



## CHAPTER - 1

# REPRODUCTION IN ORGANISMS

**Reproduction:** It is defined as a biological process in which an organism gives rise to young ones that is OFFSPRINGS similar to itself. The offspring's grow, mature and in turn produce new offspring's thus there is a cycle of birth, growth, and death. Reproduction enables the continuity of the species generation after generation.

**Life span:** the period from birth to the natural death of an organism is called life span, it is different for different organisms. E.g for a crow it is 15 years, parrot it is 140 years.

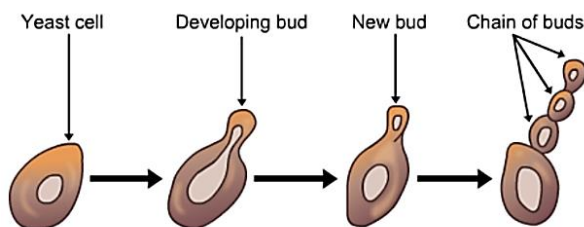
**Reproduction is of two types:**

**Asexual reproduction:** in this method a single individual is capable of producing offspring due to which the offspring that are produced are not only identical to one another but are also exact copies of their parent, the term **clone** is used to describe such morphologically and genetically similar individuals.

e.g. in Monera and Protista a division in the cell gives rise to two new individuals. In these organisms, there is no other method of reproduction, cell division is the method of reproduction itself.

### Types of asexual Reproduction:

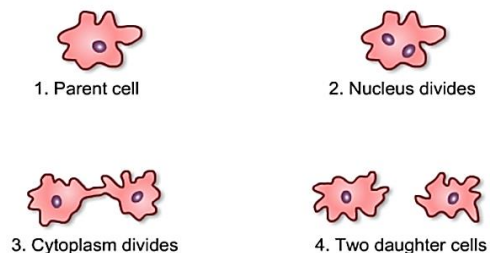
- (a) **Binary Fission:** A cell divides into two halves and swiftly develops into an adult in this type of asexual reproduction. *Amoeba* and *paramecium* are examples.
- (b) **Budding:** Small buds are formed, wn linked to the parents at first but detach as they mature. Yeast is an example.



### Budding in yeast

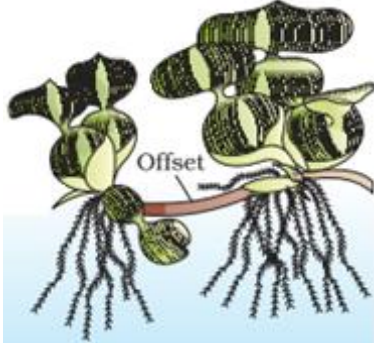
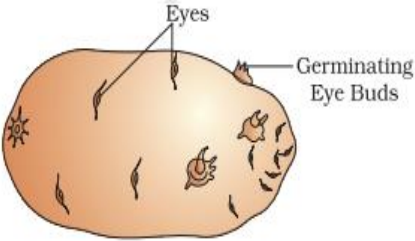
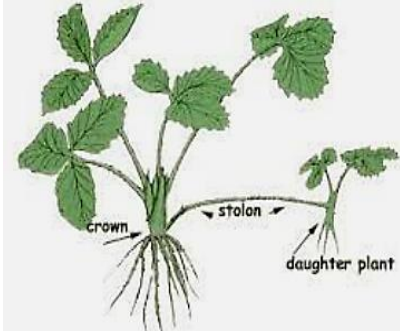

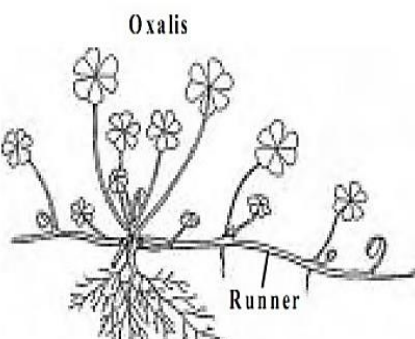
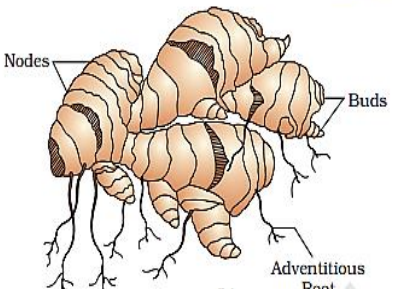
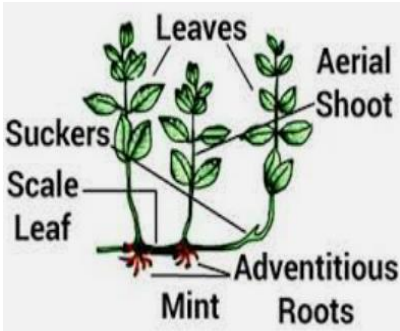
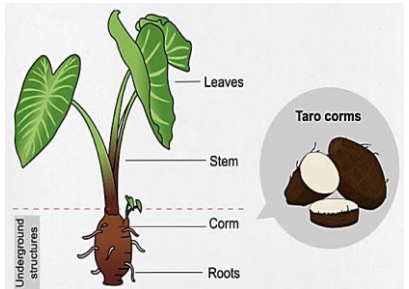
Some fungi and simple plants, such as algae, reproduce through specialised reproductive structures such as **zoospores (motile structure)**, **conidia (penicillium)**, **buds (hydra)**, and **gemmules (sponges)**.

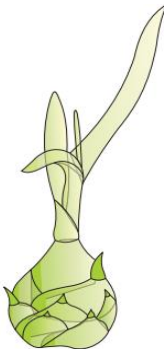


Vegetative propagules such as **runner**, **rhizome**, **sucker**, **tuber**, **offset**, and **bulb** are responsible for vegetative reproduction in plants.



### Binary fission in amoeba

Have a look at the vegetative parts responsible for vegetative propagation and examples associated with it.

