Light and Waves

- Speed of light in air = 3 X 10^8 m/s
- Law of reflection
  The angle of incidence equals the angle of reflection.
- A **real image** is an image that can be formed on a screen.
- A **virtual image** cannot be formed on a screen.
- Refractive index , n = $\frac{\text{Speed of light in air or vacuum}}{\text{Speed of light in medium}}$
- $n = \frac{\sin i}{\sin r}$ (When the ray from rarer to denser)
- $n = \frac{\sin r}{\sin i}$ (When the ray from denser to rarer)
- $n = \frac{1}{\sin c}$ Where c is critical angle
- Images formed by a Converging lens and nature

Object Position	Image Position	Image size	Upright or inverted
Beyond 2F	Between F and 2F	Smaller	Inverted
At 2F	At 2F	Same	Inverted
Between 2F and F	Beyond 2F	Larger	Inverted
Between F and lens	Behind object	Larger	Virtual,erect,Upright

- Speed of wave = Frequency X Wavelength (v=f X λ)
- Electromagnetic Waves—gamma rays,X-rays,uv rays, light ,IR, microwaves, radio waves— are **Transverse waves**
- Sound Waves – **Longitudinal waves.**
- Frequency increases **Pitch** increases.
- Amplitude increases **Loudness** increases.

Measurements

- Density = $\frac{\text{Mass}}{\text{Volume}}$
- Weight = mass X acceleration due to gravity (w=mg)
- Hooke's law
  Extension is directly proportional to stretching force

  F=kx
- Unit of Force - - newton (N)
- S.I unit of

Length- metre	Potential difference-volt	Acceleration-metre/sec^2
Mass- kilogram	Energy-joule	Frequency-hertz
Time-Second	Work-joule	Resistance-ohm
Current-Ampere	Power-watt	Resistivity-ohm-metre
Temperature-kelvin	Velocity-metre/second	Charge-coulomb

Forces and Pressures

- Moment of a force = Force X perpendicular distance of the line of action of the force from fulcrum.
- The stability of a body is increased by
  1) Lowering centre of mass
  2) Increasing the base area
- Work = force X distance moved in direction of force
- $\text{Power} = \frac{\text{Work done}}{\text{time taken}} = \frac{\text{energy transfer}}{\text{time taken}}$
- $\text{Efficiency} = \frac{\text{Output energy/power}}{\text{Input energy/power}}$
- $\text{Pressure} = \frac{\text{force}}{\text{area}}$
- Liquid Pressure = depth X density X acceleration due to gravity ($P=h\rho g$)

Motion and Energy

- Average speed = $\frac{\text{distance moved}}{\text{time taken}}$
- Velocity = $\frac{\text{Displacement}}{\text{Time taken}}$
- Acceleration = $\frac{\text{change of velocity}}{\text{time taken for change}}$
- Graphs and equations
  i) The area under a velocity – time graph measures the distance travelled.
  ii) The slope or gradient of a velocity – time graph represents the acceleration of the body.
  iii) The slope or gradient of a distance – time graph represents the velocity of the body.
- Newton's first law :
  A body stays at rest, or if moving it continues to move with uniform velocity, unless an external force makes it behave differently.
- Resultant Force, F = mass(m) X acceleration (a)
- One newton is the force required to give a mass of one kilogram an acceleration of 1 m/s^2
- Kinetic Energy = $E_k = \frac{1}{2} m v^2$
- Potential Energy = $E_p = m g h$
- Conservation of energy
  $\frac{1}{2} m v^2 = m g h$
  Loss of P.E = gain of K.E
- Centripetal force, $F = \frac{m v^2}{r}$
- Momentum, P= M X V, Impulse, Ft = mv-mu.

Thermal Energy

- Absolute Zero = -273°C
- Expansion = linear expansivity X original length X temperature rise.
- Boyle's law
  Temperature constant
  P is inversely proportional to V
  P V = constant
- Heat received or given out = mass X temperature change X specific heat capacity
  Q = m X ΔT X c
- Thermal capacity = mass X specific heat capacity = m X c
- Q = m X l_f = mass X specific latent heat of fusion
- Q = m X l_v = mass X specific latent heat of vaporization

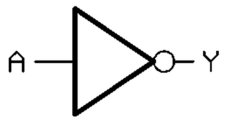
Electricity

- Charge, Q = Current (I) X time (t)
- P.d, V = E / Q
- E = I X t X V
- Ohm's Law - - V= I R
- $R_{series} = R_1 + R_2 + R_3 + \ldots$
- $\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots..$
- Resistivity, $\rho = \frac{R\,A}{l}$
- E = I t V
- P = I V
- $P = I^2 R$
- $E = I^2 R t$
- $P = \frac{V^2}{R}$
- Potential Divider - $\frac{V_1}{V_2} = \frac{R_1}{R_2}$
- 1 kWh = 3 600 000 J = 3.6MJ

Electronics

- Light dependent resistor (LDR) – More light , less resistance
- Thermistor – More temperature , less resistance
- Semiconductor diode
  a) Use – rectifier for changing **ac** to **dc**
  b) Forward bias – resistance is less
- Transistor
  a) Uses – as switch and amplifier

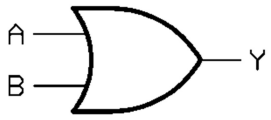
- Logic gates
  1) NOT gate or Inverter



Truth Table

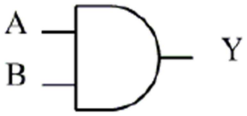
Input	Output
0	1
1	0

  2) OR gate



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

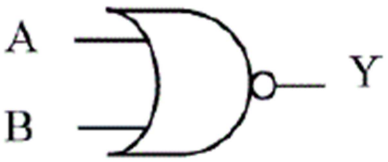
  3) AND gate



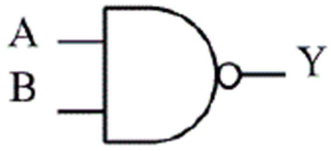
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

  4) NOR gate

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0



  5) NAND gate



A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

Magnetism

- The strength of an electromagnet increases if,
  i. The current in the coil increases,
  ii. The number of turns on the coil increases,
  iii. The poles are moved closer together.
- Fleming's left hand rule – Motor rule
- 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's law
  The direction of the induced current is such as to oppose the change causing it.
- Fleming's right hand rule – Dynamo rule
- Transformer Equation

$$\frac{\text{Secondary voltage}}{\text{primary voltage}} = \frac{\text{Secondary turns}}{\text{primary turns}}$$

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

Power in primary = power in secondary

$V_p \times I_p = V_s \times I_s$

Radioactivity

Types of radiation	Alpha particle α	Beta particle β	Gamma particle γ
	Each particle is 2 proton and 2 neutrons(like Helium)	Each particle is an electron	Electromagnetic waves similar to X-ray.
Relative charge	+2	-1	0
Mass	High compared with β	low	--
Speed	Up to 0.1Xspeed of light	Up to 0.9 X speed of light	Speed of light
Ionizing effect	Strong	Weak	Very weak
Penetrating effect	Not very penetrating. Stopped by a thick sheet of paper or by skin, or by a few centimeters of air	Penetrating, but stopped by a few millimeters of aluminium or other metal.	Very penetrating power never completely stopped,though lead and thick concrete will reduce intensity.
Effects of fields	Deflected by magnetic and electric fields	Deflected by magnetic and electric fields	Not deflected by magnetic or electric fields

- The half-life of a radioactive isotope is the time taken for half the nuclei present in any given sample to decay.