HOW DO ORGANISMS REPRODUCE ?

INTRODUCTION

Reproduction is a process by which living organisms produce new individuals of their own kind and maintain their existence generation after generation.

Reproduction is not essential to maintain the life of an organism but it is essential to maintain life on earth and perpetuation of species from one generation to another.

Reproduction at its basic level (cellular reproduction) is involved in making similar or dissimilar body designs through the genetic material (DNA) present in the chromosomes of its nucleus.

DNA is the source of information for making proteins. Any change in the information leads to production of different proteins, which ultimately lead to altered body designs.

Basic event in reproduction is production of DNA copies in a reproducing cell. The process is called DNA replication. When the cell divides into two, each new cell gets a copy of each DNA or chromosome along with the whole cellular apparatus.

Complete accuracy in DNA copying leads to two exactly identical cells but any error in duplication can lead to dissimilar cells or variations.

The inbuilt tendency for variations during reproduction forms the basis for evolution.

Variations during reproduction enable the population of a species to get adapted easily to a particular inhabiting place/niche. Hence, reproduction is linked to the stability of populations of species.

Stronger variations are useful for the survival of species over time and enable the organisms to tide over any drastic alterations in their habitats.

IMPORTANCE OF REPRODUCTION

- (i) Maintenance of the existence :- Organisms are maintaining the existence on the earth since their origin, million years ago only because of reproduction.
- (ii) **Preservation of species :-** Species are preserved because of reproduction. It is possible because reproducing organisms produce new individuals which are very similar to themselves.
- (iii) Role in evolution :- Some variations are produced in the new organisms during reproduction which play an important role in evolution.

TYPE OF REPRODUCTION

There are two main methods of reproduction in living organisms.

- (1) Asexual reproduction.
- (2) Sexual reproduction.

(1) Asexual Reproduction :

Production of offsprings by a single parent without the formation and fusion of gametes is called **asexual reproduction**.

It is a primitive type of reproduction in which **offspring** is produced by a cell or any vegetative organ of an organism .

In this type of reproduction offsprings are genetically identical to their parents.



Modes of asexual reproduction are fission, budding, spore formation, fragmentation, regeneration and vegetative propagation.

- (i) Fission. It is a kind of asexual reproduction in unicellular organisms to create two new individuals. It can be of two types:
- (a) **Binary fission**. One cell splits into two equal halves, e.g., many bacteria and protozoa like *Amoeba*, *Paramecium* and *Leishmania*.



(b) **Multiple fission.** One cell divides into many daughter cells simultaneously, e.g., *Plasmodium* (malarial parasite), *Amoeba* in unfavourable conditions.

(ii) Budding : Process in which an outgrowth (bud) is formed on the body of parent organism which then detaches and become a new organism. e.g. Yeast and Hydra.



(iii) Spore formation : Spores are the microscopic asexual reproductive bodies with a thick wall. Spores are formed in 'sporangium'.

Each spore on germination give rise to a new organism e.g. Rhizopus, Penicillium.



(iv) Fragmentation : In this process an organism breaks up into two or more fragments and each fragment develops into an adult organism. e.g. Spirogyra.



- (v) Regeneration : The process of getting back a full organism from the body parts of the parent individual is called regeneration. Regeneration is carried out by specialised cells. *e.g. Hydra*, *Planaria*.
- (vi) Vegetative propagation : This is an asexual method of

reproduction in plants where vegetative parts namely root,

stem and leaves give rise to new plants.

Vegetative propagation is of two types :

- (A) Natural vegetative propagation
- (B) Artificial vegetative propagation.



(A)Natural vegetative propagation :

Plant reproduce without the help of human being.

By leaves : Leaves of some plants produce adventitious buds on their margin. Thus buds develop into new plants e.g. *Bryophyllum, Kalanchoe.*

By stem : In many plant, underground stems produce aerial shoots annually under favourable conditions **e.g.** Potato, Zinger, Onion, Grass.



• By roots : Roots produce adventitious buds which develops into new plants. e.g sweet potato.



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(B) Artificial vegetative propagation :

To prepare plants with desirable characters.

These are of four types.

(i) Cutting :

In this method small part of plant is cut and buried partly in the moist soil then cutting develops roots and grows into a new plant. e.g. Rose, Sugarcane, Potato, Cactus.



(ii) Grafting :

Two plants of closely related varieties are joined together so that they live as one plant.

The plant of which roots remain in the soil is called as stock.

Cutting part of a plant that is grafted on the other rooted plant is called scion.

e.g. Mango, Apple, Lemon.



(iii) Layering :

In this method a branch of the parent plant is buried in the soil.