Vegetative part responsible for vegetative propagation	Examples'	Vegetative part responsible for vegetative propagation	Examples'
<b>Stem</b>			
Offsets	<b><i>Pistia and Eichhornia</i></b> 	Tuber	<b>Potato and artichoke</b> 
Stolons	<b>Jasmine</b> 	Bulb	<b>Onion and garlic</b> 
Runner	<b><i>Oxalis</i></b> 	Rhizome	<b>Ginger, banana</b> 
Sucker	<b><i>Mint and Chrysanthemum</i></b> 	Corm	<b><i>Colocasia, Amorphophallus</i></b> 

Vegetative part responsible for vegetative propagation		Examples'	Vegetative part responsible for vegetative propagation		Examples'
Bulbil	<i>Agave, lily</i> 		Leaf	<i>Bigonia, Bryophyllum</i> 	
	Turions			<i>Utricularia</i> 	

## BRUSH UP YOUR KNOWLEDGE

**Q1.** The process by which Monerans and Protists give rise to new individuals.

- (a) Meiosis (b) Mitosis  
(c) Both (a) and (b) (d) None of the above

**S1. (b)** In Protists and Monerans, the organism or the parent cell divides by mitosis into two to give rise to new individuals.

**Q2.** Which of the following can be used in the commercial production of ginger?

- (a) Tuber (b) Rhizome  
(c) Offset (d) Bulbil

**S2. (b)** The vegetative propagule by which ginger propagates is the rhizome hence it can be used to for the commercial propagation of ginger.

### SEXUAL REPRODUCTION:

It is the mode of reproduction involving the fusion of haploid female gamete and a haploid male gamete.

Offspring resulting from the fusion of male and female gametes are not similar to one other or to the parents.

All sexually reproducing creatures reproduce in the same way.

In sexual reproduction, the union of male and female gametes produces children that are not genetically similar to their parents.

**Phases in sexual reproduction:** The following are the phases of sexual reproduction:

**(i) Juvenile phase:** all organisms have to reach to a certain stage of growth and maturity in their life before they can reproduce sexually. This period of growth is called juvenile phase. This phase is of variable duration in organisms.

**Note:** Juvenile phase in plants is called as vegetative phase.

**(ii) Reproductive phase:** The end of the juvenile phase marks the beginning of the reproductive phase and this can be seen easily in higher plants when they begin to flower.

**Note:** Some plants bloom just during a specific season, while others bloom all year. Other plants, such as bamboo species, blossom just once in their lives (after 50-100 years), while *Strobilanthus kunthiana* (neelakuranji), flowers only once every 12 years.

During the reproductive period, the **female placental mammals** demonstrate cyclic changes in ovaries, accessory glands, and hormone levels.

**Menstrual Cycle:** The cycle has three phases:

- Menstrual
  - Proliferative and
  - Secretory.
- Blood flow occurs in the latter days of the cycle. During menstruation, the damaged endometrium is expelled.
  - Females are not allowed to copulate throughout the menstrual cycle. e.g. Monkeys, apes, and humans

**Oestrous cycle:** It is characterised by a brief period of oestrous or heat. In cows, it lasts 12-24 hours before the anoestrous/inactive phase begins.

- Blood flow does not occur.
- The ruptured endometrium gets reabsorbed.
- Copulation takes place only in this period.
- Hormones are responsible for the transition between distinct stages of the life cycle in both plants and

animals. Hormones and environmental variables interact to control reproductive processes.

**(iii) Senescent phase:** The phase is characterised by end of the reproductive phase and old age.

**Continuous breeders:** many mammals are reproductively active throughout the reproductive phase and hence are called continuous breeders.

### Events in sexual Reproduction

Sexual reproduction is characterized by the fusion or fertilization of the male and the female gamete leading to the formation of zygote and thereafter embryogenesis, to ease the study, all these events are divided into three stages:

- (i) Pre-fertilization
- (ii) Fertilization
- (iii) Post-fertilization events

**Let's have a look at these quickly:**

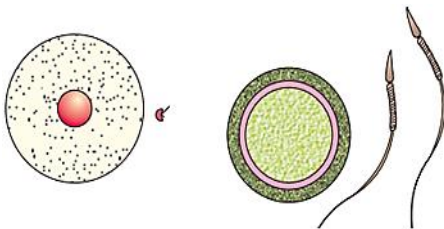
**Pre-fertilisation events:** It includes gametogenesis and gamete transfer.

#### Gametogenesis:

- ✓ is the process through which male and female gametes are formed.
- ✓ Gametes are haploid cells with structures that might be identical or distinct.
- ✓ Both gametes in algae are structurally identical and are referred to as homogametes (isogametes).



**Isogametes of cladophora**



**Heterogametes of Fucus and human beings**

- ✓ In higher organisms that reproduce sexually, two morphologically different gametes called heterogametes are generated, male gametes called antherozoid or sperm and female gametes named ovum or egg.

**Hermaphrodites:** species in animals that have both male and female organs present on the same individual are called hermaphrodites. E.g. earthworm, sponge and tapeworm. They are bisexual.

**Unisexual:** some are either male or female, they are unisexual. E.g. cockroach.

Although organisms can be haploid or diploid, gametes are always haploid (containing half a pair of chromosomes).

Diploid creatures produce gametes by meiotic division.

In diploid organisms, gamete mother cell (**meiocyte**) conducts meiosis, in which one pair of chromosomes is present in gametes.

## BRUSH UP YOUR UNDERSTANDING

- Q1.** A universal feature in all the sexually reproducing organisms is.
- |                         |                               |
|-------------------------|-------------------------------|
| (a) Transfer of gametes | (b) Formation of embryo       |
| (c) Formation of zygote | (d) Differentiation of zygote |

- S1. (c)** Zygote is the vital link that ensures the continuity of species between organism of one generation and the ext, it is a unique feature in all the sexually reproducing organisms.

