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IGCSE PHYSICS DEFINITION - 0625 -

BY MR DESMOND

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Important Equations in Physics for IGCSE course

General physics:

1. For constant motion

$$V = \frac{S}{t}$$

'v' is the velocity in m/s , 's' is the distance or displacement in meters and 't' is the time in seconds.

2. For acceleration 'a'

$$a = \frac{v - u}{t}$$

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u is the initial velocity, v is the final velocity and t is the time.

3. Graph

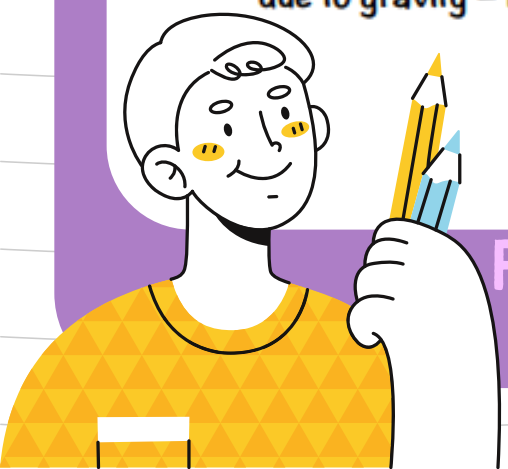
Area of a rectangular shaped graph = base x height
Area of a triangular shaped graph = ½ x base x height

In velocity-time graph the area under the graph is the total distance covered by an object.

4. Weight and mass

$$W = m \times g$$

w is the weight in Newton (N) , m is the mass in kg and g is acceleration due to gravity = 10 m/s.



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5. Density 'ρ' in kg/m³

$$\rho = \frac{m}{v}$$

✏ m is the mass and v is the volume.

6. Force F in Newton (N)

$$F = m \times a$$

✏ m is the mass and a is the acceleration.

7. Terminal velocity

Weight of an object (downwards) = air resistance (upwards)

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8. Hooke's Law

$$F = k \times x$$

✏ F is the force, x is the extension in meters and k is the spring constant.

9. Moment of a force in Nm

$$\text{moment of force} = F \times d$$

✏ F is the force and d is the distance from the pivot.

10. Law of moment or equilibrium

$$\text{Total clockwise moment} = \text{Total anticlockwise moment}$$

$$F_1 \times d_1 = F_2 \times d_2$$

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11. Work done (W) joules (J)

$$W = F \times d$$

F is the force and d is the distance covered by an object.

12. Kinetic energy Ek in joules (J)

$$E_k = \frac{1}{2} \times m \times v^2$$

m is the mass (kg) and v is the velocity (m/s).

13. Potential energy Ep in joules (J)

$$E_p = m \times g \times h$$

m is the mass (kg) and g is the acceleration due to gravity and h is the height from the ground .

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14. Law of conservation of energy

$$\text{Loss of } E_p = \text{gain of } E_k$$

$$m \times g \times h = \frac{1}{2} \times m \times v^2$$

15. Power in watts (W)

$$P = \frac{\text{work done}}{\text{time taken}} \quad ; \quad P = \frac{\text{energy transfer}}{\text{time taken}}$$

Power is the rate of doing work.

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16. Pressure I'm pascal (Pa)

$$P = \frac{F}{A}$$

F is the force in Newton (N) and A is the area in m^3.

17. Pressure p due to liquid

$$P = p \times g \times h$$

p is the density in kg/m^3, g is the acceleration due to gravity and h is the height or depth of liquid in meters.

18. Atmospheric pressure

$P = 760\ mmHg = 76\ cm\ Hg = 1.01 \times 10^5\ Pa$

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Thermal physics:

1. Pressure and volume relationship (Boyle's law)

$$PV = \text{constant}$$

$$P_1 \times V_1 = P_2 \times V_2$$

p_1 and p_2 are the two pressure in Pa and V_1 and V_2 are the two volumes in m^3.

2. Thermal Expansion (Linear)

$$\Delta L = a \times L_o \times \Delta\theta$$

L_o is the original length in meters, $\Delta\theta$ is the change in temperature in °c , ΔL is the change in length in meters ($L_1 - L_o$) and a is the linear expansivity of the material.

