Amazing

PHYSICS FORMULA

KBSM + KSSM

DREAM BIG
AIM HIGH
NEVER GIVE UP

alinaimanarif

CHAPTER 2

FORCE & MOTION

EQUATIONS OF MOTION

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{(u + v)}{2}t$$

$$v^2 = u^2 + 2as$$

SPEED / VELOCITY: $v = \frac{s}{t}$

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

MOMENTUM: $p = mv$

ELASTIC COLLISION:

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

INELASTIC COLLISION:

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

FORCE:

$$F = ma$$

IMPULSIVE FORCE:

$$F = \frac{m(v - u)}{t}$$

IMPULSE:

$$Ft = mv - mu$$

WEIGHT:

$$W = mg$$

CHAPTER 2

FORCE & MOTION

WORK DONE / ENERGY: $W = Fs$

POWER: $P = \frac{W}{t} = \frac{E}{t}$

KINETIC ENERGY: $E_k = \frac{1}{2}mv^2$

HOOKE'S LAW:

$F = kx$

SPRING CONSTANT:

$k = \frac{F}{x}$

GRAVITATIONAL POTENTIAL ENERGY: $E_p = mgh$

EFFICIENCY: $E = \frac{E_{out}}{E_{in}} x100\%$

ELASTIC POTENTIAL ENERGY:

$E_p = \frac{1}{2}Fx = \frac{1}{2}kx^2$

CHAPTER 3

FORCES & PRESSURE

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

PRESSURE IN LIQUID: $P = \rho g h$

$P_{atm} = 1.0 \text{ X } 10^5 \text{ Pa}$

$= 76 \text{ cm Hg}$

$= 10 \text{ m water}$

$= 1 \text{ Bar}$

$= 1 \text{ atm}$

PASCAL'S PRINCIPLE:

$$P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$P = A_1 h_1 = A_2 h_2$$

BUOYANT FORCE:

$$F_B = \rho V g$$

CHAPTER

4

HEAT

TEMPERATURE OF LIQUID:

$$T(\theta) = \frac{l_\theta - l_0}{l_{100} - l_0} \text{ X } 100\ ^oC$$

TRANSFORMATION OF ENERGY:

$$\frac{1}{2}mv^2 = mc\theta$$

$$mgh = mc\theta$$

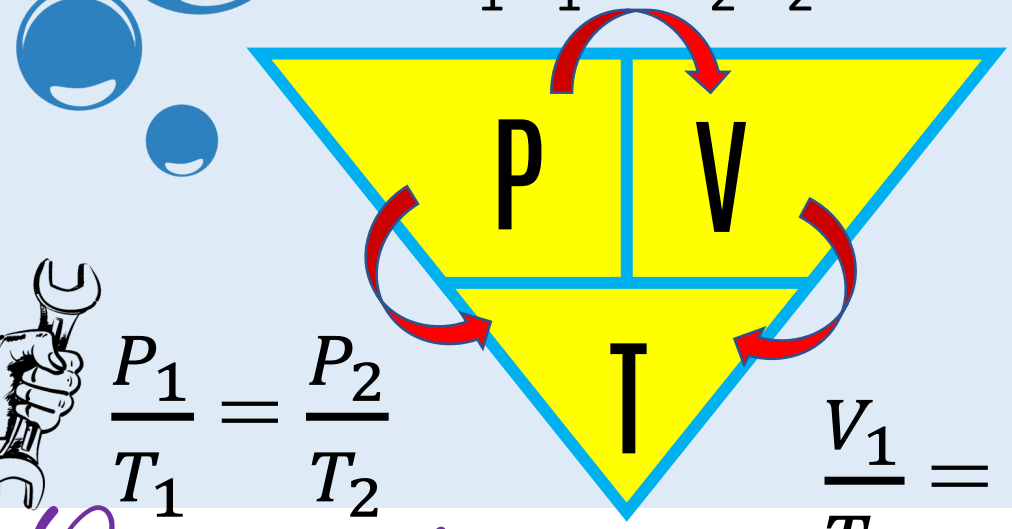
$$Pt = mc\theta$$

HEAT ENERGY: $Q = mc\theta$

LATENT HEAT ENERGY: $Q = mL$

Boyle's law

$$P_1V_1 = P_2V_2$$



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

Pressure law

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

Charles' law

Important Notes:

$$T = (\theta\ ^oC + 273)\ K$$

CHAPTER 5

LIGHT + OPTIC

REFRACTIVE INDEX:

$$\eta = \frac{\sin i}{\sin r} = \frac{\text{speed in air}}{\text{speed in medium}} = \frac{\text{H (Real)}}{\text{h (Apparent)}}$$

$$\eta = \frac{1}{Sin\ C}$$

POWER OF LENS:

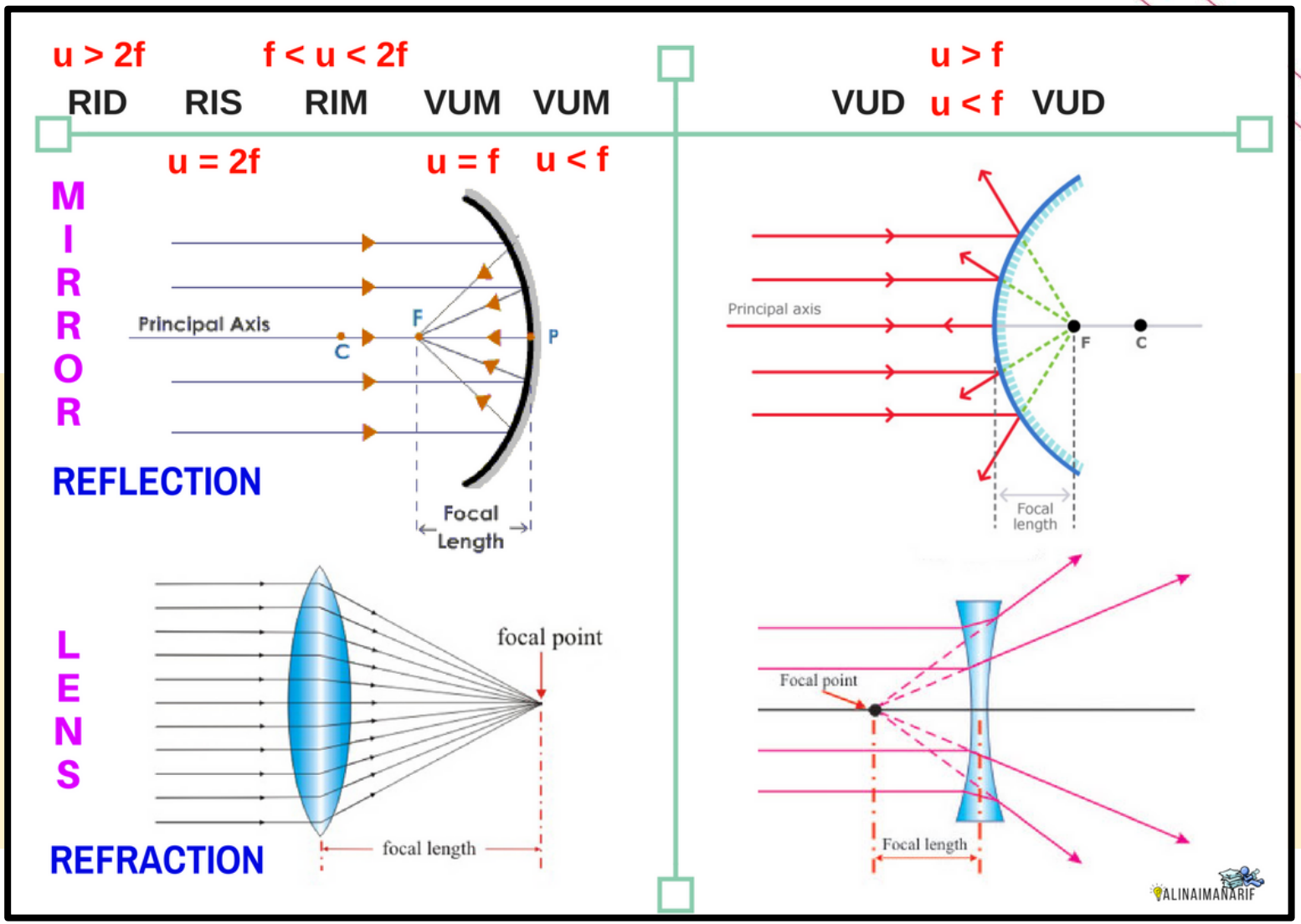
$$P = \frac{1}{f}$$

LINEAR MAGNIFICATION:

$$m = \left| \frac{v}{u} \right| = \frac{h_i}{h_o}$$

LENS EQUATION:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$



POWER OF LENS:

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

LINEAR MAGNIFICATION:

