PHYSICS

Measurements

SI units :

Mass – kg

Length – m

Time – s

Current – A

Temperature – K

Amount of substance – mol

nano ⇒ 10^{-9} n

micro ⇒ 10^{-6} μ

milli ⇒ 10^{-3}

centi ⇒ 10^{-2}

deci ⇒ 10^{-1}

kilo ⇒ 10^{3}

mega ⇒ 10^{6}

giga ⇒ 10^{9}

★ if vectors to be added are clockwise, the resultant vector must be anti-clockwise or vice versa

Kinematics :

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

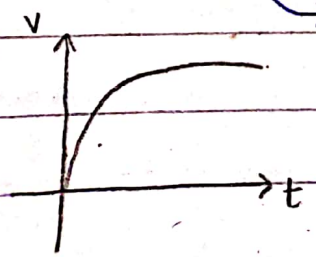
$$\text{acceleration} = \frac{\text{velocity}}{\text{time}}$$

acceleration = slope of velocity time graph

velocity = slope of displacement time graph

terminal velocity : air resistance = weight, acceleration = 0

→ object travels at constant velocity



PHYSICS

Dynamics :

Newtons I law : object will stay at rest or constant motion until a force acts on it

Newton II law : force = mass x acceleration

Newton III law : every action has an equal and opposite reaction

* balanced forces allow object to stay at rest or in constant motion
* unbalanced forces will cause it to accelerate or decelerate
* resultant force is zero when object is travelling at constant speed

Mass, Weight and Density :

$$\text{mass} = \frac{\text{force}}{\text{acceleration}} = \text{density} \times \text{volume} = \frac{\text{weight}}{g \cdot f \cdot s}$$

weight = mass x gravitational field strength
(N)

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$
(g/cm^3)

Turning effect of forces :

moment of force = force x distance

Principle of moments : $F_1 \times d_1 = F_2 \times d_2$

PHYSI

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mation

force = spring constant x extension / compression

Pressure :

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

pressure in liquids = ρgh
= density x g.f.s x depth of liquid

Pascal's principle : $\frac{F_x}{A_x} = \frac{F_y}{A_y}$

gas pressure =

Boyle's law : $P_1V_1 = P_2V_2$

Energy sources & Transfer of Thermal Energy :

work done = force x distance (energy is ability to do work)
(J)

power = $\frac{\text{work done}}{\text{time}}$ (rate of doing work)

kinetic energy = $\frac{mv^2}{2}$ mass in kg, velocity m/s
(mass, velocity)

gravitational potential energy = mgh

$E = mc^2$

↓ energy ↓ speed of light = 3×10^8 m/s

$$\text{efficiency} = \frac{\text{energy/power output}}{\text{energy/power input}} \times 100$$

$$\text{Power} = \frac{\text{work done}}{\text{time}}$$

$$\text{elastic potential energy} = \frac{ke^2}{2}$$

Temperature:

$$\theta = \frac{L_\theta - L_0}{L_{100} - L_0} \times 100$$

L_0 ⇒ length of mercury at ice point

L_{100} ⇒ length of " " steam point

L_θ ⇒ length of mercury at unknown temperature

$$\text{sensitivity} = \frac{\Delta \text{ increase in mercury level}}{\Delta\theta \text{ " in temperature}}$$

mal Properties of Matter.

heat capacity = $\frac{Q}{\theta}$ → energy supplied
(J/K)(J/°C) → increase in temperature

heat energy required to raise 1°C temperature of a substance

specific heat capacity = $\frac{Q}{m\theta}$
(J/kgK) (J/kg°C) ↓ mass of substance

heat energy required to raise the temperature of 1kg of a substance by 1°C

$Q = ml$ (J/kg)

Q → energy supplied
m → mass of substance that has changed state
l → latent heat

General Wave properties

velocity = frequency × wavelength

$v = f \times \lambda$ (lamba)

$\text{frequency} = \frac{1}{T}$

Light

$\text{refractive index } (n) = \frac{\sin i}{\sin r} = \frac{c}{v} = \frac{\text{real depth}}{\text{apparent depth}}$

c: speed of light in air; v: speed of light in vaccum

$C = \sin^{-1}\left(\frac{1}{n}\right)$

C: critical angle

Electromagnectic Spectrum

Radiowaves	:	10^4	: television, radio
Microwaves	:	10^6	: satellites
Infra-red	:	10^9	: remote control devices + grills/toasters
Visible light	:	10^{12}	: optic fibres for transmission of signals
UV rays	:	10^{15}	: sun-beds, sterilize medical equipment (+ flourescence tubes)
X-rays	:	10^{17}	: 2-dimensional image in medicine + scanners
Gamma ray	:	10^{20}	: to kill cancerous cells + tumors, cracks in metals