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3. Thermal Expansion (Cubical)

$$\Delta V = \gamma V_o \Delta\theta$$

L_o is the original length in meters, $\Delta\theta$ is the change in temperature in °c , ΔL is the change in length in meters ($L_1 - L_o$) and a is the linear expansivity of the material.

4. Relationship between linear and cubical expansivities

$$\gamma = 3a$$

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5. Charle's Law : Volume is directly proportional to absolute temperature $V \propto T$

$$\frac{V}{T} = \text{constant} \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

✏ V is the volume in m^3 and T is the temperature in Kelvin (K).

6. Pressure Law: Pressure of a gas is directly proportional to the absolute temperature $p \propto T$.

$$\frac{P}{T} = \text{constant} \qquad \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

✏ p is the pressure in Pa and T is the temperature in kelvin (K).

7. Gas Law : $\frac{pV}{T} = \text{constant}$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

✏ In thermal physics the symbol θ is used of Celsius scale and T is used for Kelvin scale.

8. Specific heat capacity : The amount of heat required to raise the temperature of 1 kg mass by 1°C.

$$C = \frac{Q}{m \times \Delta\theta}$$

✏ c is the specific heat capacity in J/kg°C , Q is the total heat in joules m is the mass in kg and $\Delta\theta$ is the change in temperature .

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9. Thermal capacity: amount of heat require to raise the Tempe of a substance of any mass by 1 °C

$$\text{Thermal capacity} = m \times c$$

$$\text{Thermal capacity} = \frac{Q}{\Delta\theta}$$

✏ The unit of thermal capacity is J/°C.

10. Specific latent heat of fusion (from ice to liquid)

$$L_f = \frac{Q}{m}$$

✏ L_f is the specific latent heat of fusion in J/kg or J/g, Q is the total heat i in joules (J), m is the mass of liquid change from ice in kg or g.

11. Specific latent heat of vaporisation (from liquid to vapour)

$$L_v = \frac{Q}{m}$$

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✏ L_v is the specific latent heat of vaporisation in J/kg or J/g, Q is the total latent heat in joules (J), m is the mass of vapour change from liquid in kg or g.

13. Thermal or heat transfer

In solid = conduction
In liquid and gas = convection and also convection current
In vacuum = radiation

14. Emitters and Radiators

Dull black surface = good emitter, good radiator, bad reflector
Bright shiny surface = poor emitter , poor radiator , good reflector

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Wave, light and sound:

1. Wave equation 1

$$V = f \times \lambda$$

v is the speed of wave in m/s , f is the frequency in Hz , λ is the wavelength in meters.

2. Wave equation 2

$$f = \frac{1}{T}$$

T is the time period of wave in seconds.

3. Movement of the particles of the medium

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Longitudinal waves = back and forth in the direction of the waves
Transverse waves = perpendicular to the direction of the waves

4. Law of reflection

Angle of incidence i = angle of reflection
angle i° = angle r°

5. Refraction

From lighter to denser medium ➡ light bend towards the normal
From denser to lighter medium ➡ light bend away from the normal

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6. Refractive index n

$$n = \frac{\sin \angle i}{\sin \angle r}$$

✏️ Refractive index has no unit.

7. Refractive index n

$$n = \frac{\text{Speed of light in air or vacuum}}{\text{Speed of light in any other medium}}$$

8. Image from a plane mirror

Virtual, upright, same size and laterally inverted, same distance from the mirror inside.

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9. Image from a convex lens

When close: virtual , enlarge, upright
When far: real, small, upside down

10. Image from a concave lens

Virtual , upright , small

11. Critical angle

When light goes from denser to lighter medium, the incident angle at which the reflected angle is 90°, is called critical angle.

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12. Total internal reflection (TIR)

When light goes from denser to lighter medium, the refracted ray bend inside the same medium then this is called (TIR).

13. Electromagnetic spectrum

Gamma rays ➡ X-ray ➡ UV ➡ Visible light ➡ IR ➡ Micro waves ➡ Radio waves

✏ ➡ this way the frequency decreases and wavelength increases.