The portion of the branch which is contect with the soil produces roots and this rooted branch is called **layer**.

Layer is then detached from the parent plant and act as a new plant. e.g. Jasmine, Hibiscus.



(iv) Tissue culture or micropropagation :

Cells or tissue which is isolated from the growing tip of plant called explant.

The explant develops into undifferentiated mass of cells called callus in the proper culture medium.

The callus is transferred to another medium containing hormones for growth and differentiation, that forms **plantlet**.

The plantlets are transplanted into pot or soil to form mature plant.

This technique is known as micropropagation. e.g. Orchids, Chrysanthemum.



ADVANTAGES OF VEGETATIVE PROPAGATION

It is a rapid, cheap and easy method of reproduction for the multiplication of plants.

Disease free plants can be produced.

Superior quality fruits or flowers can be produced by grafting.

Genetically identical plants are produced.

Plants raised by vegetative propagation can bear flowers and fruits earlier than those produce from seeds.

Do you know ?

In fission the organism have lost their parental identity while in budding they have maintained their identity.

Grafting is not possible in monocot plants.

Cambium activity is essential for the union of stock and scion.

Tissue culture is also called micro-propagation because a large number of plants are formed from a small tissue.

Virus free plants are produced by micropropagation.

REVIEW QUESTIONS

- 1. What is meant by reproduction ?
- 2. What are two general methods of reproduction in organisms ?

3. Give two examples of organisms which reproduce by budding.

- 4. What is meant by vegetative propagation ?
- 5. What are the advantages of vegetative propagation ?

6. What is grafting ? Mention any two advantages of grafting.

- 7. In which part of Bryophyllum vegetative propagation takes place ?
- 8. What is micropropagation ? Explain the process of micropropagation *in Vitro*.

(2) Sexual reproduction :-

It is a type of reproduction in which two different sexes (male and female) are involved. It involves the fusion of gametes from two different parents and results in the formation of new organism, which is genetically different from the parent.

Differences between asexual and sexual reproduction							
S. No.	Features	Asexual reproduction	Sexual reproduction				
1	Number of parents involved	One	Two				
2	Resemblance with parents	Organisms produced resemble exactly with the parent.	Organisms do not resemble exactly with the parent but resemble in certain features with both the parents.				
3	Type of cell divisions	Amitotic / mitotic.	Mitotic and meiotic both are present.				
4	Time duration for multiplication	Takes less time.	Takes more time.				
5	Variations	Variations are absent.	Variations are present.				
6	Adaptability	Organisms produced have less adaptability.	Organisms produced have more adaptability.				
7	Examples	Fission, budding, vegetative propagation.	Human beings, higher plants.				

SEXUAL REPRODUCTION IN FLOWERING PLANTS

Sexual reproduction takes place through the agency of flowers in angiosperms (flowering plants).

Flower is a specialized condensed reproductive shoot of flowering plants on which the essential reproductive parts are inserted.

A typical flower has four whorls arranged on the thalamus.

1. Calyx

Non essential organs

2. Corolla

Essential organs

4. Gynoecium

3. Androecium



1. CALYX

It is the outermost whorl consisting of sepals.

Sepals are green and leaf like structure.

Calyx protect the flower bud before it opens.



2. COROLLA

It is the second whorl, inner to calyx, consisting of petals.

Petals are generally large, coloured and showy.

Corolla attract insects for pollination.

3. ANDROECIUM

It is the third whorl, inner to corolla, consisting of male reproductive parts called stamens.

Each stamen has two parts - Filament and anther.

Anther is lobed structure present at the tip of filament. Each anther has pollen sacs (microsporangia) which contain pollen grains (microspores).

Each pollen grain produces two male gametes/ male germ cells.



4. GYNOECIUM

It is the fourth and innermost whorl consisting of carpels.

Carpel is present in the centre of flower.

Each carpel has three parts - Ovary, Style and Stigma.

Ovary is a swollen basal part of carpel. It contains ovules which are attached to placenta.

Each ovule contain an embryosac that bears a haploid egg (female gamete).

Style is the middle part of the carpel. It has stigma above it and ovary below it.

Stigma is the apical part of carpel. It receives pollen grains.



Do you know ?

Perianth :- If both sepals and petals are coloured and can not be distinguished from each other, then their whorl is known as **perianth**.

Calyx and corolla are non essential parts of the flower because they are not directly involved in reproduction.

Bisexual flower :- When the male and female reproductive parts are present in the same flower are called bisexual flower e.g. **Hibiscus**, Mustard.

Unisexual flower :- When the male and female reproductive parts are present in different flowers.

e.g. : Papaya, Date palm, Mulberry, Gourd, Water melon.