Sound:

↑ pitch = ↑ frequency

↑ amplitude = ↑ loud

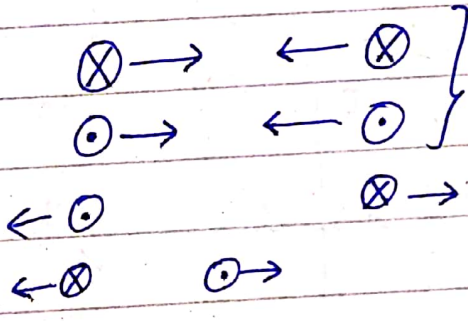
solid > liquid > gas

speed of sound in air = 300 m/s

Electromagnetism

Right hand grip rule ⇒ direction of current

⊙ ⊗ : out of the ~~page~~ wire ⊗ : into the wire



Flemming's left Hand rule: m.f ⇒ first finger

thumb ⇒ force

s.f ⇒ direction of current

split ring commutators in D.C motors

slip ring in A.C Generator

Current Electricity

$$1V = \frac{1J}{1C}$$

current = $\frac{\text{charge}}{\text{time}}$ (Amperes)

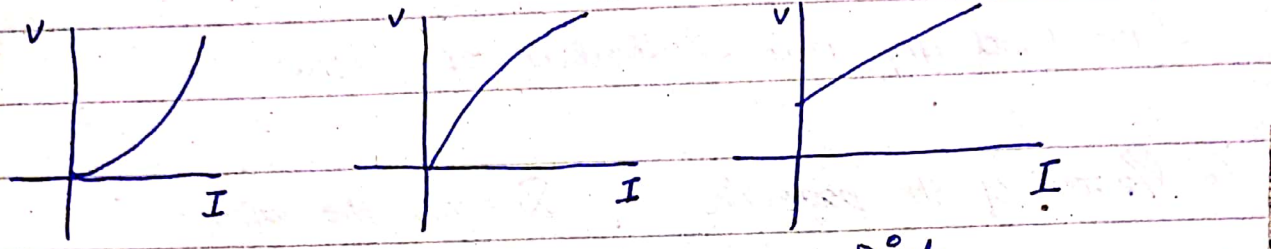
voltage = $\frac{\text{energy}}{\text{charge}} = \frac{\text{work done}}{\text{charge}}$ (Volts)

$$1A = \frac{1C}{1s}$$

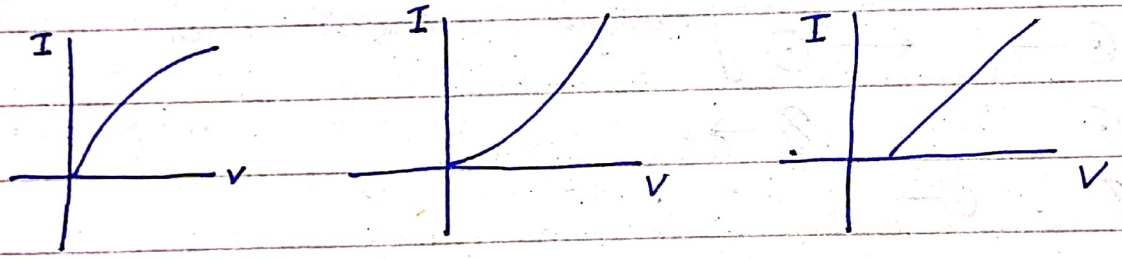
V = J/coulomb

$$V = IR$$

resistance = $\frac{\text{voltage}}{\text{current}}$ (ohms)



Filament lamp Thermistor Diode



F.L

Series combination (Resistors):

$$I_1 = I_2 = I_3$$

$$V = V_1 + V_2 + V_3$$

$$R_s = R_1 + R_2 + R_3$$

Parallel Combination:

$$I = I_1 + I_2 + I_3$$

$$V_1 = V_2 = V_3$$

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

$\mathcal{E} = Pt \quad \mathcal{E} = IVt \quad \mathcal{E} = I^2Rt \quad$ (Joules)

Power = VI (Watts)

emf / p.d $\Rightarrow$ voltage

Series (cells) : $E = E_1 + E_2 + E_3$

Parallel (cells) : $E_1 = E_2 = E_3$

* if one fails, others keep working
* lasts longer
* ↓ resistance
* ↓ energy loss

