Newton's Laws

1. A body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force. (Things don't move on their own, bodies are lazy)
2. When a body is acted upon by a force, the time rate of change of its momentum equals the force. ($F = ma$)
3. If two bodies exert forces on each other, these forces have the same magnitude but opposite directions. (If I push a thing that won't budge, it pushes back at me with the same magnitude, but opposite direction)

Gravity and Normal Forces

The force of gravity is given as $F = mg$. $g = 9.82$ in Sweden.

Normal forces are always perpendicular to the ground. On a level plane at rest this is equal to the force of gravity. These are *not* counter forces according to Newton's 3rd law, since they act only on one object, not two separate ones.

Friction

$$F_f = \mu \times F_N$$

Where F_f is the force of friction, μ is the coefficient of friction, and F_N is the normal force.

Motion Formulae

$$\Delta s = v \times \Delta t$$

$$\Delta v = a \times \Delta t$$

$$\Delta s = v_0 t + \frac{at^2}{2}$$

$$2 \times a \times \Delta s = v_1^2 - v_0^2$$

Where Δs is change in position, Δt is change in time, Δv is change in velocity, a is acceleration, v is velocity, t is time, s is position, g is $9.82 m/s^2$ (in Sweden).

Energy

$$W = F_{res} \times \Delta S$$

$$\Delta E = W$$

$$E_p = mgh$$

$$E_k = \frac{m \times v^2}{2}$$

$$P = \frac{\Delta E}{\Delta t}$$

$$\eta = \frac{\Delta E_{useful}}{\Delta E_{total}} = \frac{P_{useful}}{P_{total}}$$

$$p = m \times v$$

$$F\Delta t = \Delta p = mv_2 - mv_1$$

Where E is energy (J), P is power (W), η is efficieny, p is momentum (kgm/s), Δp is impulse (kgm/s) and W is work (Nm)

Energy Principle

Energy is always conserved, it is the same both before and after an event.

Conservation of Momentum

The sum of the momentum before and after a collsion always equal.

$$p_{a1} + p_{b1} = p_{a2} + p_{b2}$$

Pressure

Liquids

$$p = \rho g h$$

Where p is the pressure, ρ is the density of the liquid (), g is the force downwards (In physics 1, $g = 9.82$), and h is the depth.

$$F_{lyft} = \rho g V$$

Where F_{lyft} is the force of lift, ρ is the density of the liquid (or gas), V is the volume of the submerged object, and g is the force downwards (In physics 1, $g = 9.82$).

Ideal Gas Law

$$Pv = \eta RT$$

Where P is pressure in Pa, v is volume in m^3, η is number of moles, R is rate constant $R = 8.31451 J/molK$, and T is temperature (Kelvin).

Heat

$$Q = cm\Delta T$$

Q is ΔE, c is specific heat capacity (4180 $K/kg \times K$ for water), m is mass and ΔT is change in temp (Either C or K).

$$Q = lm$$

Q is ΔE, l is the energy required for one unit of mass to undergo the phase transition, and m is the mass.

Constants for water

$l = 2260000$ J/kg for boiling/condensation
$l = 330000$ J/kg for freezing/melting

Hot thing cold thing question

$-\Delta E_{thing1} = \Delta E_{thing2}$