PHYSICS A2

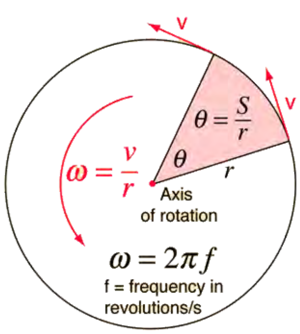
CHAPTER 12 : MOTION IN A CIRCLE

12.1 Kinematics of uniform circular motion

- define the radian and express angular displacement in radians
- understand and use the concept of angular speed

TERMS	DEFINITION/ FORMULA
Angular displacement	- Change in angle of a body - as it rotates around a circle
Radian	- Angle subtended at the centre of a circle - by an arc of length equal to the radius of the circle
Angular velocity	- Rate of change of angular displacement - swept out by radius
Angular speed	1. string: - Rate of change of angle - by the string 2. ball : - Change in angular displacement - per unit time

- <u>Relationship between v, r and ω</u>



- ω : angular velocity / angular frequency

- Kinetic theory equation :

$$\overline{u2} = \frac{1}{3}\,\overline{c2}$$

$$Pressure = \frac{Force}{Area}$$

$$Force = \frac{Nmc2}{3\,l^2}$$

$$P = \frac{Nmc2}{3l^3}$$

$$P = \frac{Nmc^2}{3V}$$

$$PV = \frac{Nmc^2}{3}$$

- Kinetic energy
  - KE is directly proportional to T

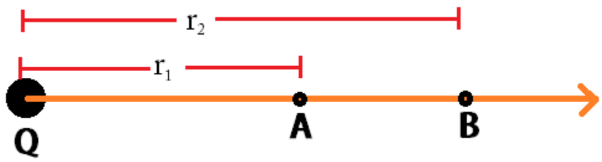
$$KE = \frac{1}{2}Nm\overline{c^2}$$

$$PV = \frac{Nmc^2}{3} PV = nRT$$

$$Nm\overline{c^2} = 3nRT$$

$$KE = \frac{3}{2}nRT$$

- Potential difference

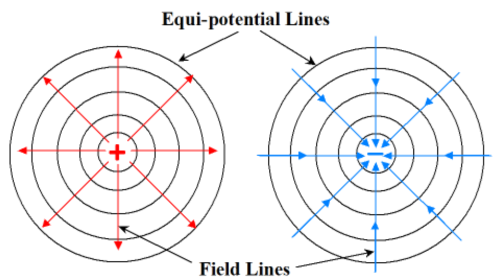


$$V_{AB} = \frac{Q}{4\pi\varepsilon_0 (r_2 - r_1)}$$

$$V_{AB} = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{r_2} - \frac{1}{r_1}\right)$$

- V_{AB} is equal to the gain in electrical potential energy if Q is positive and loss if Q is negative

- Equipotential line
  - Equipotential surface: a surface where the electric potential is constant
  - Equipotential lines are drawn such that potential is constant between intervals
  - Potential gradient = 0, E = 0 → no work is done when a charge moved along the surface/ line
  - Electric field lines must meet equipotential surface at
  - right angles



- Electric potential energy

$$E = Fs$$

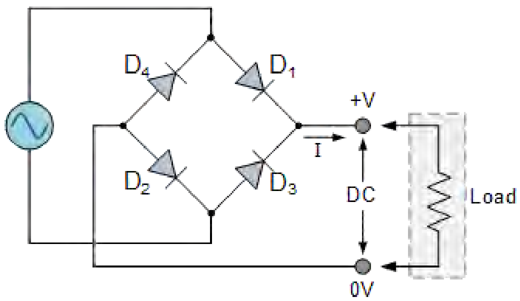
$$F = \frac{Qq}{4\pi\varepsilon_0 r^2}$$