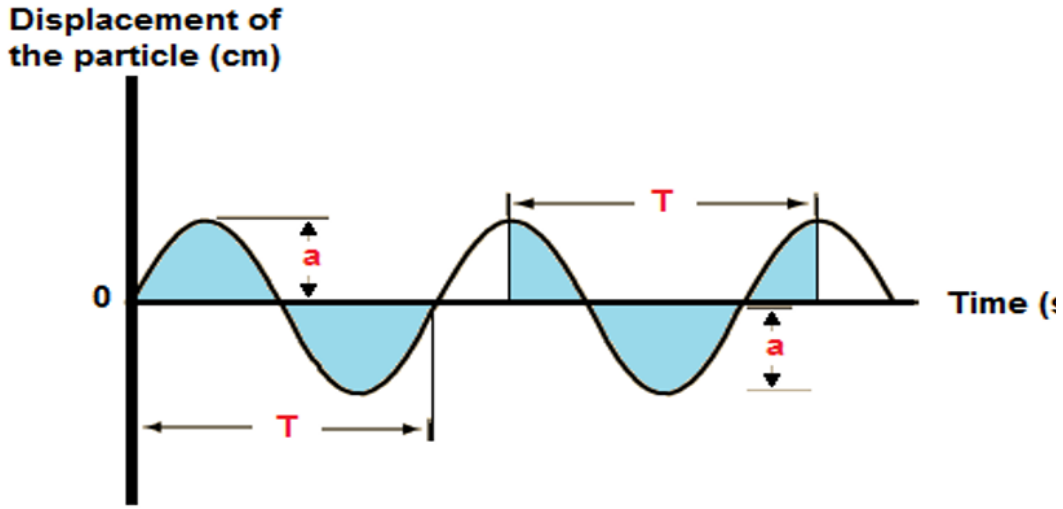
$$m = \frac{f_o}{f_e}$$

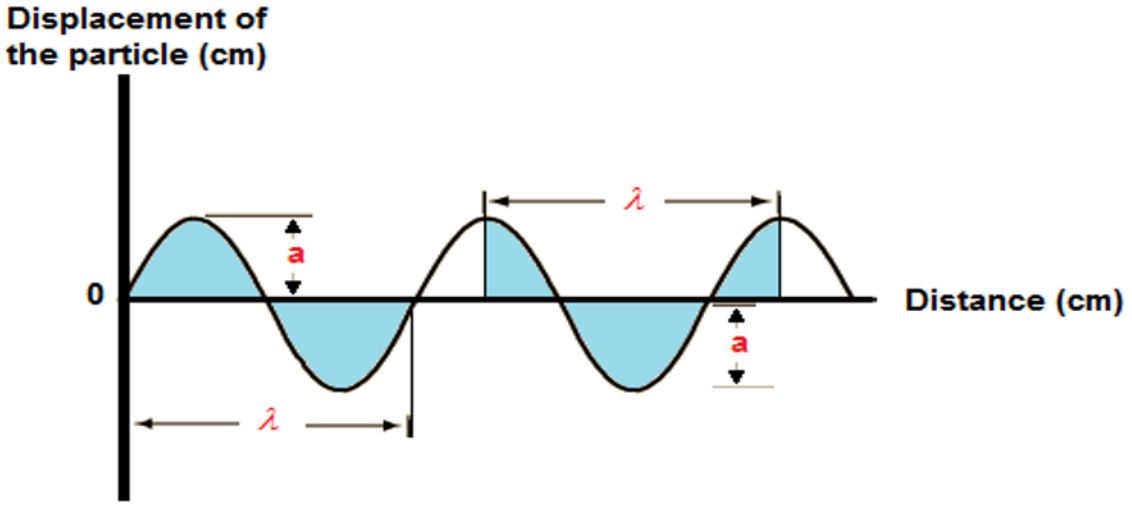
CHARACTERISTICS	MICROSCOPE	TELESCOPE
DIAGRAM		
fo (objective lens)	P↑ so f↓ To produce bigger image	P↓ so f↑ To produce a higher magnification
fe (eyepiece lens)	f↑	f↓
D (normal adjustment)	D > fo + fe To produce bigger image from the eyepiece // to increase the magnification	D = fo + fe To produce sharp & bright image
u (object distance)	f < u < 2f (RIM)	Infinity (oo) (RID)
First image	RIM	RID (at f)
Final image	VIM	VIM (oo)

CHAPTER

6

WAVES

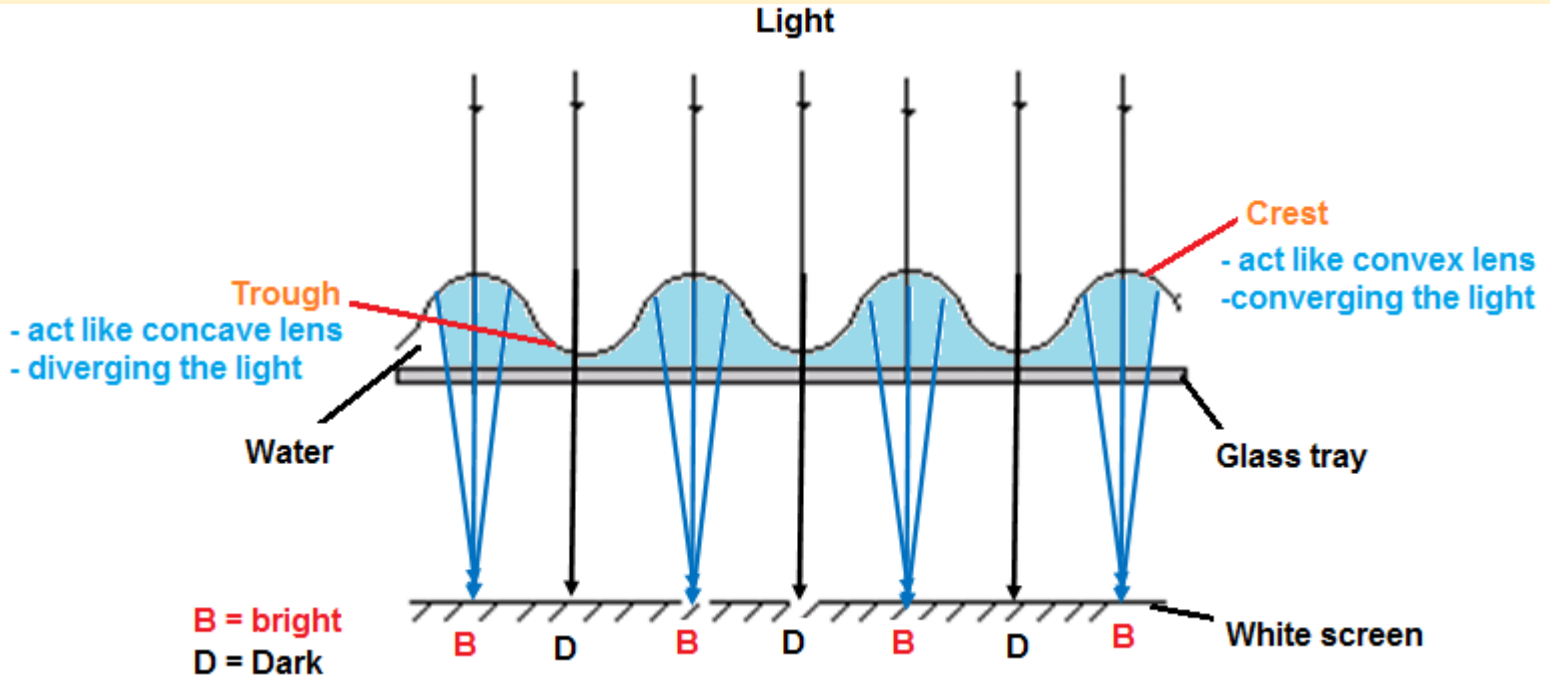




PERIOD: $T = \frac{1}{f}$

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

SPEED OF WAVES: $v = f\lambda$



Characteristics of the **REFLECTION** of waves:

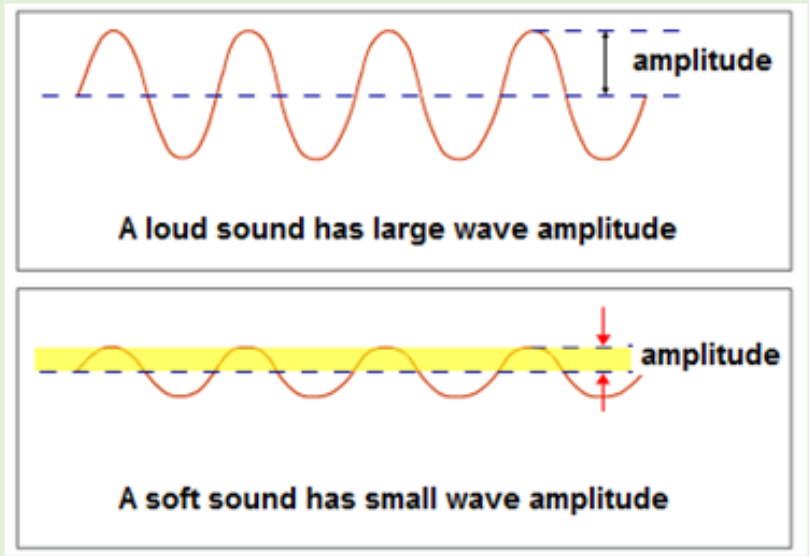
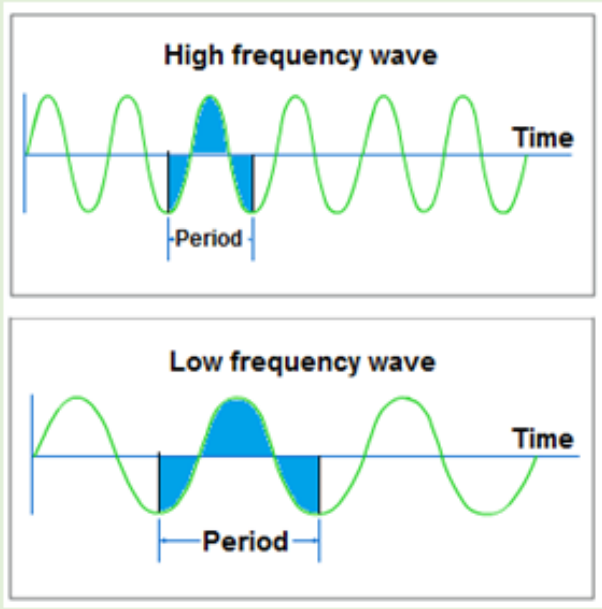
Physical Quantity	INCIDENCE WAVE	REFLECTED WAVE
Frequency	Unchanged (come from the same source; water wave)	
Speed	Unchanged	
Wavelength	Unchanged	
Direction of Propagation	Changed	