**Viviparous:** the zygote develops inside the body of the female. After the development is complete, the young one is delivered outside the body.

**Chances of survival are greater in viviparous animals.**

**In flowering plants:**

Zygote is formed inside the ovule.

**Fate of flower structures after fertilisation:**

After fertilisation is complete, the stamens, petals, sepals fall off.

Zygote develops into an embryo.

Ovule develops into seed.

Ovary develops into fruit that has a thick wall around called as pericarp that is protective in function.

After dispersal, the seed germinated into a new plant.

### BRUSH UP YOUR UNDERSTANDING

- Q1.** During embryogenesis, the zygote undergoes.  
(a) Meiosis (b) Mitosis  
(c) Both (a) and (b) (d) None of the above

**S1. (b)**

- Q2.** Which part of the flower after fertilisation is complete develops into a fruit?  
(a) Ovule (b) Ovary  
(c) Sepal (d) Petal

**S2. (b)**

## SUMMARY

Life span is the period from birth to the natural death of an organism represents its life span.

Whatever be the life span, death of every individual organism is a certainty, i.e., no individual is immortal, except single-celled organisms.

Reproduction a biological process in which an organism gives rise to young ones (offspring) similar to itself. Reproduction enables the continuity of the species, generation after generation. Reproduction is of two types:

When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is **asexual**. Asexual reproduction is common among single-celled organisms, and in plants and animals with relatively simple organisations. Binary fission, budding, specialised spores like zoospores are modes of vegetative reproduction. In plants, it takes place via special vegetative propagules like runner, rhizome, sucker, tuber, offset and bulb.

When two parents (opposite sex) participate in the reproductive process and also involve fusion of male and female gametes, it is called **sexual** reproduction. Sexual reproduction involves pre-fertilisation (gametogenesis, gamete transfer), fertilisation and post-fertilisation (formation of zygote, embryogenesis) events.

The period of growth is called as juvenile phase and in plants it is called vegetative phase the end of which marks the beginning of reproductive phase.

The females of placental mammals exhibit cyclical changes in the activities of ovaries and hormones.

Organisms can be bisexual or unisexual.

Gametes are haploid and are produced by meiotic divisions.

In sexually reproducing organisms there occurs transfer of gametes, the same occurs in unisexual organisms by either copulation or simultaneous release and in plants (angiosperms) by pollination.

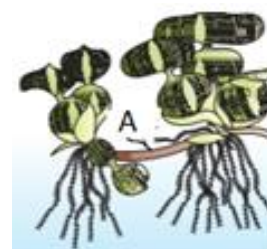
## IMPORTANT POINTERS

- Reproduction enables the continuity of the species, generation after generation.
- The offspring's produced by asexual reproduction are called clones.
- Binary fission (*Amoeba*, *Paramecium*), fragmentation (*Hydra*, planaria)
- Budding (*Yeast*), conidia (*Penicillium*), buds (*Hydra*) and gemmules (*sponge*).
- Tuber (potato), rhizome (ginger), bulbil (*Agave*), adventitious buds (*Bryophyllum*), offset (*water hyacinth*-Terror of Bengal).
- Bamboo species and *Strobilanthus kunthiana* (neelakuranji) exhibit unusual flowering phenomenon.
- Oestrus cycle occurs in cows, sheep, rats, deers, dogs, tiger and in primates (monkeys, apes, and humans) it is called menstrual cycle.
- Gametogenesis refers to the process of formation of the two types of gametes – male and female.

- Earthworms, sponge, tapeworm and leech bisexual (hermaphrodites) and cockroach are unisexual.
- In rotifers, honeybees and even some lizards and birds (turkey), the female gamete parthenogenesis.
- In algae, fish and amphibians, fertilisation occurs in water (external).
- In fungi, higher animals such as reptiles, birds, mammals and in a majority of plants (bryophytes, pteridophytes, gymnosperms and angiosperms), fertilisation is internal.
- Embryogenesis refers to the process of development of embryo from the zygote.
- Reptiles and birds are oviparous and majority of mammals and humans are viviparous.
- In plants, after fertilisation, the zygote develops into the embryo and the ovules develop into the seed ovary forms fruit.

