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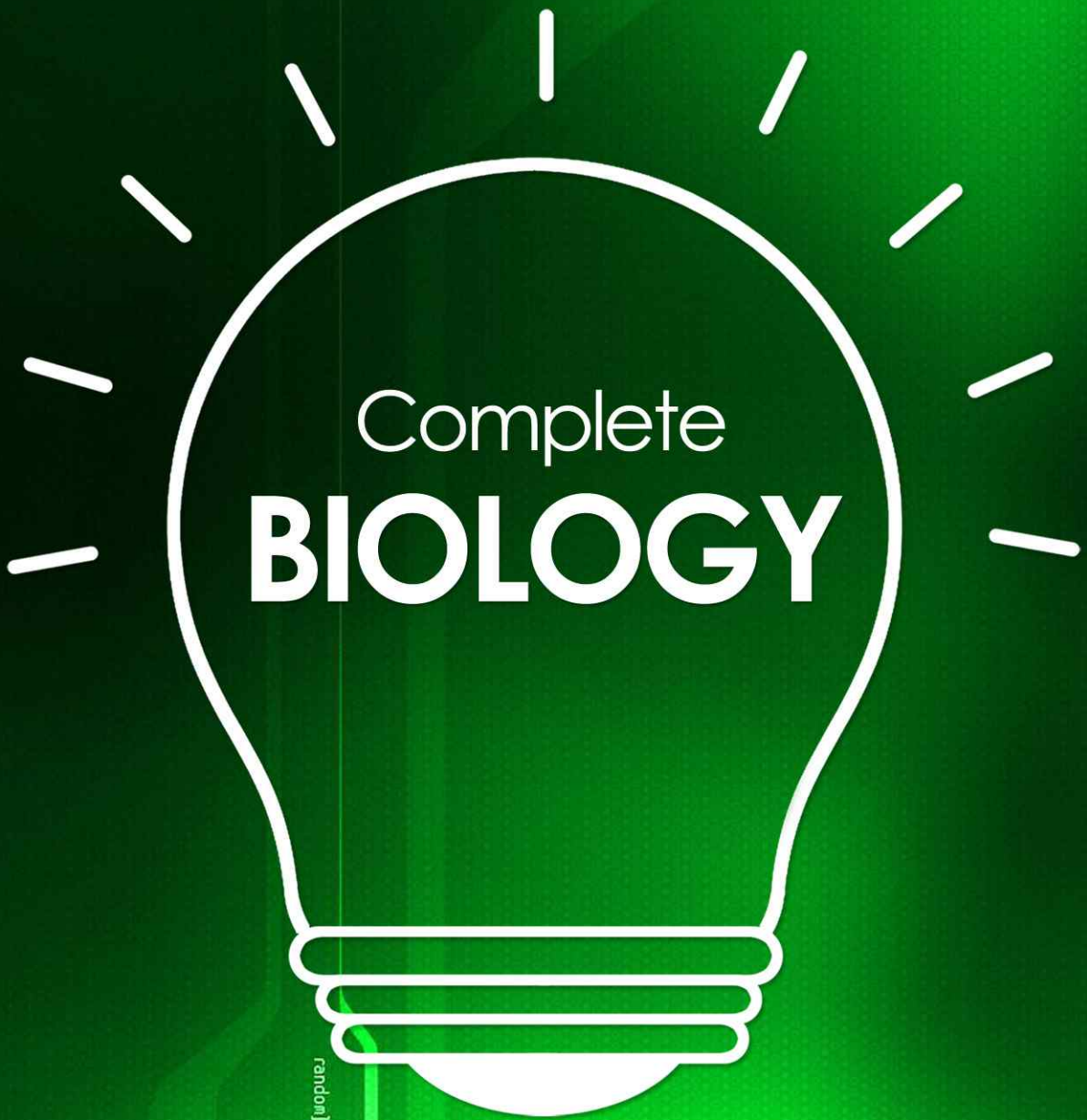

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CLASS 11th

Plant Growth and Development

01. Growth

Growth can be defined as an irreversible increase in size of an individual cell or organ or its parts. This increase occurs as a result of all the metabolic activities. These activities make use of energy obtained by nutrition. Growth occurs when there is synthesis of new materials inside or outside the cell.