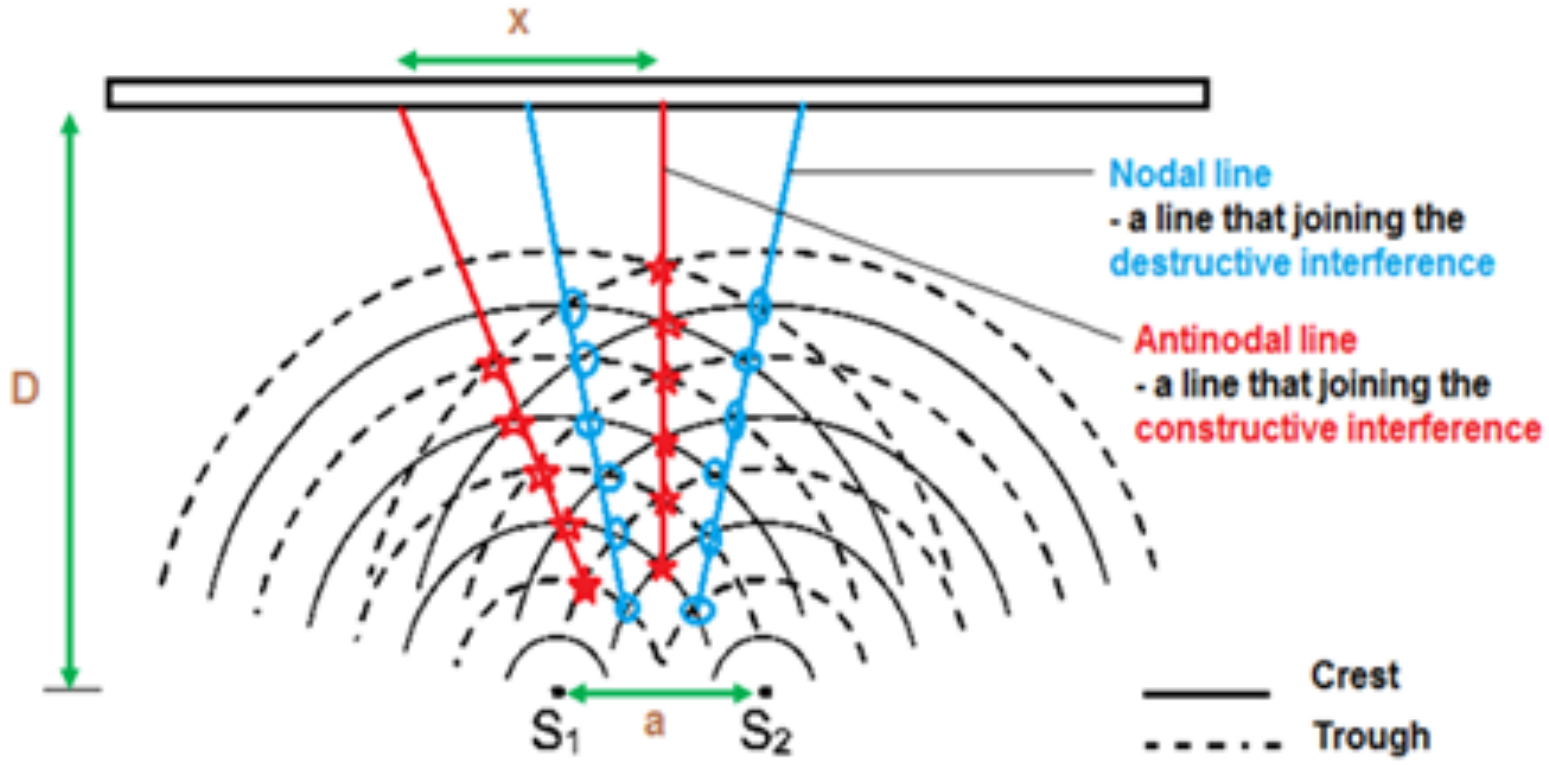
Characteristics of the **REFRACTION** of waves:

Physical Quantity	SHALLOW AREA	DEEP AREA
Frequency	Unchanged (come from the same source; water wave)	
Velocity	Decrease	Increase
Wavelength	Decrease	Increase
Direction of Propagation	Bends towards the normal line	Bends away the normal line

Characteristics of the **DIFFRACTION** of waves:

Physical Quantity	Condition (diffracted waves)
Frequency	Unchanged (come from the same source; water wave)
Speed	Unchanged
Wavelength	Unchanged
Amplitude (Energy)	Decrease

LOUDNESS	PITCH
	
Loudness increase, amplitude (energy) increase	Frequency increase, pitch increase Frequency increase, period decrease



$$\lambda = \frac{ax}{D}$$

λ = wavelength of water waves

a = distance between two dippers

x = distance between two consecutive antinodal line or nodal line

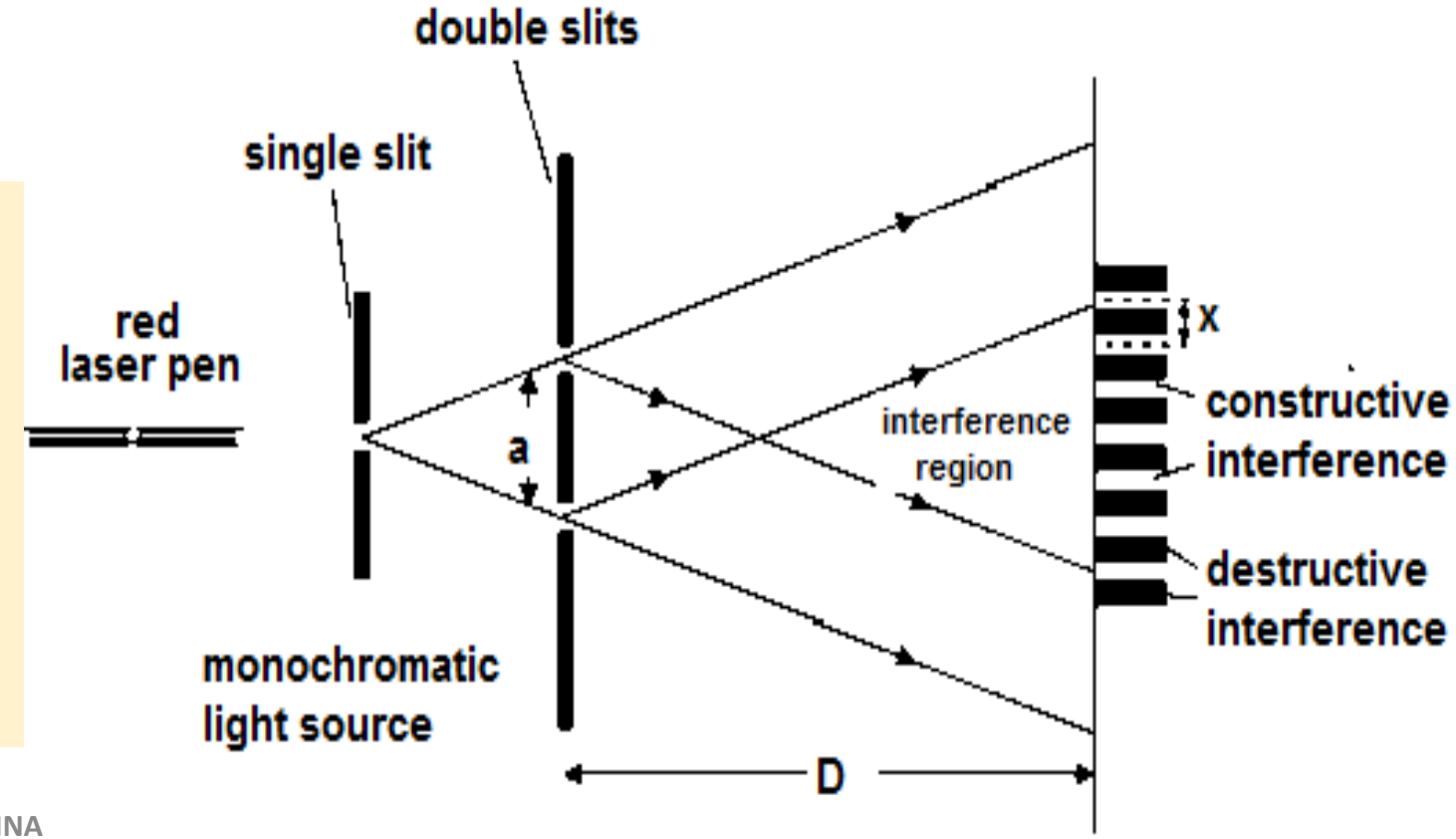
D = distance between dippers and screen

The wavelength of **monochromatic** light can be found by the formula:

$$\lambda = \frac{ax}{D}$$

a = distance between two slits
x = distance between two consecutive bright fringe or dark fringe
D = distance between slits and screen

When **constructive** occurs there will be a **bright fringe.**
When **destructive** occurs there will be a **dark fringe.**

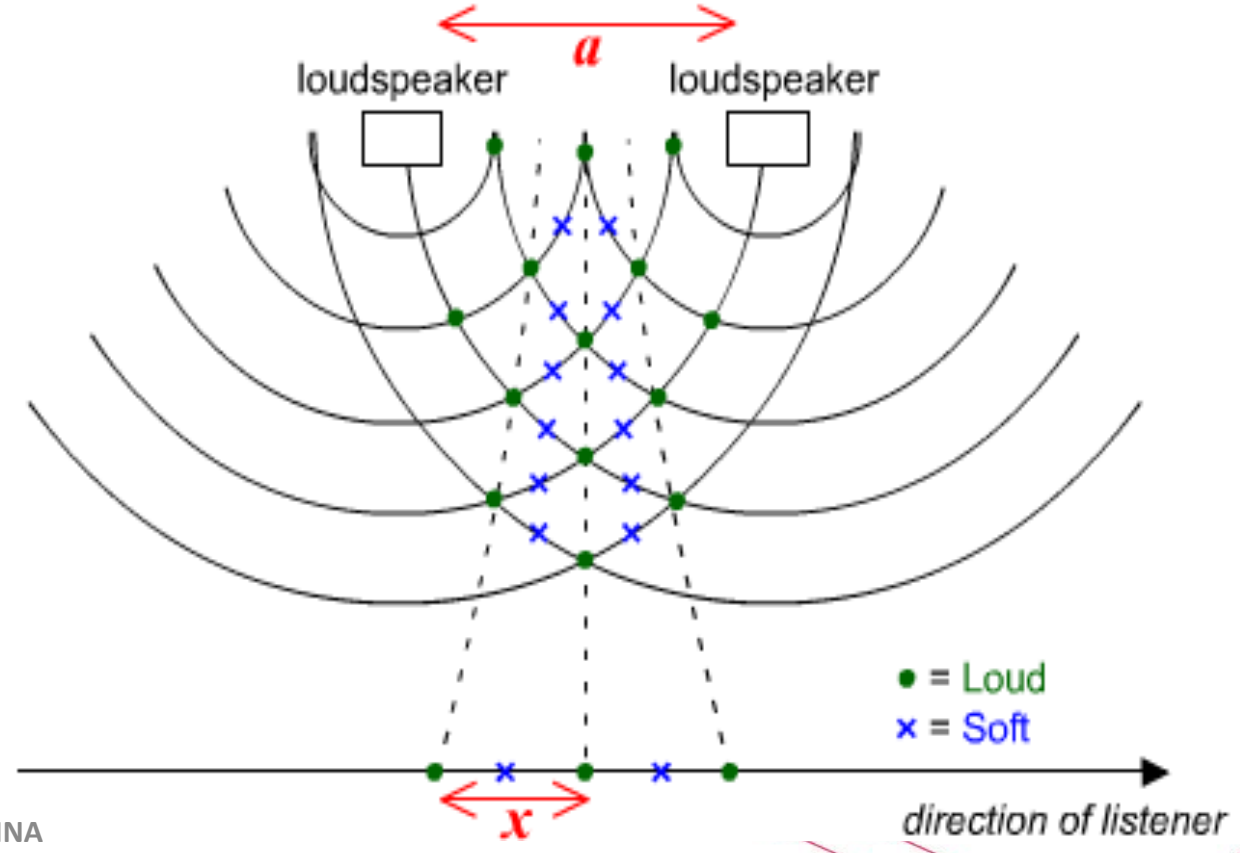


The wavelength of **sound wave** can be found by the formula:

$$\lambda = \frac{ax}{D}$$

a = distance between two loudspeakers
x = distance between two consecutive loud sound or soft sound
D = distance between loudspeakers and where the sound heard