Energy = Power (time)

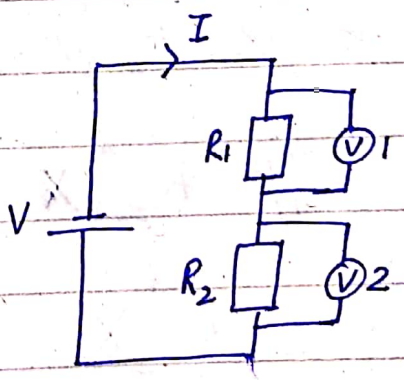
Joules = Watts × seconds

KiloWatthour = ~~Watts~~ KiloWatt × seconds

Electronics:

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

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



Radioactivity

Unstable Nuclei →

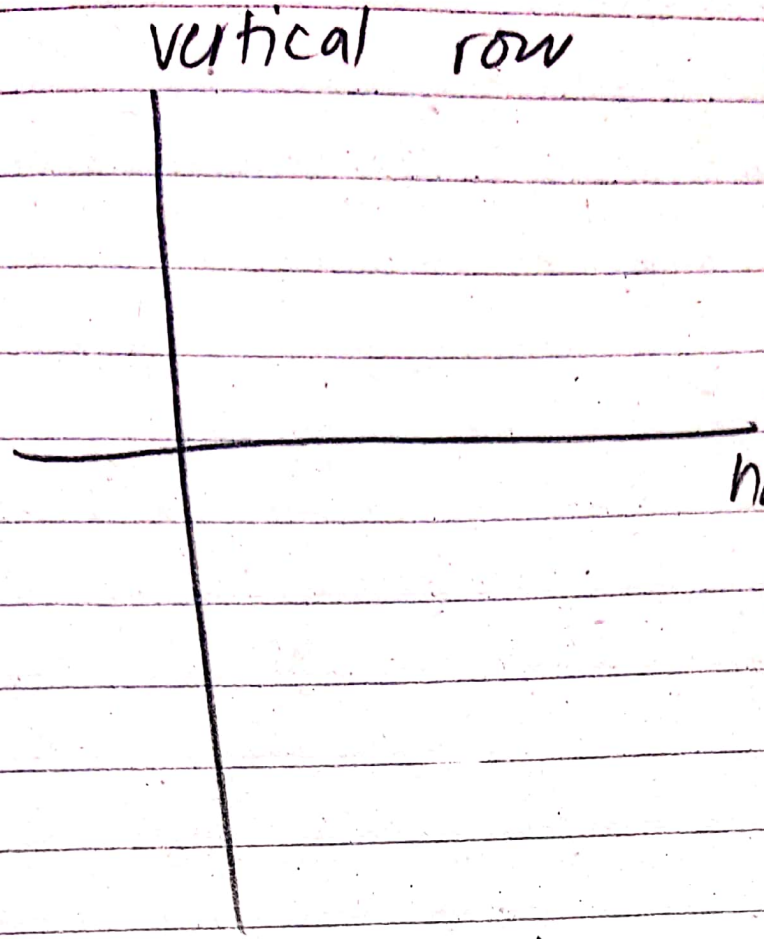
- α^{4}_{2} particles (helium nucleus) (lesser)
  - ↑ mass = ↑ ionization power ↓ penetration
  - stopped by paper (10% c) ⇒ speed 8-10cm
  - deflects in electric & (lesser) magnetic fields
- β^{0}_{-1} particles (electrons)
  - ionization power less than α
  - penetration ↑ than α
  - stopped by 10cm - 100cm aluminum
  - (90% c) ⇒ speed
  - deflects in electric & (most deflection) magnetic field
- γ & λ rays (electromagnetic wave)
  - no charge = no mass
  - won't deflect b/c no charge (none)
  - stopped by lead block
  - greatest penetration power
  - no ionization power
  - $c = 3 \times 10^{8}\ m/s$

$$ {}^{A}_{Z}X = {}^{A+}_{2}\alpha + {}^{A-4}_{Z-2}Y $$

$$ {}^{A}_{Z}X = {}^{0}_{-1}\beta + {}^{A}_{Z+1}X $$

$$ {}^{A}_{Z}X = \lambda + {}^{A}_{Z}X $$

⇒ in every half life, the no. of atoms, the mass & the activity halves



m.p b.p scale

periscope image properties

d/t & s/t graph comparison