A}}{|\overrightarrow{A}|}$
    - Cross Product $\overrightarrow{A} \times \overrightarrow{B} = |\overrightarrow{A}| \times |\overrightarrow{B}| sin(\theta)$
    - Scalar product $\overrightarrow{A} \cdot \overrightarrow{B} = |\overrightarrow{A}| \times |\overrightarrow{B}| cos(\theta) = A_1B_1 + A_2B_2 + ...A_nB_n$
2. Displacement Velocity and Acceleration
    - $s = \int v(t)dt$
    - $v = \frac{d(s(t))}{dt}$ or $\int a(t)dt$
    - $a = \frac{d(v(t))}{dt}$
    - $v = u + at$
    - $s = \frac{1}{2}(u + v)t$
    - $s = ut + \frac{1}{2}at^2$
    - $v^2 = u^2 + 2as$
3. Moment of Inertia
    - $I = ml^2$ for a point at distance l from axis
    - $I = \int_0^M r^2 dm$
    - For rod mass M with axis perpendicular to longest side length L
        - through center $I = \frac{1}{12}ML^2$
        - through one end $I = \frac{1}{3}ML^2$
    - For rectangular plate axis a long, b wide
        - $\perp$, center of larger side $I = \frac{1}{12}M(a^2 + b^2)$
        - Along edge of longer side $I = \frac{1}{3}Ma^2$
    - For Cylinder R
        - Solid cylinder $I = \frac{1}{2}MR^2$
        - Tube inner radius R_1, $I = \frac{1}{2}M(R^2 + R_1^2)$
        - $R - R1$ neglectable $I = MR^2$
    - Sphere with R
        - solid $I = \frac{2}{5}MR^2$
        - hollow $I = \frac{2}{3}MR^2$
4. Inertia Changing Axis
    - Parallelly shifted d $I = I + Md^2$
    - Perpendicular $I = \frac{1}{2}I$
5. Circular Motion
    - Acceleration(a and α) $a = \frac{v^2}{r} = r\omega^2 = \alpha r$
    - Period $T = \frac{2\pi}{\omega}$
6. Newtons's Laws
    - $F = ma$
    - $F = \frac{\Delta P}{\Delta t}$
7. Moment
    - $T = Fd$
    - $T = I\alpha$

8. Momentum & Impulse
    - $p = mv$
    - $J = Ft$
    - $J = \int_{t_1}^{t_2} \sum \overrightarrow{F} dt$
9. Friction
    - Limiting $f = \mu R$
10. Gravity
    - $F = -\frac{GMm}{r^2}$
    - $\phi = -\frac{Gm}{r}$
11. Charge
    - $V = \frac{Q}{4\pi\varepsilon_0 r}$
12. Gas
    - Work done $W = p\Delta V$
    - Hydrostatic Pressure $p = \rho gh$
13. SHM
    - $a = -\omega^2 x$
    - $v = v_0 cos(\omega t)$
    - $v = \pm\omega(x_0^2 - x^2)$
14. Doppler Effect
    - $f_0 = \frac{f_s v}{v \pm v_s}$
15. Capacitor
    - Series $\frac{1}{C} = \sum_1^n \frac{1}{C_n}$
    - Parallel $C = \sum_1^n C_n$
16. Resistors - Series $R = \sum_1^n R_n$ - Parallel $\frac{1}{R} = \sum_1^n \frac{1}{R_n}$
17. Hall Voltage
    - $V_h = \frac{BI}{ntq}$
18. Energy
    - Gravitational mgh
    - Kinetic $\frac{1}{2}mv^2$
    - Spring $\frac{1}{2}kx^2$
    - Rotational $\frac{1}{2}I\omega^2$
    - Work done $w = \int F(x)dx$
    - Power $P = \frac{\Delta W}{\Delta t}$
    - Power for Constant Speed $P = FV$
19. Rotational Bodies Angular Velocity and Acceleration
    - Displacement $s = r\theta$
    - Velocity $\omega = rv = \frac{\Delta\theta}{\Delta t}$
    - Acceleration $\alpha = ar = \frac{\Delta\omega}{\Delta t}$
20. Elasticity
    - strain $\varepsilon = \frac{x}{L}$
    - stress $\sigma = \frac{F}{A}$
    - Young Modulus $Y = \frac{\sigma}{\varepsilon}$
    - $T = \frac{\lambda x}{l}$
    - $E = \frac{\lambda x^2}{2l}$