When **constructive** occurs there will be a **loud sound.**
When **destructive** occurs there will be a **soft sound.**



CHAPTER

7

ELECTRICITY

ELECTRIC CURRENT:

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

POTENTIAL DIFFERENCE:

$$V = \frac{W}{Q} = \frac{E}{It} = IR$$

RESISTANCE:

$$R = \frac{V}{I} = \frac{\rho l}{A}$$

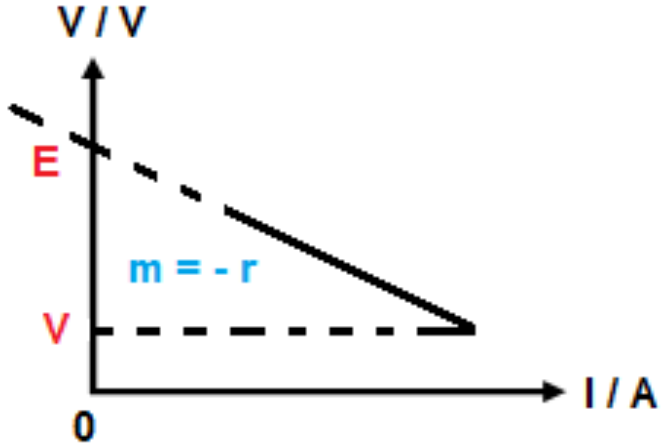
OHM'S LAW:

$$V = IR$$

ELECTROMOTIVE FORCE:

$$E = I(R + r)$$

$$E = V + Ir$$



INTERNAL RESISTANCE:

$$m = -r$$

$$= -\left(\frac{E - V}{I}\right)$$

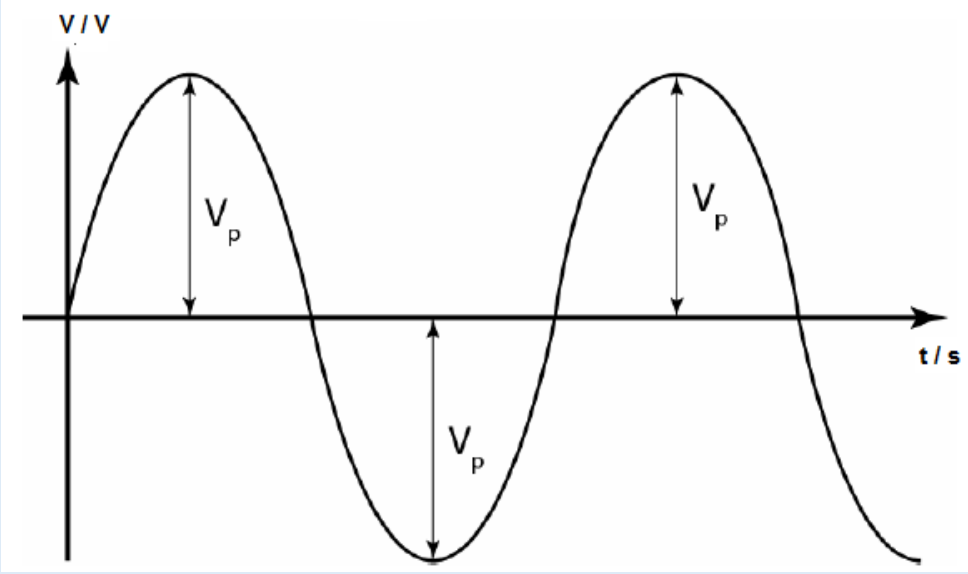
ELECTRICAL POWER:

$$P = \frac{W}{t} = \frac{E}{t} = IV = I^2R = \frac{V^2}{R}$$

ELECTRICAL ENERGY:

$$E = Pt$$

ROOT MEAN SQUARE VALUE:



$$V_{rms} = \frac{V_p}{\sqrt{2}}$$

V_{rms} = root mean square voltage (V)

V_p = peak voltage (V)

$$I_{rms} = \frac{I_p}{\sqrt{2}}$$

I_{rms} = root mean square current (A)

I_p = peak current (A)

TRANSFORMER: $$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

IDEAL TRANSFORMER: $$V_p I_p = V_s I_s$$

NON-IDEAL TRANSFORMER: $$\text{Efficiency} = \frac{V_s I_s}{V_p I_p} x100\%$$

ENERGY CHANGE OF ELECTRON IN AN ELECTRON GUN:

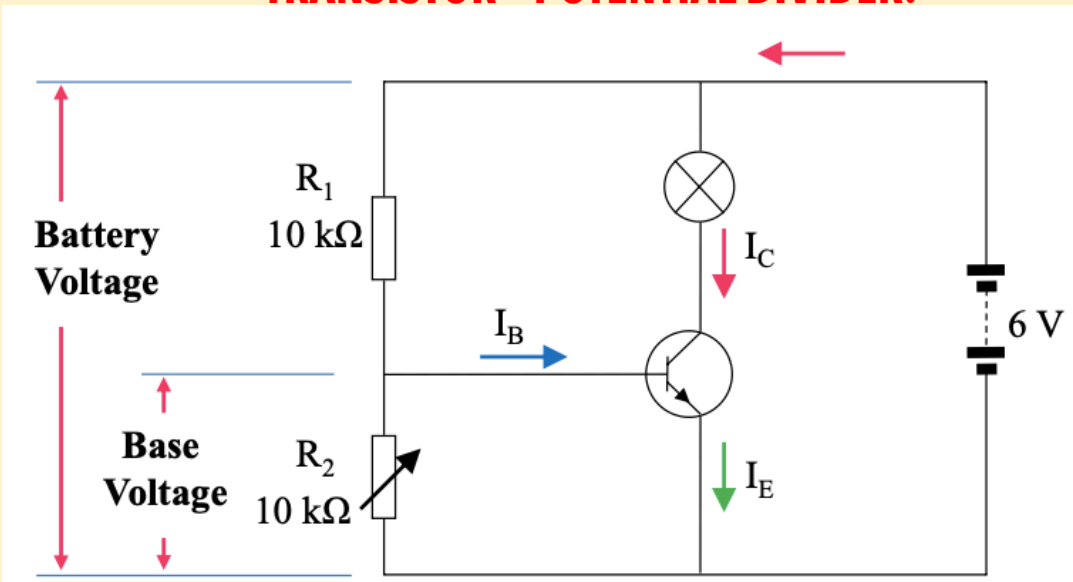
Kinetic Energy ⟶ Electrical Potential Energy

$$\frac{1}{2}mv^2 = eV$$

$$v = \sqrt{\frac{2eV}{m}}$$

v = speed of electron (ms^{-1})
V = potential difference across the electron gun (V)
e = charge of 1 electron (1.66×10^{-19} C)
m = mass of 1 electron (3.11×10^{-31} kg)

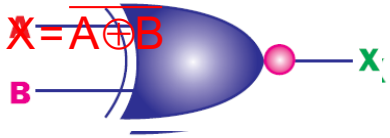
TRANSISTOR – POTENTIAL DIVIDER:



$$V_1 + V_2 = V$$

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

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



9

ELECTRONIC

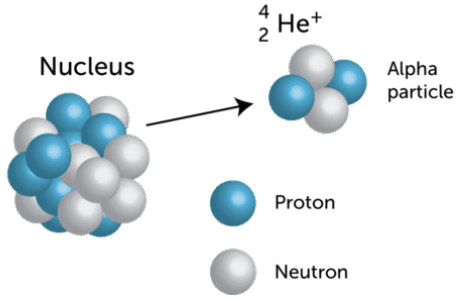
Logic Gate

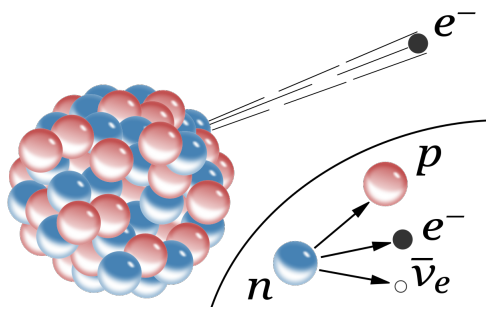
has **one** or **more** **input** signals but only **one** **output** signal

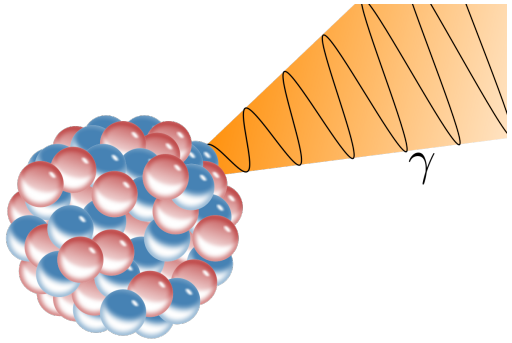
GATES	SYMBOL	BOOLEAN EXPRESSION	TRUTH TABLE
AND gate		$X=A \cdot B$	INPUT A B / OUTPUT X: 0 0 0; 0 1 0; 1 0 0; 1 1 1
OR gate		$X=A+B$	INPUT A B / OUTPUT X: 0 0 0; 0 1 1; 1 0 1; 1 1 1
NOT gate		$X=\overline{A}$	INPUT A / OUTPUT X: 0 1; 1 0
NAND gate		$X=\overline{A \cdot B}$	INPUT A B / OUTPUT X: 0 0 1; 0 1 1; 1 0 1; 1 1 0
NOR gate		$X=\overline{A+B}$	INPUT A B / OUTPUT X: 0 0 1; 0 1 0; 1 0 0; 1 1 0