## MULTIPLE CHOICE QUESTIONS

- Q1.** Which of the following is correct about reproduction in organisms?  
 (a) It is a chemical process  
 (b) It is a biological process  
 (c) It is a mechanical process  
 (d) It is a physical process
- Q2.** Which of the following is correct about the term "clone"?  
 (a) It is a term used to describe organisms that are morphologically similar.  
 (b) It is a term used to describe organisms that are genetically similar.  
 (c) It is a term used to describe organisms that are morphologically and genetically similar.  
 (d) None of the above
- Q3.** Which among the following process enables the continuity of species, generation after generation?  
 (a) Digestion (b) Reproduction  
 (c) Respiration (d) Excretion
- Q4.** Which of the following organism reproduces through gemmules?  
 (a) Hydra (b) Sponge  
 (c) *Penicillium* (d) Amoeba
- Q5.** Which among the following are the units of vegetative reproduction in plants?  
 (a) Offset (b) Bulb  
 (c) Conidia (d) Both (a) and (b)
- Q6.** Which of the following is correct about 'water hyacinth'?  
 (a) It is also called as pride of Bengal.  
 (b) It is also called as terror of Bengal.  
 (c) It is also called as victory of Bengal  
 (d) It is also called as glory of Bengal
- Q7.** Which of the following vegetatively propagates through the adventitious buds?  
 (a) Potato (b) Sugarcane  
 (c) Bryophyllum (d) Ginger
- Q8.** Which of the following is correct about monoecious plants?  
 (a) In such plants both male and female flowers are present on the same individual.  
 (b) In such plants only a male flower is present in an individual.  
 (c) In such plants both male and female flowers are present on the different individual.  
 (d) In such plants only female flower is present in an individual.
- Q9.** Which of the following is correct about syngamy?  
 (a) It is the process of fusion of eggs  
 (b) It is the process of fusion of gametes  
 (c) It is the process of fusion of zygotes  
 (d) It is the process of fusion of sperms
- Q10.** Which among the following organisms reproduces by parthenogenesis?  
 (a) Honeybee (b) Rotifers  
 (c) Lizards (d) All of the above
- Q11.** In which of the following organisms, syngamy occurs in water?  
 (a) Algae (b) Fishes  
 (c) Birds (d) Both (a) and (b)
- Q12.** Which of the following ensures continuity of species between organisms of various generations?  
 (a) Egg (b) Zygote  
 (c) Sperm (d) Embryo
- Q13.** Which of the following mode of asexual reproduction is adopted by amoeba during the unfavourable conditions?  
 (a) Budding (b) Binary fission  
 (c) Encystation (d) Sporulation
- Q14.** Below given is a diagram of water hyacinth, name "A" that is a vegetative reproductive structure marked in the diagram that it uses it for propagation.  
 (a) Adventitious buds  
 (b) Nodes  
 (c) Offset  
 (d) Sucker
- Q15.** Which of the following plant/plants uses rhizome for vegetative propagation?  
 (a) Sugarcane (b) Banana  
 (c) Ginger (d) Both (b) and (c)
- Q16.** Which among the following plant species flowers once in their life time?  
 (a) Mango (b) Bamboo  
 (c) Papaya (d) Banana



- Q17.** Which of the following plant flowers once in 12 years?  
 (a) *Ficus benghalensis*  
 (b) *Strobilanthus kunthiana*  
 (c) *Mangifera indica*  
 (d) *Tectona grandis*
- Q18.** Which among the following regulates the reproductive process and the associated behavioural expressions of organisms?  
 (a) Environmental factors (b) Genes  
 (c) Hormones (d) Both (a) and (c)
- Q19.** Which of the following organism produces isogametes?  
 (a) *Fucus* (b) *Cladophora*  
 (c) *Penicillium* (d) *Hydra*
- Q20.** Which of the following term is used to describe a unisexual condition in most plants and fungi?  
 (a) Monoecious  
 (b) Heterothallic  
 (c) Homothallic  
 (d) Pistillate
- Q21.** Imagine, what would be a unisexual male flower in a flowering plant?  
 (a) Pistillate (b) Haploid  
 (c) Staminate (d) Diploid
- Q22.** Which among the following are specialized mother cells that undergo meiosis?  
 (a) Myocytes (b) Meiocytes  
 (c) Gametocytes (d) None of the above
- Q23.** Which of the following event facilitates transfer of pollen grains from the anther to stigma of a flowering plants?  
 (a) Sporulation (b) Pollination  
 (c) Fertilisation (d) Parthenogenesis
- Q24.** Which of the following helps in the transfer of non-motile gamete to female gamete in seed bearing plants?  
 (a) Pistil (b) Pollen tube  
 (c) Style (d) Stigma
- Q25.** Which among the following is universal to all the sexually reproducing organisms?  
 (a) Haploid zygote (b) Haploid gamete  
 (c) Diploid zygote (d) Diploid gamete
- Q26.** Which of the following is correct about embryogenesis?  
 (a) It is the formation of embryo from male gamete

- (b) It is the formation of embryo from zygote  
 (c) It is the formation of embryo from an organism  
 (d) It is the formation of embryo from female gamete
- Q27.** Which of the following process helps group of cells to undergo certain modifications to form specialized tissues and organs and thus an organism during embryogenesis?  
 (a) Cell division (b) Meiosis  
 (c) Cell differentiation (d) Mitosis
- Q28.** Which of the following is correct about viviparous animals?  
 (a) Development of zygote takes place inside the body of male parent  
 (b) Development of zygote takes place inside an egg  
 (c) Development of zygote takes place inside the body of female parent  
 (d) Development of zygote takes place in an external medium like water
- Q29.** Where does the development of zygote takes place in plants?  
 (a) Flower (b) Stamen  
 (c) Ovule (d) Anther
- Q30.** Which of the following part of a flower forms fruit?  
 (a) Sepals (b) Petals  
 (c) Pericarp (d) Ovary
- Q31.** Which among the following is a monoecious plant?  
 (a) *Marchantia* (b) *Chara*  
 (c) Sweet potato (d) Onion
- Q32.** What are the number of chromosomes in meiocyte of housefly?  
 (a) 8 (b) 12  
 (c) 78 (d) 380
- Q33.** Which of the following organisms exhibit oestrus cycle?  
 (a) Apes  
 (b) Sheep  
 (c) Monkeys  
 (d) All of the above
- Q34.** Which of the following process gives rise to variations?  
 (a) Asexual reproduction  
 (b) Parthenogenesis  
 (c) Sexual reproduction  
 (d) Vegetative propagation