POLLINATION

Process in which pollen grains are transferred from the ripe anther to the stigma. It is of two types :

(i) Self pollination :- It is the transfer of pollen grains from an anther to the stigma of the same plant. If it is in the same flower it is called **autogamy** (e.g. **Pea**) and if it is between flowers of the same plant then it is called **geitnogamy** (e.g. **Oxalis**).

(ii) Cross pollination :- It is the transfer of pollen grains from anther to the stigma of different plants of the same species (e.g. Mango).

Agencies of pollination :- Transfer of pollen from one flower to another is achieved by agents like wind, water, animals, insects and birds.



Bats (Chiropterophily) Birds (Ornithophily) Insect (Entomophily) Water (Hydrophily) Wind (Anemophily)

Significance of bright colour of flower :- The bright colour of flowers is meant to attract insects which help in pollination. White colour shine in dark which attracts insects at night. Similarly, bright colour day-blooming flowers attract insects.

FERTILIZATION

Fertilization is the process of fusion of the male and female gametes, which takes place in the **embryo sac** present in the ovule.

After pollination, pollen grains germinate on the stigma by producing pollen tube.

The nucleus in the pollen tube divides into two male gametes.

Pollen tube penetrates the stigma and passes through the style and enters the ovule through micropyle.

It releases two male gametes in embryo sac.

One male gamete fuses with egg cell and second male gamete fuses with the two polar nuclei.

One male gamete + Egg cell $\xrightarrow{Syngamy}$ Zygote.

Second male gamete + Two polar nuclei $\xrightarrow{\text{Triple fusion}}$ Triploid nucleus (Primary Endosperm Nucleus) Syngamy + Triple fusion = Double fertilization.





- 1. Name the various parts of flower.
- 2. Write the name of non essential parts of flowers.
- 3. Write the name of parts of stamen and carpel.
- 4. Name the swallon part of carpel.
- 5. Describe the unisexual and bisexual flower.
- 6. Fertilization takes place in which part of ovule.

EXERCISE # 1

FOR SCHOOL EXAMS.

OBJECTIVE QUESTIONS

1.	Vegetative propagation in Bryophyllum takes place by :-								
	(A) stem	(B) leaf	(C) root	(D) none of these					
2.	The group of petals is called :-								
	(A) sepals	(B) calyx	(C) root	(D) None of these					
3.	During grafting, the por	During grafting, the portion of plant that is grafted is called :-							
	(A) stock	(B) scion	(C) stalk	(D) stem					
4.	In roses, the method co	mmonly used to produce	new plants is :-						
	(A) tissue culture	(B) cutting	(C) layering	(D) None of these					
5.	Pollen grains are produced by :-								
	(A) ovary	(B) anther	(C) stigma	(D) petal					
6.	Which one is applicable	to insect pollinated flowe	ers :						
	(A) Flowers are very small produced in large quantities.								
	(B) Flowers are not pror	ninent and without nectar							
	(C) Flowers are conspicuous and scented having nectar.								
	(D) None of these								
7.	The group of sepals is called :-								
	(A) gynoecium	(B) calyx	(C) corolla	(D) androecium					
8.	Maize is :-								
	(A) self pollinated		(B) cross pollinated by ra	ain					
	(C) cross pollinated by ir	nsects	(D) cross pollinated by wind						
9.	Which of the following	produces male gametes ir	n a flower :-						
	(A) sepals	(B) petals	(C) carpels	(D) stamens					
10.	During pollination, polle	n grains get carried to w	hich part of the carpel ?						
	(A) Ovary	(B) Stigma	(C) Ovule	(D) Style					
11.	At the time of entering into ovule, pollen tube has :-								
	(A) three male nuclei	(B) two male nuclei	(C) one gamete nucleus	(D) four male gamets					
12.	The transfer of pollen grains from anther to stigma is termed :-								
	(A) ovulation	(B) double fertilization	(C) pollination	(D) fertilization					
13.	Fertilization in plants oc	curs in the :-							
	(A) embryo sac	(B) style	(C) pollen tube	(D) stigma					
14.	Stem cutting are commo	only used for propagation	in :-						
	(A) mango	(B) jasmine	(C) cotton	(D) sugarcane					
15.	Vegetative reproduction	in plants like citrus, jasm	ine and grapevine is done	e by the process of :-					
	(A) stem layering	(B) stem cutting	(C) stem grafting	(D) none of these					