CHAPTER 10

RADIOACTIVITY







α- decay

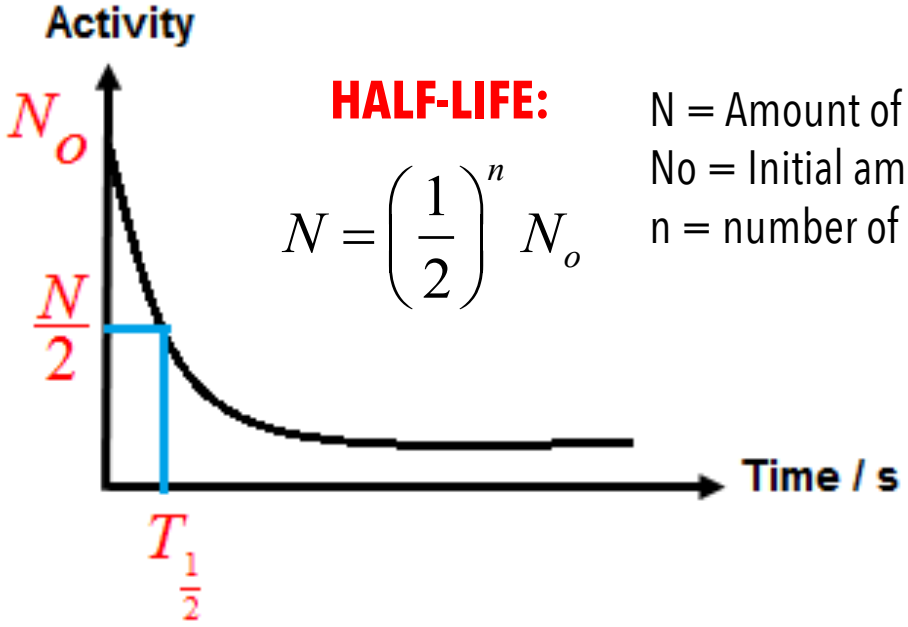
$$^A_ZX \rightarrow {}^{A-4}_{Z-2}Y + {}^4_2He$$

$\beta-$ decay

$$^A_ZX \rightarrow {}^A_{Z+1}Y + {}^0_{-1}e$$

$\gamma-$ decay

$$^A_ZX \rightarrow {}^A_ZX + \gamma$$



HALF-LIFE:

$$N = \left(\frac{1}{2}\right)^n N_o$$

N = Amount of radioisotope particles after nth half-life
No = Initial amount of radioisotope particles
n = number of half-life

NUCLEAR ENERGY:

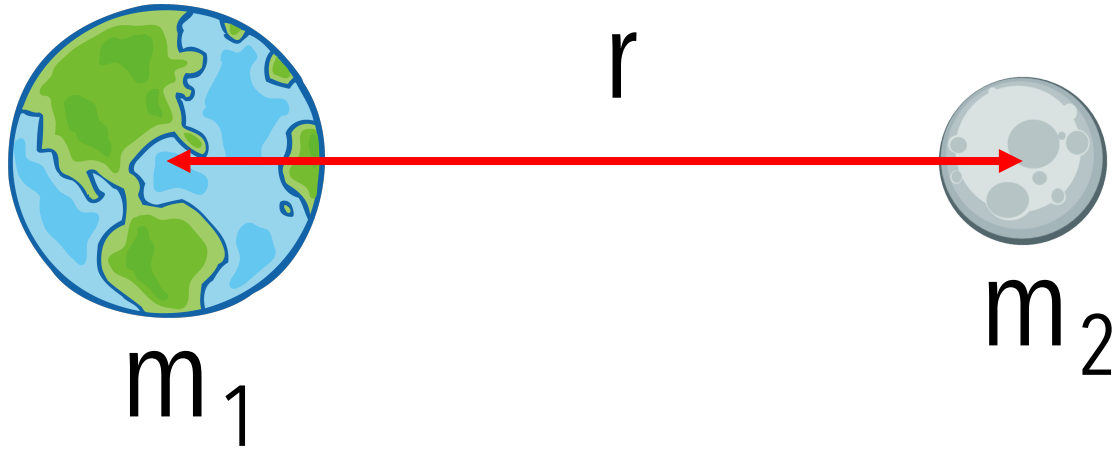
$$E = mc^2$$

m = mass change (kg)
c = speed of light (3×10^8 ms^{-1})
E = energy changed (J)

CHAPTER 3

GRAVITATION++KSSM

GRAVITATIONAL FORCE



$$F = \frac{G m_1 m_2}{r^2}$$

F = Gravitational force between two objects
G = Universal gravitational constant (6.67×10^{-11} N m^2 kg^{-2})
m_1 = mass of first object
m_2 = mass of second object
r = distance between the center of two objects

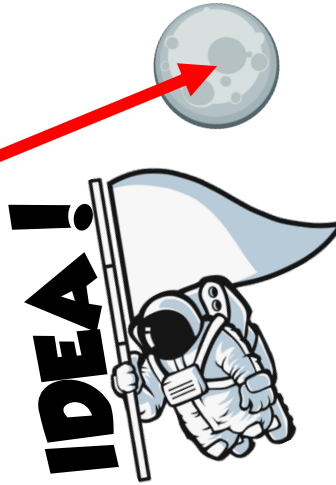
RELATIONSHIP BETWEEN g and G

Newton's Second Law of Motion

$$F = mg \quad \text{.....1}$$

Newton's Universal Law of Gravitation

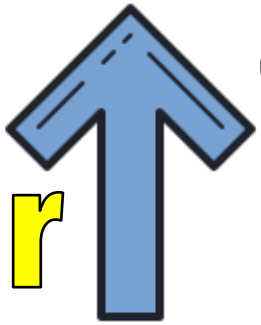
$$F = \frac{GmM}{r^2} \quad \text{.....2}$$



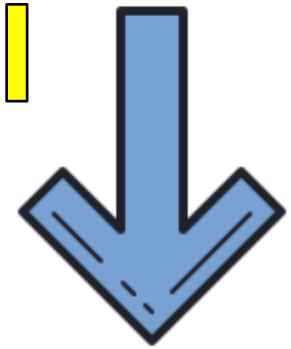
Equation 1 = Equation 2

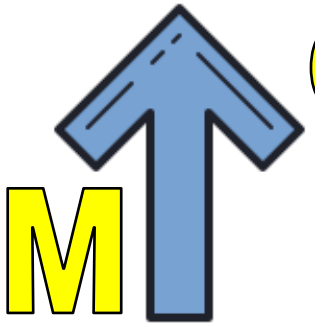
$$mg = \frac{GmM}{r^2}$$

$$g = \frac{GM}{r^2}$$

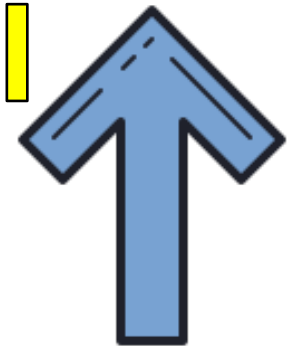


Gravitational acceleration





Gravitational acceleration

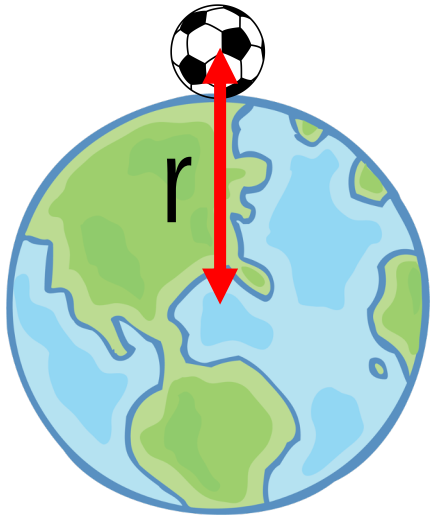


RELATIONSHIP BETWEEN g and G

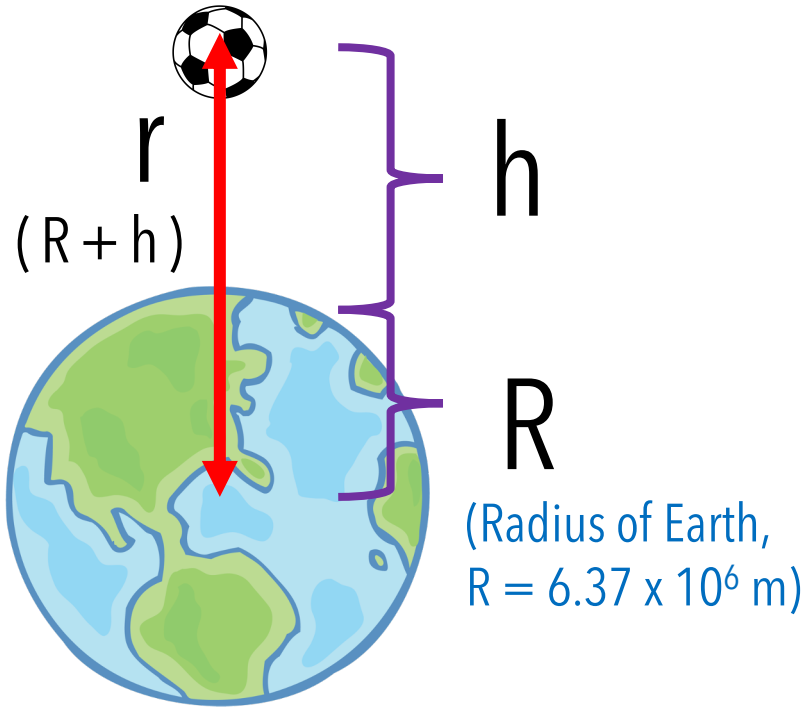
g = Gravitational acceleration
G = Universal gravitational constant (6.67×10^{-11} N m^2 kg^{-2})
M = mass of object
r = distance between the centers

$$g = \frac{GM}{(R+h)^2}$$

$$g = \frac{GM}{r^2}$$



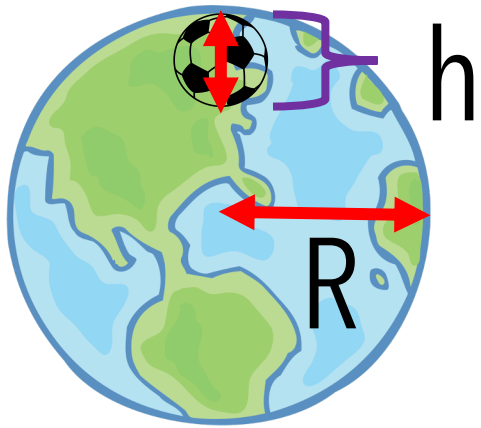
On the surface



(Radius of Earth, R = 6.37×10^6 m)