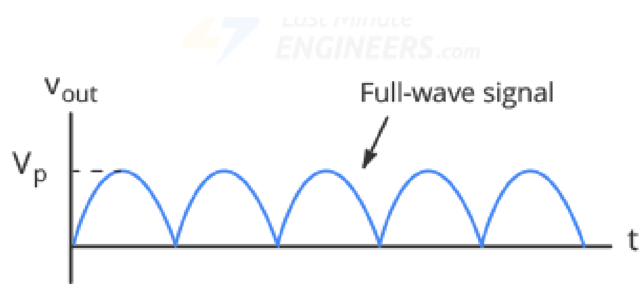
$$E = \frac{Qqr}{4\pi\varepsilon_0 r^2}$$

$$E = \frac{Qq}{4\pi\varepsilon_0 r}$$

Full-wave rectification

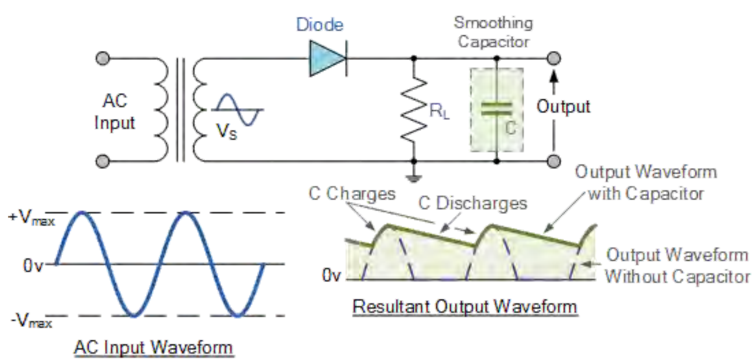
- Use 4 diodes (bridge rectifier)



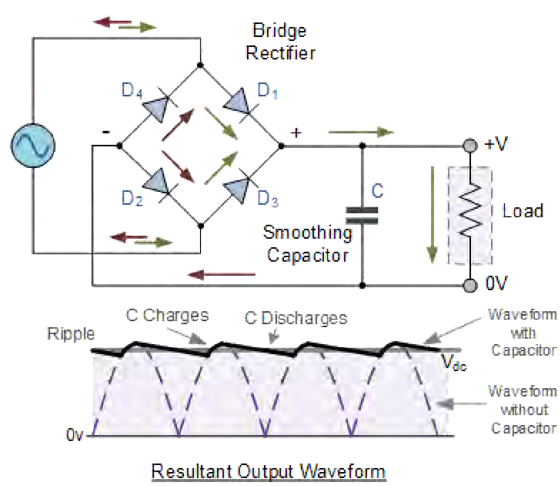


Smoothing

- Use a capacitor to reduce amount of ripple
- The capacitor charges and maintains the voltage as a.c. voltage rises, (first half of the wave)
- As the wave slopes downward, the capacitor begins to discharge in order to maintain the voltage
- **Half wave :**



- **Full wave :**



constant
- There is negligible absorption of this radiated power between the star and the Earth → energy radiated = energy received

<u>Radiant flux intensity/ density (F)</u>
- Radiant flux intensity = Luminosity/ surface area
- Unit : Wm^{-2}

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

$$F = \frac{L}{4\pi d^2}$$

<u>Standard candles</u>
- Source of light that has a known luminosity, without having to know its distance
- Example : Cepheid variable stars, Type Ia supernovae
- If we know the luminosity, we can estimates its distance from how bright it appears from Earth

25.2 Stellar radii
- recall and use Wien's displacement law $\lambda max \propto 1 / T$ to estimate the peak surface temperature of a star
- use the Stefan–Boltzmann law L = 4πσr^2^4
- use Wien's displacement law and the Stefan–Boltzmann law to estimate the radius of a star

TERMS	DEFINITION/ FORMULA
Black body	- An idealised object that absorbs all incident electromagnetic radiation
Wien's displacement law	- The black-body radiation curve for different temperatures will peak at different wavelengths that are inversely proportional to the temperature
Stefan-Boltzmann law	- The total energy radiated per unit time per unit surface area of a black body is proportional to the fourth power of its absolute temperature