Physics laws and formulae (O level)

This list is a list of physics laws and formulae used in O level physics.

Kinematics

- $average\ speed = \frac{total\ distance\ moved}{time\ taken}$
- $velocity = \frac{distance\ moved\ in\ a\ specified\ direction}{time\ taken}$
- $velocity = \frac{displacement}{time\ taken}$
- $acceleration = \frac{change\ in\ velocity}{time\ taken}$

Equations of motion with constant acceleration

- $v = u + at$
- $s = \frac{(u+v)t}{2}$
- $s = ut + \frac{1}{2}at^2$
- $v^2 = u^2 + 2as$

Density

- $\rho = \frac{m}{V}$

Hooke's law

- Hooke's law - that the extension was of a material is proportional to the stretching force provided the material is not permanently stretched.
- $F = ke$

Forces

- Parallelogram law - If two forces acting at a point are represented in size and direction by the sides of a parallelogram, their resultant is represented in size and direction by the diagonal of the parallelogram drawn at that point.
- Newton's first law of motion - A body stays in its state of rest or uniform velocity unless acted upon by an external force.

- Newton's second law of motion - The acceleration of a body is directly proportional to the resultant force acting on it.
- Newton's third law of motion - To every action there is an equal and opposite reaction.
- $F = ma$
- $W = mg$

Circular motion

- $F = \frac{mv^2}{r}$

Moments

- Law of moments - When a body is in equilibrium the sum of the clockwise moments about any point is equal to the sum of the anticlockwise moments about the same point.
- moment of a force = force × perpendicular distance of the line of action of the force from the pivot

Momentum

- $momentum = mass \times velocity$

Work, energy and power

- Law of conservation of energy - energy can neither be created nor destroyed but can be converted from one form to another.
- $work\ done = force \times distance\ moved\ in\ the\ direction\ of\ the\ force$
- $power = \frac{work\ done}{time\ taken}$
- $power = \frac{energy\ transfered}{time\ taken}$
- $efficiency = \frac{useful\ energy\ output}{total\ energy\ input} \times 100$
- $efficiency = \frac{work\ done\ on\ load}{work\ done\ by\ effort} \times 100$
- $Kinetic\ energy = \frac{1}{2}mv^2$
- $Potential\ energy = mgh$

Pressure

- $Pressure = \frac{force}{area}$
- $Liquid\ pressure = \rho gh$

Gas Laws

- Boyle's law - The pressure of a fixed mass of gas is inversely proportional to its volume if its temperature is kept constant.
- Charles's law - The volume of a fixed mass of gas is directly proportional to its absolute temperature if the pressure is kept constant.
- Pressure law - The pressure of a fixed mass of gas is directly proportional to its absolute temperature if the volume is kept constant.
- $\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$

Thermal Physics

- $Q = mc\Delta\theta$
- $Q = ml$

Waves and optics

- Law of reflection - The angle of incidence is equal to the angle of reflection.
- $v = f\lambda$
- $f = \frac{1}{T}$
- $refractive\ index = \frac{speed\ of\ light\ in\ vacuum}{speed\ of\ light\ in\ medium}$
- $n = \frac{\sin i}{\sin r}$

Magnetism

- Law of magnetic attraction - Like poles repel, unlike poles attract.

Electricity

- Law of electrostatic attraction - Like charges repel, unlike charges attract.
- Ohm's law - The current in an ohmic conductor is directly proportional to the p.d. across its ends if the temperature is kept constant.
- $Q = It$

- $E = QV$
- $E = ItV$
- $V = IR$
- $R = \frac{\rho l}{A}$
- $P = IV$
- $P = \frac{V^2}{R}$
- $P = I^2R$

Resistors in series

- $R_{total} = R_1 + R_2 + R_3$

Resistors in parallel

- $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Electromagnetism

- Faraday's law - The size of the induced p.d. is directly proportional to the rate at which the conductor cuts magnetic field lines.
- Lenz law - The direction of the induced current is such as to oppose the change causing it.

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