At a height

$$g = \frac{GM}{(R-h)^2}$$



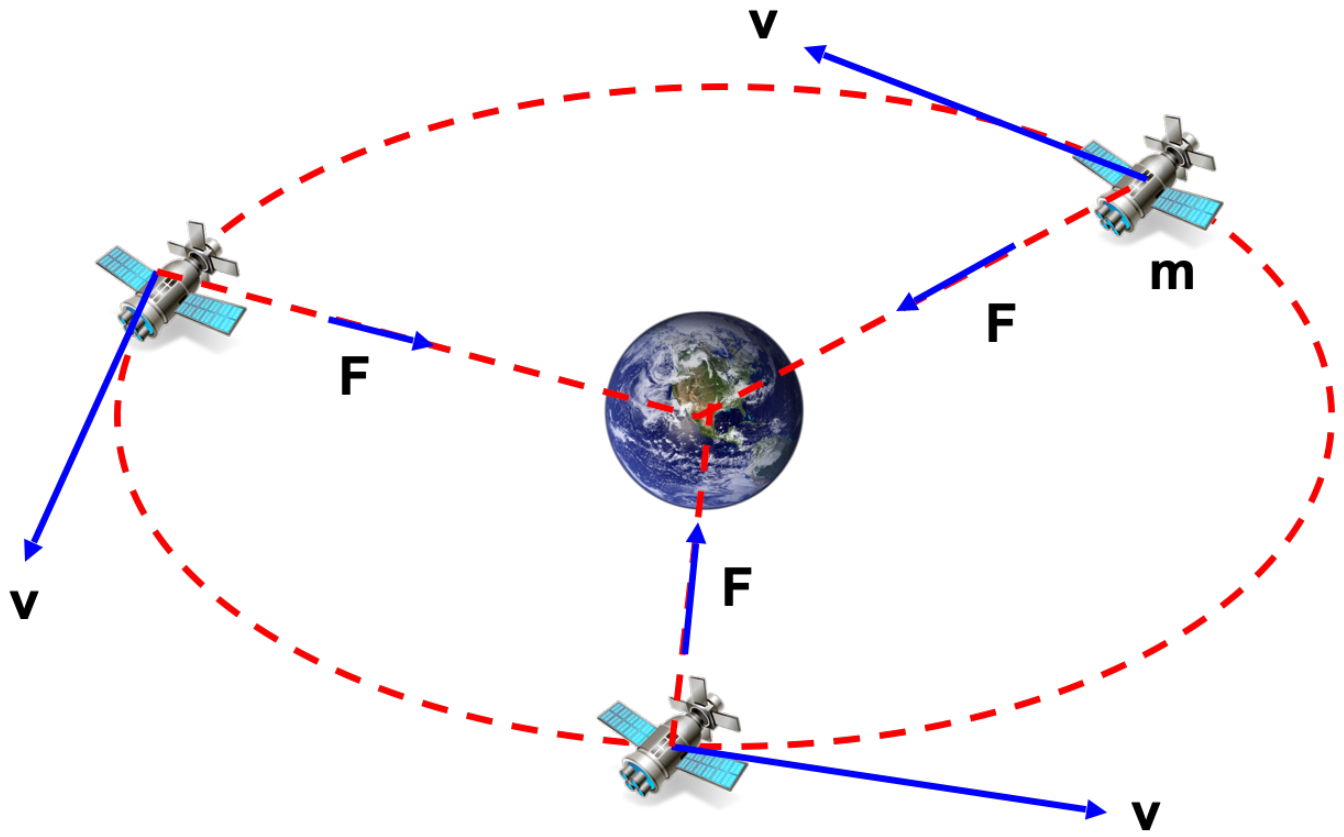
Below the surface

CENTRIPETAL FORCE

For an object in a circular motion

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

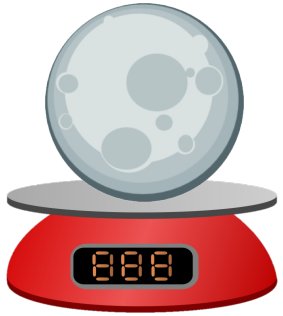
F = Centripetal force
m = mass of orbiting body
v = linear speed
r = radius of orbit