14. Colour of visible spectrum (light)

VIBGYOR (from bottom-up)

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15. Speed of light

In air : 3×10^8 m/s
In glass : 2×10^8 m/s

16. Light wave

Electromagnetic waves

17. Sound wave

Particle of the medium come close ➡ compression
Particle of the medium far apart ➡ rarefaction

✏ Longitudinal waves

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18. Echo

$$V = \frac{2 \times d}{t}$$

v is the speed of sound waves, d is the distance in meters between source and the reflection surface and t is the time for echo.

19. Properties of sound waves

Pitch means the frequency of the wave
Loudness means the amplitude of the wave

20. Speed of sound waves

Air : 330-340 m/s
Water : 1400 m/s
Concrete : 5000 m/s
Steel : 6000-7000 m/s

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Electricity and magnetism:

1. Ferrous materials

Attracted by magnet and can be magnetized

- Eg : iron, steel, nickel and cobalt.

2. Non- ferrous materials

Not attracted by magnet and cannot be magnetized

- Eg : copper, silver, aluminium, wood, glass.

3. Electric field intensity

Force exerted by the field on a unit charge placed at a point around another charge

- E is the electric field intensity in N/C. $E = \frac{F}{q}$

4. Current: Rate of flow of charges in a conductor

$$I = \frac{Q}{t}$$

- I is the current in amperes (A), Q is the charge in coulombs (C), t is the time in seconds (s).

5. Current

In circuits the current always choose the easiest path

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6. Ohms law

Voltage across the resistor is directly proportional to current, $V \propto I$ or

$$\frac{V}{I} = R$$

✏ V is the voltage in volts (V), I is the current in amperes (A) and R is resistance in ohms (Ω).

7. Voltage

Energy per unit charge $V = \frac{\text{energy}}{Q}$

✏ Q is the charge in coulombs (C), V is the voltage in volts (V), energy in joules (J).

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8. E.M.F. Electromotive force

e.m.f = lost volts + terminal potential difference
E.M.F = Ir + IR

9. Resistance and resistivity

$$R = \rho \frac{L}{A}$$

✏ p is the resistivity of resistor in Ω, R is the resistance of a resistor, L is the length of a resistor in meters, A is the area of cross-section of a resistor in m^2.

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10. Circuit

In series circuit ➡ the current stays the same and voltage divides

In parallel circuit ➡ the voltage stays the same and current divides

11. Resistance in series

$$R = R_1 + R_2 + R_3$$

12. Resistance in parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

✏ R, R_1, R_2 and R_3 are resistances of resistor in ohms.

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13. Potential divider

$$\frac{V_1}{V_2} = \frac{R_1}{R_2}$$

14. Potential divider

$$V_2 = \left(\frac{R_2}{R_1 + R_2}\right) \times V \qquad V_1 = \left(\frac{R_1}{R_1 + R_2}\right) \times V$$

15. Power

$$P = I \times V \qquad P = I^2 \times R \qquad P = \frac{V^2}{R}$$

✏ P is the power in watts (W).

16. Power

$$P = \frac{\text{Energy}}{\text{time}}$$

✏️ The unit of energy is joules (J).

17. Transformer

$$\frac{V_P}{V_S} = \frac{n_P}{n_S}$$

✏️ Vp is the voltage in primary coil, Vs is the voltage in secondary coil, np is the no of turns in primary and ns is the no of turns in secondary.

18. Transformer

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Power of primary coil = power of secondary coil

$$P_P = P_S$$

$$I_P \times V_P = I_S \times V_S$$

$$\frac{V_P}{V_S} = \frac{I_S}{I_P}$$

✏️ Ip is the current in primary coil and Is is the current in secondary coil.

19. Cathode rays

Stream of electrons emitted from geared metal (cathode). This process is called thermionic emission.

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Atomic Physics:

1. Alpha-particles α - particles

Helium nucleus
Stopped by paper
Highest ionization potential

2. Beta-particles β- particles

Fast moving electrons
Stopped by aluminium
Less ionization potential

3. Gamma-particles γ - rays

Electromagnetic radiation
Only stopped by thick sheet of lead
Least ionization potential

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4. Half life

Time in which the activity or mass becomes half

5. Atomic symbol

$${}^{A}_{Z}X$$

✏️ A is the total no of protons and neutrons , Z is the total no of protons.

6. Isotopes

Same number of protons but different number of neutrons.

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