- Q35.** Which among the following sentence is correct about eyes of potato tuber?  
 (a) They are referred to flower of potato tuber  
 (b) They are referred to bud of potato tuber  
 (c) They are referred to leaf of potato tuber  
 (d) They are referred to stem of potato tuber
- Q36.** Which of the following organism reproduces by transverse binary fission?  
 (a) Amoeba (b) Euglena  
 (c) Paramecium (d) Hydra
- Q37.** What is the nature of gametes produced after meiosis in sexually reproducing organisms?  
 (a) Diploid (b) Haploid  
 (c) Tetraploid (d) Triploid
- Q38.** Which among the following organism shows the process of sporulation?  
 (a) Amoeba (b) Paramecium  
 (c) Plasmodium (d) Both (a) and (c)
- Q39.** In animals, which phase follows juvenile phase?  
 (a) Vegetative phase (b) Senescent phase  
 (c) Reproductive phase (d) None of the above
- Q40.** Which of the following is correct about sexuality of an earthworm?  
 (a) They are unisexual  
 (b) They are bisexual  
 (c) They are monoecious  
 (d) They are dioecious
- Q41.** Which among the following is a unisexual species?  
 (a) Sponge (b) Earthworm  
 (c) Cockroach (d) Tapeworm
- Q42.** Which among the following animals are hermaphrodites?  
 (a) Tapeworm (b) Leech  
 (c) Sponge (d) All of the above
- Q43.** What is the approximate life span of a crow?  
 (a) 1-2 weeks (b) 15 years  
 (c) 140 years (d) 150 years
- Q44.** In yeast, budding is.  
 (a) Equal (b) Unequal  
 (c) Multiple (d) In a plane
- Q45.** Other than budding, which of the following mode is adopted by hydra for reproduction?  
 (a) Encystation (b) Sporulation

- (c) Fragmentation (d) Fission

- Q46.** Which among the following acts as a medium for the transfer of gametes in simple plants like algae, bryophytes and pteridophytes?  
 (a) Wind (b) Water  
 (c) Birds (d) Insects
- Q47.** Which of the following event is/are pre-fertilisation event/event/s?  
 (a) Embryogenesis (b) Gametogenesis  
 (c) Gamete transfer (d) Both (b) and (c)
- Q48.** What is the disadvantage of external fertilization?  
 (a) Off-springs are extremely vulnerable  
 (b) Survival up-to adulthood becomes difficult  
 (c) Off-springs produced are in large number  
 (d) Both (a) and (b)
- Q49.** Minute amoeba produced by multiple fission are called.  
 (a) Spores (b) Pseudopodiospores  
 (c) Buds (d) Fragments
- Q50.** Which of the following is correct about gemmules, zoospores, conidia and buds?  
 (a) They are special sexual reproductive structures of kingdom fungi and simple plants  
 (b) They are special vegetative reproductive structures of kingdom fungi and simple plants  
 (c) They are special asexual reproductive structures of kingdom fungi and simple plants  
 (d) They are special protective structures of kingdom fungi and simple plants

### ASSERTION AND REASON

**Direction:** in the following questions, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct option among a, b, c and d.

- Q1. Assertion (A):** Many single-celled organisms reproduce by binary fission, where a cell divides into two halves and each rapidly grows into an adult  
**Reason (R):** Yeast divides by binary fission.  
 (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)  
 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)  
 (c) Assertion (A) is true but reason(R) is false  
 (d) Assertion (A) is false but reason(R) is true

**Q2. Assertion (A):** In some organisms, if the body breaks into distinct pieces, each fragment grows into an adult capable of producing offspring.

**Reason (R):** In plants, the units of vegetative propagation are all capable of giving rise to new offspring.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

**Q3. Assertion(A):** Spores are unicellular bodies.

**Reason (R) :** The parent body simply breaks up into smaller pieces on maturation.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

**Q4. Assertion(A):** The offspring produced by sexual reproduction is likely to adjust better in environmental fluctuation.

**Reason (R):** During the fusion of gametes there is mixing of genetic material from two parents.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

### TRUE/FALSE

**Q1.** After attainment of maturity, all sexually reproducing organisms exhibit events and processes that have remarkable fundamental similarity.

**Q2.** In several fungi and plants, terms such as heterothallic and dioecious are used to denote the bisexual condition.

**Q3.** Cockroach is an example of a bi-sexual species.

**Q4.** This process called syngamy results in the formation of a diploid zygote.

## PRACTICE QUESTIONS

**Q1.** When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is.

- (a) Sexual
- (b) Asexual
- (c) Both (a) and (b)
- (d) None of the above

**Q2.** Among the following which of the following is a mode of reproduction?

- (a) Cell cycle
- (b) Photosynthesis
- (c) Respiration
- (d) Cell division

**Q3.** The process by which Monerans and Protists give rise to new individuals.

- (a) Meiosis
- (b) Mitosis
- (c) Both (a) and (b)
- (d) None of the above

**Q4.** Encystation is related to which of the following organism?

- (a) Sponge
- (b) Amoeba
- (c) Hydra
- (d) *Penicillium*

**Q5.** Select the odd one out with respect to sexual reproduction.

- (a) Diverse organism show great diversity in sexual mode of reproduction
- (b) Juvenile phase is called vegetative phase in plants
- (c) Off-springs are not identical to parents
- (d) Fusion of gametes results in the formation of zygote

**Q6.** In diploid organism, specialised gamete mother cells produce gametes. They are called.

- (a) Meiocytes
- (b) Mitocytes
- (c) Egg
- (d) Pollen

**Q7.** In majority of plants, fertilisation is.

- (a) Internal
- (b) External
- (c) Internal and oogamous
- (d) External and oogamous