BIOLOGY

16.	Asexual reproduction	are :								
	(A) Fission			(B) l	Budding					
	(C) Vegetative propagation			(D)	(D) All of these					
17.	Binary fission occurs	in :								
	(A) <i>Plasmodium</i>	(B) Hyd	lra	(C) .	Pomegranate	(D) <i>Amoeba</i>				
18.	Multiple fission occur	s in :								
	(A) <i>Euglena</i>	(B) Yeas	st	(C) I	Plasmodium	(D) Paramecium				
19.	In which of the follow	wing reprodu	iction parental i	dentity	is lost :					
	(A) Budding	(B) Bina	ry fission	(C) I	Multiple fission	(D) Both B and C				
20.	Which of the followin	ng organisms	shows budding	:						
	(A) Spirogyra	(B) <i>Hyd</i>	Ira	(C) 4	Amoeba	(D) Paramecium				
FILL	IN THE BLANKS :									
1.	In <i>Rhizopus</i> asexu	al reproduct	ion takes place	by	formatic	on.				
2.	In <i>Bryophyllum</i> ve	egetative pro	pagation takes	place	through their					
3.	The process in wl	hich new org	ganisms are form	ned by	existing organism	n is called				
4.	In <i>Spirogyra</i> , asex	kual reprodu	ction, takes pla	ce by						
5.	Natural vegetative	propagation	n takes place in	sweet	potato by					
6.	In me	ethod a bran	ch of parent pl	ant is	buried in the soil.					
7.	In me	ethod a cut	ting part of a p	lant is	grafted on the ot	her plant part.				
8.	Unorganised mass	s of cells is l	nown as	•••••						
9.	Tissue culture is a	lso known a	s							
10.	Grafting is not po	ssible in	plants.							
11.	All floral leaves at	re placed on	the	of fl	ower.					
12.	Stalk of flower is	known as	•••••							
13.	prote	cts the flowe	er bud before it	opens						
14.	If both sepals and petals are coloured can not be distinguished from each other then their whorl is known									
	as									
15.	Each stamen has	two parts fil	ament and	•••••	. .					
16.	Each pollen grain	produces	male	game	tes.					
17.	A carpel has three parts ovary, and stigma.									
18.	is a swollen basal part of carpel.									
19.	of carpel recieves pollen grains.									
20.	Second male gamete + Two polar nuclei =									
MAT										
			Column I	l						
	(a) Calyx	(i	Ovary							
	(b) Corolla	(i	i) Sepal							

Stigma

Filament

Petal Anther

(iii)

(iv)

(v) (vi)

Stamen

Carpel

(c)

(d)

VERY SHORT TYPE QUESTIONS :

- **1**. Mention the reproductive parts of a flower.
- 2. Which parts of plants can grow vegetatively ?
- **3.** What is the function of pollen grains in flowers ?
- 4. What is the other name of (i) Calyx (ii) Corolla (iii) Androecium (iv) Gynoecium ?
- 5. Give one example of each plant which propagates artificially by (a) cutting, (b) layering.
- 6. Which vegetative part is used in the propagation of *Bryophyllum* ?
- 7. What is stock in grafting ?
- 8. Name the agencies through which cross-pollination take place.
- 9. Name two abiotic agents of pollination.
- 10. Which group of plants shows double fertilisation ?

HOW DO ORGANISMS REPRODUCE			AN	SWER	KEY			EXE	RCISE # 1			
•	• Objective Question :											
	Q.No.	1	2	3	4	5	6	7	8	9	10	
	Ans.	В	D	В	В	В	С	В	D	D	В	
	Q.No.	11	12	13	14	15	16	17	18	19	20	
	Ans.	В	С	А	D	А	D	D	С	D	В	
•	Fill In Th	e Bnalks :										
	1 . spo	ore	2 . leat		3.	reproducti	on 4 .	fragme	ntation	5.	root	
	6. lay	ering	7 . gra	fting	8.	callus	9.	microp	ropagatio	n 10 .	monoco	t
	11. tha	lamus	12 . pec	licel	13.	calyx	14.	periant	:h	15.	anther	
	16. two)	17. styl	6	18.	ovary	19.	. stigma				
	20. primary endosperm nucleus											
•	Матсн тн	e followin	1G :									
	Ans. (a) - ii, (b) - iv (c) - v, vi (d) - i, iii											
•	• Very Short Answer Type Questions :											
	1.	Stamen a	nd carpel		2.	Root, ster	n and lea	ves				
	3. It produces male gametes which fertilizes the egg cell											
	4.	(i) Sepal,	(ii) Petal,	(iii) Stame	n, (iv) Ca	arpel		5. (a)	Rose, (b)	Jasmine		
	6.	leaf	7.	Rooted pl	ant is cal	lled stock	:	8 . Wa	ter, Wind,	, Insect, B	ird, Man	
	9.	Water and	d Wind		10.	Angiosper	ms					

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EXERCISE # 2

FOR SCHOOL EXAMS.