CENTRIPETAL FORCE

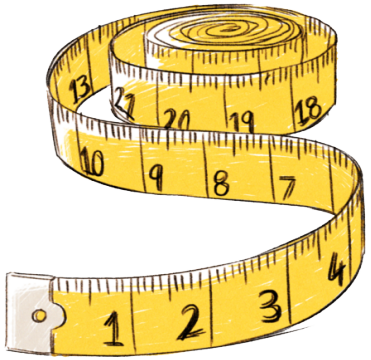
For an object in a circular motion

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



Mass ↑ F ↑

Speed ↑ F ↑



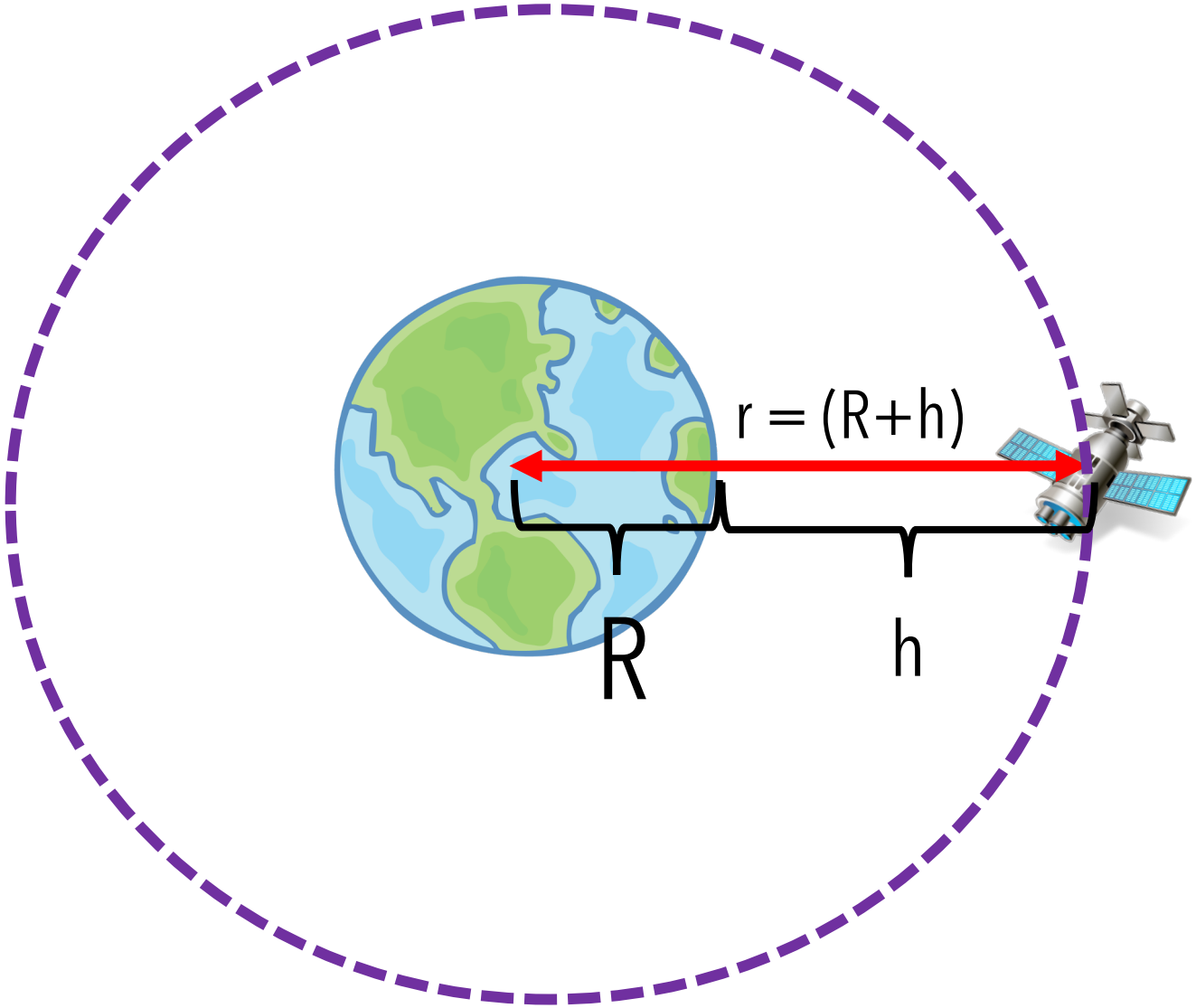
r ↑ F ↓

CENTRIPETAL ACCELERATION

Acceleration of an object in a circular motion

$$a = \frac{v^2}{r}$$

a = Centripetal acceleration
v = linear speed
r = radius of orbit

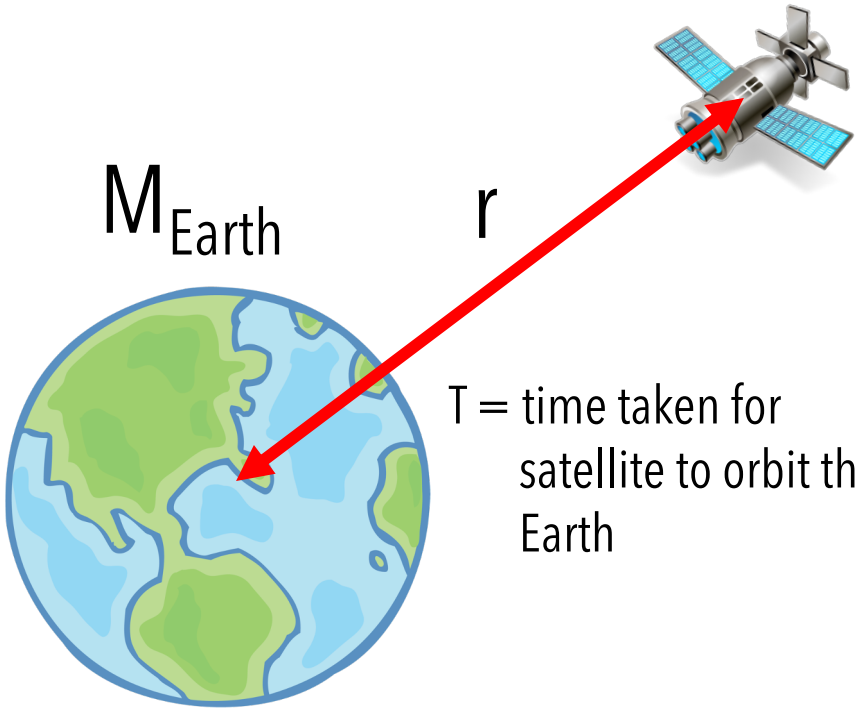


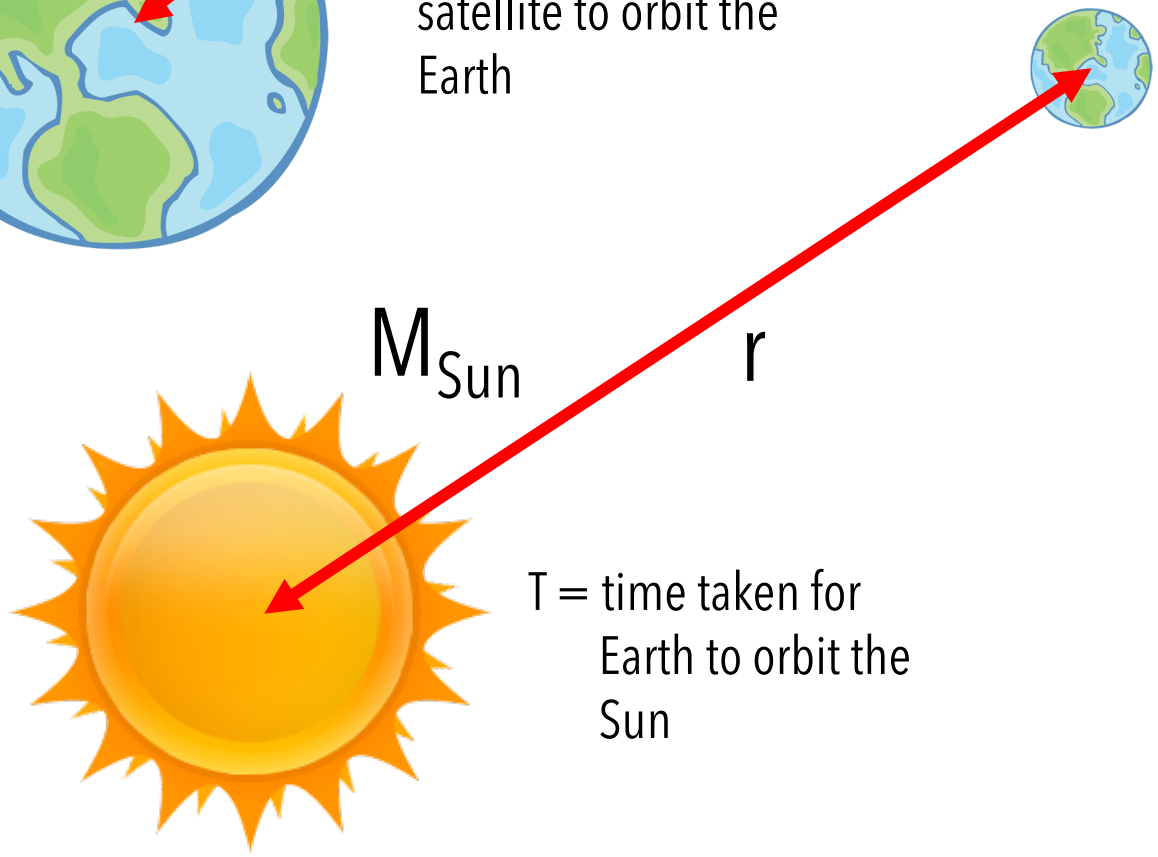
MASS OF A BODY

Mass of a body at the centre of an orbit

$$M = \frac{4\pi^2 r^3}{GT^2}$$

M = Mass (object at center)
G = gravitational constant (6.67×10^{-11} N m^2 kg^{-2})
r = radius of orbit
T = Period of revolution (time taken to circle the orbit)



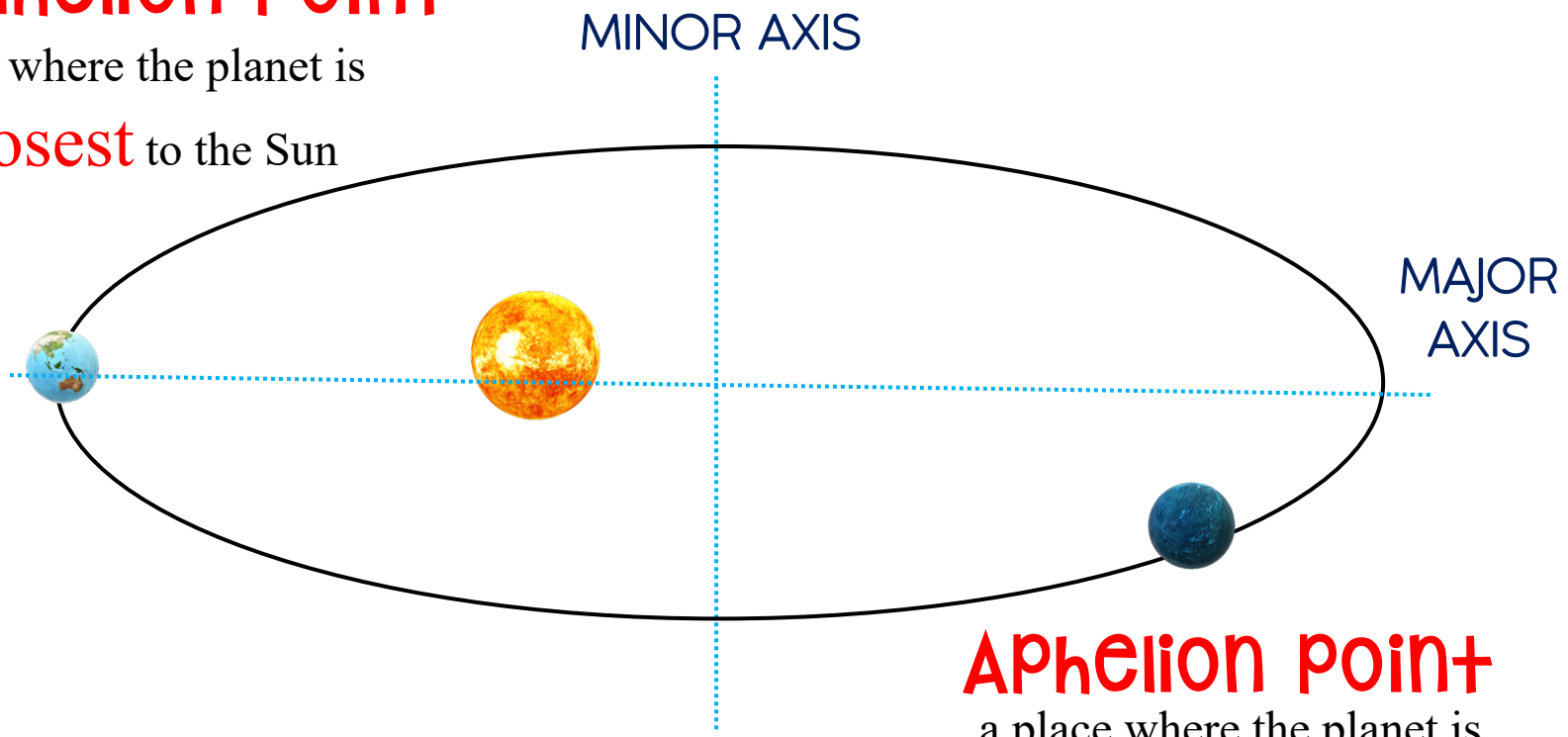


KEPLER'S 1

All planets move in **elliptical orbits** with the **sun at one focus**

Perihelion point

a place where the planet is the **closest** to the Sun



Aphelion point

a place where the planet is the **farthest** to the Sun

KEPLER'S 2
(Law Of Areas)

A line that connects a planet to the sun sweeps out equal areas in equal times

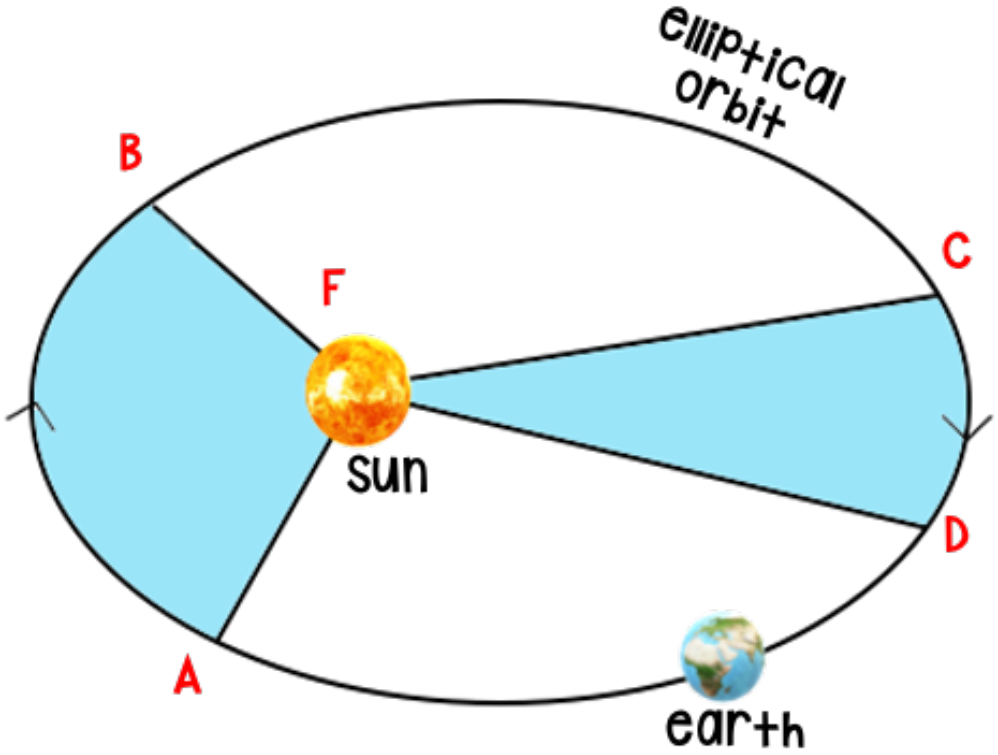
time: 

area: 

distance: 