- Q8.** Process of reproduction which results in the production of identical offsprings is.  
 (a) Simple and slow (b) Complex and fast  
 (c) Fast and simple (d) Fast and elaborate
- Q9.** Which of the following can be used in the commercial production of ginger?  
 (a) Tuber (b) Rhizome  
 (c) Offset (d) Bulbil
- Q10.** Offsprings produced by which of the following process/structure is called a clone?  
 (a) Syngamy  
 (b) Vegetative propagule  
 (c) Fusion of gametes  
 (d) All of the above
- Q11.** A vegetative propagule that is a large fleshy bud is.  
 (a) Rhizome (b) Bulb  
 (c) Bulbil (d) Sucker
- Q12.** Choose the odd one out with respect to vegetative propagule involved in cultivation in following plants.  
 (a) Ginger (b) Potato  
 (c) Banana (d) *Bryophyllum*
- Q13.** Most of the sexually reproducing organism form.  
 (a) Homogametes  
 (b) Isogametes  
 (c) Heterogametes  
 (d) All of the above
- Q14.** What will the ploidy of the following?  
 Ovum, Zygote, endosperm  
 (a)  $2n, 3n, n$  (b)  $n, 3n, 2n$   
 (c)  $n, 2n, 3n$  (d)  $3n, n, 2n$
- Q15.** A universal feature in all the sexually reproducing organisms is.  
 (a) Transfer of gametes  
 (b) Formation of embryo  
 (c) Formation of zygote  
 (d) Differentiation of zygote
- Q16.** Homothallic term in fungi represents.  
 (a) Unisexual condition (b) Bisexual condition  
 (c) Dioecious condition (d) None of the above
- Q17.** Which of the following is incorrect with respect to transition after fertilisation in angiosperms?  
 (a) Zygote forms embryo  
 (b) PEN forms endosperm  
 (c) Ovary forms the fruit  
 (d) Integument forms pericarp
- Q18.** Members of which of the following group reproduces through special reproductive structures?  
 (a) Algae, bryophytes  
 (b) Fungi, algae  
 (c) Pteridophytes, angiosperms  
 (d) Fungi, petridophytes
- Q19.** Given below are the names of some buds. Which of the following is present in potato?  
 Axillary bud, adventitious bud, nodal bud, Leaf bud.  
 (a) Adventitious, axillary bud  
 (b) Nodal, axillary bud  
 (c) Leaf, nodal bud  
 (d) Nodal, adventitious bud
- Q20.** The among the following flowers once in its life time.  
 (a) Mango (b) Bamboo  
 (c) Papaya (d) Jackfruit
- Q21.** Which of the following is correct about offsets?  
 (a) It reproduces by parthenogenesis  
 (b) It reproduces by meiotic division  
 (c) It reproduces by mitotic division  
 (d) It reproduces by binary fission
- Q22.** Select the odd one out with respect to life span  
 (a) Life span of organism are not correlated with their size  
 (b) Crows and parrots show wide difference in their life span  
 (c) Life span of rice is 3-4 weeks  
 (d) It is the period between birth and natural death of an organism
- Q23.** Which of the following is a life process that is not essential for an individual's survival but for survival of the species.  
 (a) Growth (b) Reproduction  
 (c) Respiration (d) Nutrition
- Q24.** Fragmentation is a mode of asexual reproduction seen in.  
 (a) *Penicillium* (b) *Amoeba*  
 (c) *Hydra* (d) *Paramecium*
- Q25.** Every sexually reproducing organism begins life as a.  
 (a) embryo (b) zygote  
 (c) spore (d) gamete
- Q26.** Which among these is not a post fertilization event?  
 (a) Fruit formation  
 (b) Gametogenesis  
 (c) Seed formation  
 (d) Embryogenesis

**Q27.** Which of the following parts of the flower wither and fall off after fertilization?

- (a) Stamens                                      (b) Petals
- (c) Pistil                                        (d) Both (a) and (b)

**Q28.** Process of fusion of haploid cells is called.

- (a) cell cycle                                      (b) meiosis
- (c) mitosis                                        (d) syngamy

**Q29.** Sexual reproduction is characterized by.

- (a) fertilization of male and female gametes
- (b) zygote formation
- (c) embryogenesis
- (d) all of these

**Q30.** Potato is multiplied vegetatively with the help of.

- (a) bulb
- (b) rhizome
- (c) eyes (buds) on tubers
- (d) offset

**Q31.** Pick the odd one out.

- (a) Offset    (b) Bulbil
- (c) Rhizome                                        (d) Conidia

### ASSERTION AND REASON

**Q1. Assertion (A):** Asexual reproduction is the common method of reproduction in organisms that have a relatively simple organization.

**Reason (R):** Zoospores are special asexual reproductive structure present in plants.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

**Q2. Assertion (A):** That period of growth is called the juvenile phase.

**Reason (R):** The end of juvenile/vegetative phase which marks the beginning of the reproductive phase can be seen easily in the higher plants when they come to flower.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

**Q3. Assertion (A):** Cyclical changes during reproduction are called oestrus cycle.

**Reason (R):** It is seen in monkeys, apes and humans.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

**Q4. Assertion (A):** Gametogenesis refers to the process of formation of the two types of gametes – male and female.

**Reason (R):** It is a post fertilisation event.

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)
- (c) Assertion (A) is true but reason(R) is false
- (d) Assertion (A) is false but reason(R) is true