SHORT TYPE QUESTIONS :

- 1. What methods will you use for growing jasmine and rose plant ?
- 2. Leaves of Bryophyllum fallen on the ground produce new plants whereas the leaves of rose do not. Why?
- **3.** What are the two possibilities of self-pollination ?
- 4. What are the advantages of tissue culture ?
- 5. Why is cross-pollination considered to be superior than the self-pollination ?
- 6. List two main advantages of sexual reproduction.
- 7. 'Grafting is a common method of obtaining a superior plant from two different plants'. Explain.
- 8. Describe about the different parts of a stamen in male reproductive organ of a plant.
- 9. What is vegetative propagation ? Classify it along with examples.
- 10. How are these ornamental plants propagated ? Mention the name of the method :

(i) Jasmine (ii) Rose (iii) *Bougainvillea* (iv) *Hibiscus*

LONG ANSWER TYPE QUESTIONS :

- 1. Define the terms unisexual flower and bisexual flower giving one example of each.
- 2. Explain double fertilisation in plants.
- 3. What is vegetative propagation ? When is it used ? Name three methods of vegetative propagation.
- 4. Differentiate between 'self-pollination' and 'cross-pollination'.
- 5. Draw a diagram of a flower to show its male and female reproductive parts. Label on it :
 (i) The ovary
 (ii) The anther
 (iii) The filament
 (iv) The stigma
- 6. Draw a labelled diagram of the longitudinal section of a pistil showing pollen germination.
- 7. Give two advantages of vegetative propagation.
- **8.** What is pollination ? Describe cross-pollination.

NCERT QUESTIONS

- 1. What is the importance of DNA copying in reproduction ?
- 2. Why is variation beneficial to the species but not necessary for the individual ?
- 3. How does binary fission differ from multiple fission ?
- 4. How will an organism be benefited if it reproduces through spores ?
- 5. Can you think of reasons why more complex organisms can not give rise to new individuals through regeneration?
- 6. Why is vegetative propagation practiced for growing some types of plants ?
- 7. Why is DNA copying an essential part of the process of reproduction ?
- 8. How is the process of pollination different from fertilisation ?
- 9. What are the advantages of sexual reproduction over asexual reproduction ?
- 10. Draw a labelled diagram of the longitudinal section of a flower.
- 11. How are the modes of reproduction different in unicellular and multicellular organisms ?
- 12. How does reproduction help in providing stability to population of species ?

EXERCISE # 3

COMPETITIVE EXAMS.

11

А

12

В

10

С

1.	If the pollen is transferred to the stigma of the same flower, it is termed :-					
	(A) allogamy	(B) geitnogamy	(C) autogamy	(D) all of these		
2.	Which part of the flow	ver forms the fruit ?				
	(A) Whole flower		(B) Only stamens and ca	rpel		
	(C) Only ovary		(D) Only carpel			
3.	In angiosperm after th	e fertilization endosperm	become :-			
	(A) Haploid	(B) Diploid	(C) Triploid	(D) Tetraploid		
4.	After fertilization ovule	grows into :-				
	(A) seed	(B) fruit	(C) placenta	(D) None		
5.	Which is not a part of	f carpel :-				
	(A) Stigma	(B) Ovary	(C) Anther	(D) Style		
6.	Nucleus of the bud is	formed by the division o	f :			
	(A) Meiosis	(B) Amitosis	(C) Mitosis	(D) All of these		
7.	Clones are formed as					
	(A) Budding		(B) Regeneration			
	(C) Vegetative propaga	ation	(D) All of them			
8.	Malarial parasite reproduces by :					
	(A) Multiple fission	(B) Binary fission	(C) Budding	(D) Regeneration		
9.	The outgrowth of Hydra is termed as :					
	(A) Bulb	(B) Bud	(C) Daughter <i>Hydra</i>	(D) Tentacles		
10.	Asexual reproduction takes place by the process of budding :					
	(A) <i>Plasmodium</i>	(B) Amoeba	(C) Yeast	(D) <i>Rhizopus</i>		
11.	1. Asexual reproduction involves :					
	(A) Only one parent	(B) Two parent	(C) Meiosis and syngamy	(D) Fusion of two gametes		
12.	Which is a part of stamen :-					
	(A) Stigma	(B) Filament	(C) Style	(D) None		
		ANSWE	R KEY			

5

С

7

D

8

Α

9

В

6

С

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Q.No.

Ans.

1

С

2

С

3

С

4

А