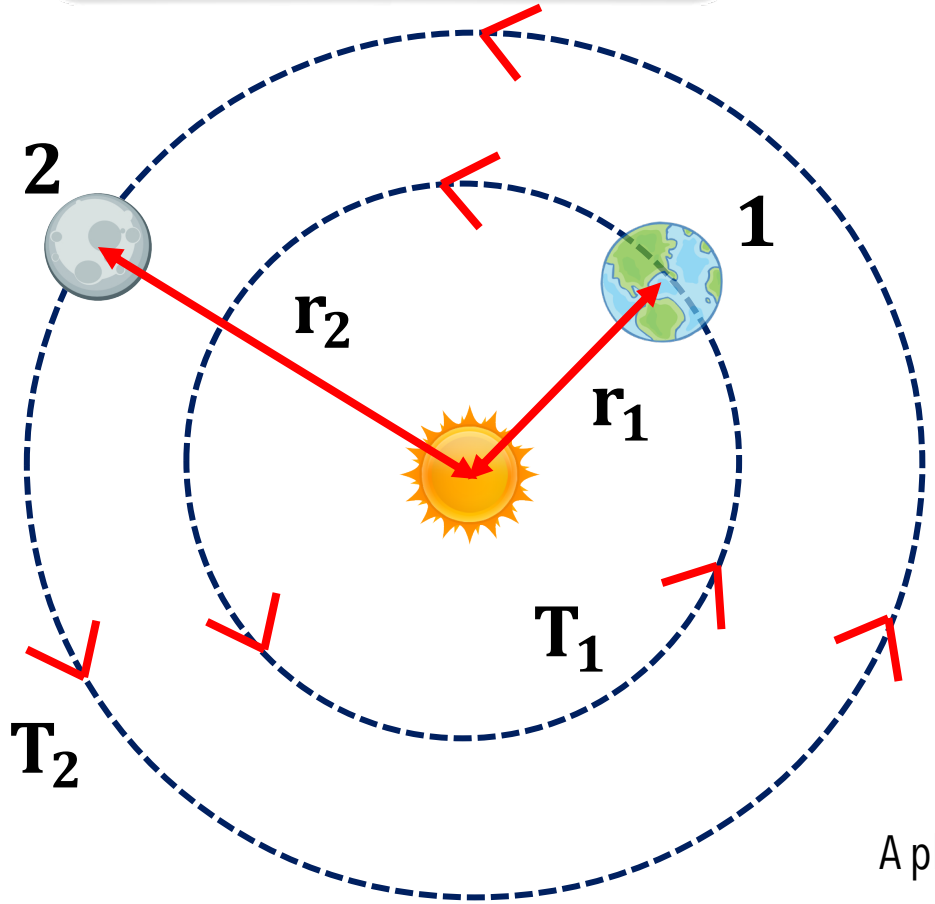
linear speed: 

A to B	=	C to D
AFB	=	CFD
AB	>	CD
A to B	>	C to D



KEPLER'S 3 (Law Of Period)

The square of **period** of any planet is directly proportional to the cube of the radius of its orbit



$$T^2 \propto r^3$$

$$\frac{T_1^2}{T_2^2} = \frac{r_1^3}{r_2^3}$$

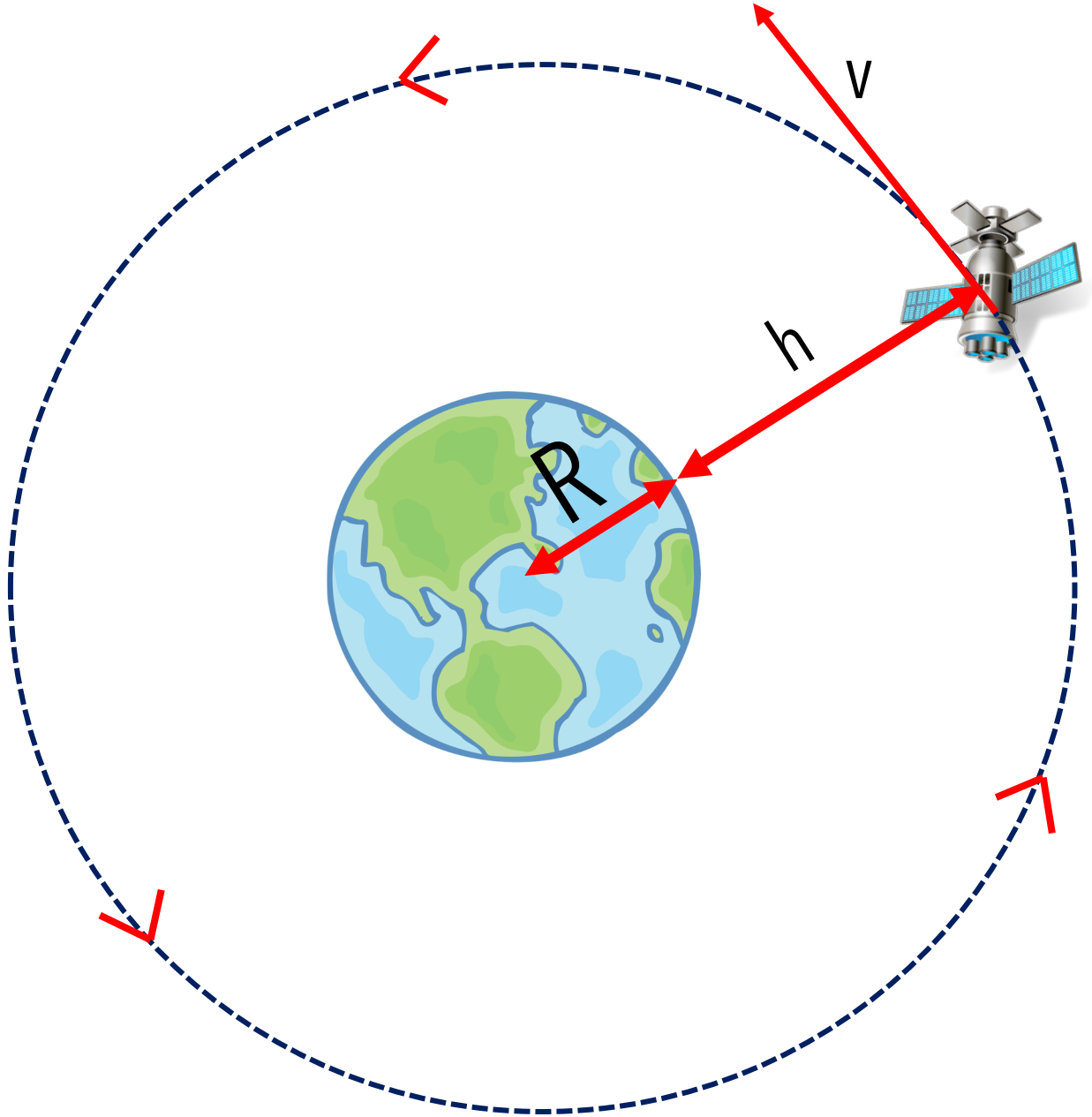
A planet which orbits with a larger radius has a longer orbital period

LINEAR SPEED

For satellite orbiting Earth

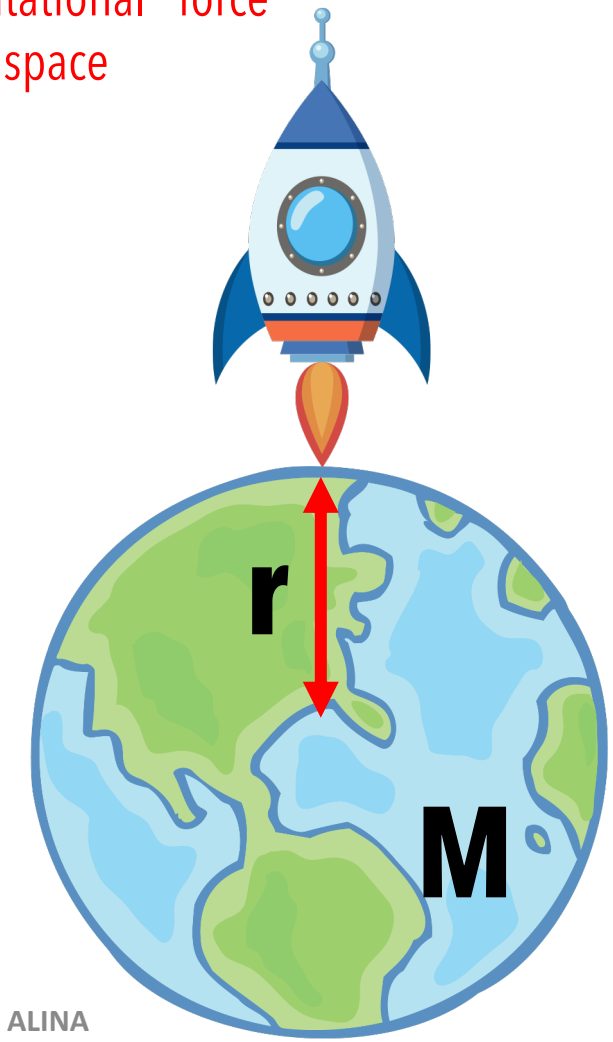
$$v = \sqrt{\frac{GM}{r}}$$

M = Mass of Earth
G = gravitational constant
(6.67×10^{-11} N m^2 kg^{-2})
r = radius of orbit
v = linear speed



ESCAPE VELOCITY

Minimum velocity needed by an object on the surface of the Earth to overcome gravitational force and escape to outer space



$$V = \sqrt{\frac{2GM}{r}}$$

M = Mass of Earth
G = gravitational constant
(6.67×10^{-11} N m^2 kg^{-2})
r = Distance of object (From the centre of Earth)
v = linear speed

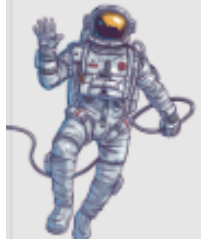
Geostationary satellites versus non-geostationary satellites

Orbit at: Geostationary Earth Orbit

Direction of rotation: same to Earth's rotation

Orbital period: 24 hours
(period of Earth's rotation)

Specific FUNCTION:
COMMUNICATION satellite



Example: MEASAT

FUNCTION:
Orbit the Earth

LINEAR SPEED:

$$v = \sqrt{\frac{GM}{r}}$$

ORBITAL PERIOD:

$$T = \sqrt{\frac{4\pi^3 r^3}{GM}}$$

Orbit at: LOWER or HIGHER
Geostationary Earth Orbit

Direction of rotation: same to Earth's rotation

Orbital period: < or > than 24 hours

Specific FUNCTION: EARTH IMAGING
GPS &
WEATHER FORECAST

Example: TiungSAT
RazakSAT
Pipit
ISS