## MULTIPLE CHOICE SOLUTION

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| <p><b>S1. (b)</b> Reproduction is a biological process in which an organism gives rise to its young ones that are similar to those from whom they are born.</p> <p><b>S2. (c)</b> The term clone is used for offspring that are similar/identical to each other and are also exact copies of their parents.</p> <p><b>S3. (b)</b> Reproduction is an important aspect of life, that maintains the continuity of a race.</p> <p><b>S4. (b)</b> Gemmules are special asexual reproductive structures that is used by sponge for asexual reproduction.</p> <p><b>S5. (d)</b> units of vegetative reproduction like offset, bulb, sucker tuber in plants are capable of giving rise to new offspring's.</p> <p><b>S6. (b)</b> Water hyacinth is an aquatic plant and a most invasive weed and propagates vegetatively at a rapid rate in water bodies.</p> <p><b>S7. (c)</b> Adventitious buds arise from the notches present at the margins of the leaves by which it propagates vegetatively.</p> <p><b>S8. (a)</b> Monoecious term is used to denote bisexual condition in plants.</p> <p><b>S9. (b)</b> Syngamy is the process of fusion of gametes that results in the formation of zygote.</p> <p><b>S10. (d)</b> Parthenogenesis is a process in which the female gamete undergoes development to form a new organism without fertilization.</p> <p><b>S11. (d)</b> In some organisms, mostly aquatic organisms, syngamy occurs in an external medium like water.</p> <p><b>S12. (b)</b> Zygote is formed by the fusion of a male gamete with the female gamete and is a vital link between organisms of various generations in a species.</p> <p><b>S13. (c)</b> During unfavourable conditions, amoeba withdraws its pseudopodia and secretes a three layered cyst around itself, when conditions become favourable, amoeba divides by multiple fission and produces many minute amoeba.</p> <p><b>S14. (c)</b> Water Hyacinth uses offset for vegetative propagation and spreads at a phenomenal rate in water bodies.</p> <p><b>S15. (d)</b> Banana and ginger both propagate vegetatively with rhizome.</p> | <p><b>S16. (b)</b> Bamboo flowers only once in 50-100 years, at this time it produces large number of fruits this time and then dies.</p> <p><b>S17. (b)</b> Strobilanthus kunthiana or neelakuranji flowers in mass and turns it surrounding area into blue stretches.</p> <p><b>S18. (d)</b> Both environmental factors and hormones affect the reproductive process.</p> <p><b>S19. (b)</b> Cladophora produces homo-gametes or isogametes for sexual reproduction.</p> <p><b>S20. (b)</b> Heterothallic or dioecious terms are used to describe unisexual condition in most plants and fungi.</p> <p><b>S21. (c)</b> A unisexual male flower in a flowering plant would bear stamens and would be staminate.</p> <p><b>S22. (b)</b> Meiocytes are specialized mother cells that undergo meiosis at the end of which only one set of chromosomes are incorporated in each gamete.</p> <p><b>S23. (b)</b> Pollination is a specialized event that governs the transfer of pollen grains from anther to stigma of a flowering plant and is facilitated by wind, insects, water etc.</p> <p><b>S24. (b)</b> When pollen grains land on the stigma, a pollen tube is created that extends through the pistil carrying the male gamete to the female gamete.</p> <p><b>S25. (c)</b> A diploid zygote is the common among all sexually reproducing organisms.</p> <p><b>S26. (b)</b> During embryogenesis a zygote undergoes cell division and cell differentiation.</p> <p><b>S27. (c)</b> Cell differentiation helps in the development of specialized tissues, organs and organ system and thus an organism.</p> <p><b>S28. (c)</b> Animals are classified into oviparous and viviparous based on whether the development of zygote takes place outside the body of female parent or inside.</p> <p><b>S29. (c)</b> In flowering plants, development of zygote takes place inside ovule of a flower.</p> <p><b>S30. (d)</b> Ovary forms the fruit and rest parts of flower get shed off.</p> <p><b>S31. (b)</b> Chara is a monoecious plant that is bisexual.</p> |
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- S32. (b)** Meiocytes are gamete mother cells and their number varies in every organism.
- S33. (b)** Non-primate mammals like cow, sheep rats show cyclical changes during reproduction and that is called the oestrous cycle.
- S34. (c)** Sexual reproduction gives rise to new combinations and thus variations among species.
- S35. (b)** Eyes of potato tuber are also called as buds and help in vegetative propagation.
- S36. (c)** Paramecium reproduces by transverse binary fission during favourable conditions.
- S37. (b)** After meiosis, only one set of chromosomes get incorporated into each gamete, hence their nature is haploid.
- S38. (d)** Amoeba and plasmodium both of them show sporulation
- S39. (c)** All organism has to reach a certain stage of growth and maturity in their life. Before they reproduce sexually and that is called juvenile phase.
- S40. (b)** They are bisexual with testis and ovaries located in the same organism.
- S41. (c)** Cockroach is a unisexual species, male and female being separate.
- S42. (d)** Tapeworm, sponge and leech all are hermaphrodites with both male and female reproductive organs present in the same individual.
- S43. (b)** Life span is defined as the period from birth to natural death of an organism and is different for different ones.
- S44. (b)** in yeast division is unequal, the small buds produced remain attached initially to the parent and eventually get separated and develop into a new organism later.
- S45. (c)** If hydra accidentally breaks into pieces/fragments each fragment is capable of growing into a new hydra, this is called fragmentation.
- S46. (b)** Water is an active transfer medium via which the male motile gamete is transferred to the female gamete.
- S47. (d)** Gametogenesis (process of formation of male and female gametes) and gamete transfer (transfer of

male gamete to female gamete) are important pre-fertilisation events.

- S48. (d)** Organisms showing external fertilization show great synchrony between the sexes but also have certain disadvantages.
- S49. (b)** Pseudopodiospores are produced when the encysted amoeba bursts on arrival of the favourable conditions.
- S50. (c)** Conidia, zoospores gemmules and buds are special asexual reproductive structures of fungi and some plants.

### ASSERTION AND REASON

- S1. (c)** Many single-celled organisms reproduce by binary fission, where a cell divides into two halves and each rapidly grows into an adult. In yeast, there is budding, the division is unequal and small buds are produced that remain attached initially to the parent cell which, eventually gets separated and mature into new yeast organisms (cells).
- S2. (b)** Both of the above statements are true, fragmentation is a mode of asexual reproduction in Hydra. In plants, the term vegetative reproduction is frequently used. In plants, the units of vegetative propagation such as runner, rhizome, sucker, tuber, offset, bulb are all capable of giving rise to new offspring. These structures are called vegetative propagules.
- S3. (c)** Sporulation provides a multilayered structure that can be maintained for a long time. Spores are designed to protect a bacterium from dryness, heat, and intense radiation for a long time, relative to the normal life span of the microorganism. Amoeba reproduces by the formation of spores internally, under unfavourable conditions.
- S4. (a)** During sexual reproduction there is mixing of genetic material and the organism are well fit to survive in the environment.

