ABIOTIC FACTORS - LIGHT

- Sun releases radiant energy in the form of **electromagnetic waves**
- solar energy Perceived by human eye is **Visible light**
- Visible light wave length is - 360 nm to 760 nm
- A large density of solar radiation measured outside Earth's atmosphere is called Solar constant
- Energy reaching the upper layers of atmosphere is fifty millionth part (1/50,000,000) 1.9g.cal, cm2/min.
- Incoming solar radiation that reaches the earth's surface is called Insolation
- Solar radiation reflected from the earth is - **Albedo**
- 51% of sunlight is available at the earth surface
- 49% of sunlight does not reach the earth's surface
- 4% of sunlight reflects back to space by the earth's surface
- 26% of sunlight is scattered or reflected to space by clouds and atmospheric particles
- 19% of sunlight is absorbed by atmospheric **gases**, particles and clouds

Factors on which insolation depends are

i. Angle of' incidence,
ii. length of the day and
iii. absorption of light rays by the layers of atmosphere
    - Average duration of light in equatorial region **is** 12 hours/day
    - Regions where light is available for 24 hours during, summer and 24 hours darkness during winter is **Tundra**
    - Depending on the **p**enetration of light Ocean water and large lakes are divided into three regions
    - The three zones are Euphotic, Dysphotic and Aphotic zone
    - The zone that extends upto the depth of 80 m from surface is **Euphotic zone**
    - Aquatic vegetation, phytoplankton and number of animals depending upon plants are abundant in **Euphotic zone**
    - The zone that extends from the depth of 80 m to 200 m is **Dysphotic zone**
    - The zone where limited photosynthetic activity occurs is **Dysphotic Zone**
    - The light rays that are predominant beyond 100 metres are Blue **light rays**

The different depths at which light rays are absorbed by water are

Red - first 4 metres **Orange -** first **20** metres

Yellow - first **50** metres **Green and violet** -first 100 metres

- The region without light and is deeper than 200 meters' is **Aphotic zone**
- Photosynthetic plants are totally absent in **Aphotic zone**
- BIOLOGICAL EFFECTS OF LIGHT Effect on the pigmentation of animals
- Less pigmentation found in cave dwelling animals **is** because of non - **Exposure to light.**
- Dark skin colour of human beings living **in tropical** regions is because of - **the exposure to greater intensity of light**
- **Less pigmented skin is the character of people living in -** temperate regions

Effect of light on movement

- Movement of the entire organism in response to light is - Phototaxis
- Oriented locomotor movements of an animal in response to light is termed - Phototaxis
- Movement of Euglena towards the source of light is - Positive phototactic
- Movement of animals like earth worms, planarians cockroaches away from the light source is Negative phototaxis

- Non directional movement in which the rate of movement is related to intensity of stimulus is termed **Photokinesis**
- **Example for photokinesis –** Larvae of mussel crab **(Pinnotheres maculatus)**

Effect of light on behavior

- **Animals which move about during daytime and take rest during night time are -** Diurnal animals

- **Animals which are active during night time and takerest during daytime ure -** Nocturnal animals Effect of light on metabolism
- Increase in the intensity of light causes the - Increase the rate of metabolism
- Metabolic rate of cave dwelling animals is less as they live in - Darkness

Ultraviolet Rays

Wave length of ultraviolet rays is less than 380 nm

- Wave length of UV - C – I00 nm to 280 nm
- Wave length of UV - B - 280 nm to 320 nm
- Wave length of UV - A - 320 nm to 380 nm
- Lethal rays are - UV - C rays
- UV rays harmful to organisms - UV B
- Prolonged exposure to UV A rays causes skin cancers in man
- UV Rays - Help to convert the sterols of the skin in to Vitamin D.

BIOLOGICAL RHYTHMS

- Behavioural activities of living organisms that occurs at regular intervals at the same time are known as Biorhythms/Biological Rhythm:
- Biological rhythms with a periodicity of about 24 hrs are called -**Circadian rhythms**
- Emergence of fruit flies (Drosophila) from pupae at dawn, return of birds to their nests at dusk an examples of - **Circadian rhythms**

Correlation of some activities of organisms and the phases of the moon is called Circalunar Rhythms

- Example of lunar periodicity is the reproductive cycle of - Eunice viridis (Palaloworm)

  Swarming of palalo worms occurs during last quarter of lunar cycle in month of October and November to release eggs and sperms.

- Innate, (or) endogenous mechanism controlling biological rhythms are called - Biological clocks.
- Entrainer that sets or resets the biological clocks is light

Photoperiodism

- Duration of an organism's daily exposure to light is called - Photoperiod
- Growth and development or other responses of organisms to the length of photoperiod is called Photoperiodism
- Specific length of photoperiod is Critical photoperiod
- Reproductive action occurs when the photoperiod falls below the critical photoperiod in Short day animals
- An action will not occur until the photoperiod hac passed the length of critical photoperiod in Long day animals.
- Responses that occur in late summer or autumn due to changes in the length of photoperiod are called Circannual rhythm
- In insects, a period during which growth anc development is suspended due to adverse ' environmental conditions is called – Diapause
- Migratory behaviour in birds is an example of Photoperiodism
- The critical photoperiod is - 12.5 hours
- Size of testis gets affected by photoperiod in hamsters when critical photoperiod is longer than 12.5 hours
- Both the sexes of hamsters are synchronise because - Female has a similar day length of male.

Bioluminescence

- Cold light emitted by animals like jelly fish - *ctenophores, Chaetopterus , deep sea fishes, some protozoans* is called **-Bioluminescence**
- Heat cannot be produced in biological light due to the absence of **-Infra red rays.**
- Light is emitted by animals due to the presence of (protein- **Luciferin**
- Types of luceferin molecules are - **Six**
- Necessary reactants together form a unit called **Photoprotein**
- Photoprotein is triggered to produce light **by Calcium ions (Ca+2).**
- Luciferin + O_2 + Salt + ATP *Luaferase* → Oxyluciferin + H_2O + ADP + light