Characterstics of growth

The characteristics of plant growth are as follows

(i) **Plant growth is indeterminate** Plants have the capacity of growing throughout their life. It is due to the presence of meristem tissue in them, which divide and self- perpetuate. Some plant structures such as leaves, flowers and fruits may show **determinate growth.** These grow upto a size and them undergo death.

(ii) **Growth is measurable** At cellular level growth is due to increase in amount of protoplasm. This leads to increase in cell number and size. These two broad parameters are used in calculating the growth. In detail, different parameters used for measuring the growth of plants are as follows

(a) Increase in cellular dimensions, i.e. length, diameter, surface area, etc.

(b) increase in dry and fresh weight, volume of cells.

02. Phases of Growth

In plants, growth occurs in three phases depending upon the region of its occurrence

(i) **Meristematic phase** It occurs in the meristematic regions, e.g. shoot apex and root apex. The cells in this phase can be easily differentiated from other cells. They have a dense protoplasm and a have a large nucleus. They possess a primary cell. wall. The cells divide actively and grows in number. The respiratory rate is higher.

(ii) **Elongation phase** Cells of this phase are found around the meristematic cells. These cells are highly vacuolated. Cell wall starts accumulating new material. These are lager then the other cells.

(iii) **Maturation phase** Cells of this phase undergo structural and functional differentiation and thus, these cells develops into a specialised tissue. After differentiation, no further growth occurs in them, e.g. xylem and phloem.

03. Types of Growth

Arithmetic growth

It is the growth of an organ or a part of a plant at a constant rate. In this type of growth, after mitosis two cells are formed. One of these cells, differentiate into a particular type of cell. The other one undergo further division again and again. In this way, growth progress in arithmetic manner, i.e. 2, 4, 6, 8, etc This type of growth is found in root and shoot elongation. On plotting the growth against time, a linear curve is obtained.

This growth can be expressed as

$$L_t = L_0 + rt$$

Where, L_t = Length of plant after time *t*,
L_0 = Length of plant at initial stage (time = 0),
t = Time taken for the growth,
r = Growth rate or elongation per unit time.

Geometric growth

In this type of growth, cell divides repeatedly to form many daughter cells and each cell divide again. This type of growth is common on microorganisms. Geometric growth rate when plotted against time, shows S-shaped curved. *This curve can be studied in following phases*

(i) **Lag phase** This phase represents the beginning of growth. Here the growth rate is very slow.

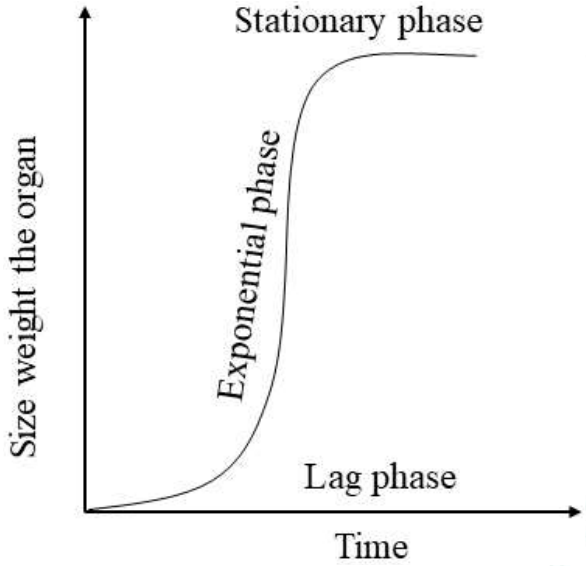
(ii) **Exponential or log phase** In this phase, growth occurs at a very hight rate, i.e. exponentially. Both parent and daughter cells divide repeatedly by utilising the available food.

(iii) **Stationary phase** Due to rapid growth, number of cells are more in this phase. It leads to shortage of food and space. Also, there is increase in toxin accumulation. Thus, growth becomes slow and constant. This is the stationary phase.

The geometric growth can be expressed as

$$W_1 = W_0 e^{rt}$$

Where, W_1 = final size, W_0 = initial size, *r* = growth rate (efficiency index), *t* = time and *e* = base of natural logarithm.



An idealised sigmoid growth curve typical of cells in culture and many higher plant and plant organs