### TRUE/FALSE

- S1. (True)**
- S2. (False)** In several fungi and plants, terms such as homothallic and monoecious are used to denote the bisexual condition.
- S3. (False)** Cockroach is an example of a unisexual species.
- S4. (True)**

## SOLUTIONS PRACTICE QUESTIONS

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| <p><b>S1. (b)</b> When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is asexual.</p> <p><b>S2. (d)</b> In reproduction, excessive cell divisions takes place, meiosis during the formation of gametes and mitosis after the zygote is formed.</p> <p><b>S3. (b)</b> In Protists and Monerans, the organism or the parent cell divides by mitosis into two to give rise to new individuals</p> <p><b>S4. (b)</b> Under unfavourable condition the Amoeba withdraws its pseudopodia and secretes a three-layered hard covering or cyst around itself. This phenomenon is termed as encystation.</p> <p><b>S5. (a)</b> Diverse organism show great diversity in sexual mode of reproduction</p> <p><b>S6. (a)</b> Meiocytes are the cells that undergo meiosis to produce gametes. They are diploid and produce 4 haploid cells after meiosis or reduction division. They are also known as gamete mother cells.</p> <p><b>S7. (c)</b> in majority of plants like bryophytes, petridophytes etc. the fertilisation is internal and oogamous.</p> <p><b>S8. (c)</b> the process of reproduction is a fast process, it is simple but period of reproduction is different in different organisms.</p> <p><b>S9. (b)</b> The vegetative propagule by which ginger propagates is the rhizome hence it can be used to for the commercial propagation of ginger</p> <p><b>S10. (b)</b> Syngamy is fusion of gametes hence they it is sexual reproduction, vegetative propagation is asexual method of reproduction adopted by plants like potato, ginger etc hence the offsprings produced can be called as clones.</p> <p><b>S11. (c)</b> Bulbil is a vegetative propagule that is found in agave and is large and fleshy.</p> <p><b>S12. (d)</b> ginger, potato and banana all are cultivated by their vegetative propagules while <i>Bryophyllum</i> is not cultivated commercially though it can propagate itself by buds that are produced in its notches.</p> <p><b>S13. (c)</b> Most of the sexually reproducing organisms form gametes that are dissimilar with respect to motility and storage of food.</p> | <p><b>S14. (c)</b> ovum is a gamete hence its ploidy will be <math>n</math>, zygote is formed by fusion of a male and a female gamete so its ploidy will be <math>2n</math> and endosperms ploidy will be <math>3n</math>.</p> <p><b>S15. (c)</b> Zygote is the vital link that ensures the continuity of species between organism of one generation and the next, it is a unique feature in all the sexually reproducing organisms.</p> <p><b>S16. (b)</b> In several fungi and plants, terms such as homothallic and monoecious are used to denote the bisexual condition.</p> <p><b>S17. (d)</b> the integuments are the outer layer(s) of the ovule and develop into a seed coat as the ovule matures following <u>fertilization</u>. Pericarp is a thick walled protective covering of the fruit.</p> <p><b>S18. (b)</b> Members of the Kingdom Fungi and simple plants such as algae reproduce through special asexual reproductive structures.</p> <p><b>S19. (b)</b> The buds present in potato tuber is nodal and axillary bud.</p> <p><b>S20. (b)</b> bamboo species flower only once in their life time, generally after 50-100 years, produce large number of fruits and die.</p> <p><b>S21. (c)</b> Offsets are vegetative propagules that are found in Water hyacinth and it the divisions that take place in it are mitotic.</p> <p><b>S22. (c)</b> All are correct with respect to life span except (c)</p> <p><b>S23. (b)</b> reproduction is the process that is important for the survival of the species.</p> <p><b>S24. (c)</b> Fragmentation is an asexual mode of reproduction in which the body of some organisms break into distinct pieces (fragments). Each fragment grows into an adult capable of producing an offspring.</p> <p><b>S25. (b)</b> Zygote is the vital link that ensures the continuity of the species.</p> <p><b>S26. (b)</b> Gametogenesis is the formation of gametes (male and female ) and is a pre-fertilisation event.</p> <p><b>S27. (d)</b> In flowering plants, the zygote is formed inside the ovule. After fertilization the sepals, petals and stamens of the flower wither and fall off. The pistil however, remains attached to the plant.</p> |
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| <p><b>S28. (d)</b> the fusion of haploid cells that is the male and the female gametes is called fertilisation or syngamy.</p> <p><b>S29. (d)</b> sexual reproduction is characterized by fusion of the male and the female gametes, then formation of zygote takes place, then embryogenesis that further grows to form a complete individual.</p> | <p><b>S30. (c)</b> potato multiplies by tubers or eyes on the potato.</p> <p><b>S31. (d)</b> Conidia is found in <i>Penicillium</i> while offset, bulbil and rhizome are vegetative propagules of plants.</p> |
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### ASSERTION AND REASON

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| <p><b>S1. (c)</b> Asexual reproduction is the common method of reproduction in organisms that have a relatively simple organization and zoospores are special asexual reproductive structure, they are microscopic and motile. Other common asexual reproductive structures are conidia (<i>Penicillium</i>), buds (<i>Hydra</i>) and gemmules (<i>sponge</i>).</p> <p><b>S2. (a)</b> All organisms have to reach a certain stage of growth and maturity in their life, before they can reproduce sexually. That period of growth is called the juvenile phase. It is known as vegetative phase in plants. This phase is of variable durations in different organisms. The</p> | <p>end of juvenile/vegetative phase which marks the beginning of the reproductive phase can be seen easily in the higher plants when they come to flower.</p> <p><b>S3. (c)</b> In non-primate mammals like cows, sheep, rats, deers, dogs, tiger, etc., such cyclical changes during reproduction are called oestrus cycle where as in primates (monkeys, apes, and humans) it is called menstrual cycle.</p> <p><b>S4. (c)</b> Gametogenesis is a pre-fertilisation event and it is the process of formation of male and the female gametes.</p> |
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