CBSE Class 12 Science

NCERT Exemplar Solutions

CHAPTER 1

REPRODUCTION IN ORGANISMS

Multiple Choice Questions (MCQs)

1. A few statements describing certain features of reproduction are given below:

(i) Gametic fusion takes place

(ii) Transfer of genetic material takes place

(iii) Reduction division takes place

(iv) Progeny have some resemblance with parents

Select the options that are true for both asexual and sexual reproduction from the options given below:

(a) (i) and (ii);

(b) (ii) and (iii);

(c) (ii) and (iv);

(d) (i) and (iii).

Ans. (c) (ii) and (iv)

Explanation: Gametic fusion and reduction division take place only in case of sexual reproduction. Hence, (ii) and (iv) are correct statements.

2. The term 'clone' cannot be applied to offspring formed by sexual reproduction because:

(a) Offspring do not possess exact copies of parental DNA

(b) DNA of only one parent is copied and passed on to the offspring

(c) Offspring are formed at different times

(d) DNA of parent and offspring are completely different.

Ans. (a) Offspring do not possess exact copies of parental DNA

Explanation: Gametogenesis takes place through meiosis and crossing over takes place during meiosis. Crossing over is responsible for some alteration in genotype. Moreover, fertilization results in gene pools from two different individuals and thus zygote has a somewhat different genotype than both the presents. Hence, the term clone cannot be applied to offspring formed by sexual reproduction.

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3. A sexual method of reproduction by binary fission is common to which of the following?

(i) Some eukaryotes

(ii) All eukaryotes

(iii) Some prokaryotes

(iv) All prokaryotes

(a) (i) and (ii)

(b) (ii) and (iii)

(c) (i) and (iii)

(d) (iii) and (iv)

Ans. (c) (i) and (iii)

Explanation: Various methods of asexual reproduction are seen in prokaryotes, like binary fission, multiple fission, spore formation, etc. In eukaryotes; many methods of asexual reproduction as well as sexual reproduction are seen.

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4. A few statements with regard to sexual reproduction are given below:

(i) Sexual reproduction does not always require two individuals

(ii) Sexual reproduction generally involves gametic fusion

(iii) Meiosis never occurs during sexual reproduction

(iv) External fertilisation is a rule during sexual reproduction

Choose the correct statements from the options below:

(a) (i) and (iv)

(b) (i) and (ii)

(c) (ii) and (iii)

(d) (i) and (iv)

Ans. (b) (i) and (ii)

Explanation: In some case, both the sexes are present on the some individual and some of those cases, both the gametes from the same individual are involved in fertilization, e.g. self-pollination in many flowering plants. Fusion of gametes, i.e., fertilization is an important step in sexual reproduction. Hence, (i) and (ii) are correct.

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5. A multicellular, filamentous alga exhibits a type of sexual life cycle in which the meiotic division occurs after the formation of zygote. The adult filament of this alga has

(a) haploid vegetative cells and diploid gametangia

(b) diploid vegetative cells and diploid gametangia

(c) diploid vegetative cells and haploid gametangia

(d) haploid vegetative cells and haploid gametangia.

Ans. (d) haploid vegetative cells and haploid gametangia.

Explanation: Many algae show haplontic life cycle. In this case, the dominant phase is free-living gametophyte. Sporophytic generation is represented by single-called zygote. Meiosis results in formation of haploid spores, e.g. Spirogyra and Chlamydomonas.

6. The male gametes of rice plant have 12 chromosomes in their nucleus. The chromosome number in the female gamete, zygote and the cells of the seedling will be, respectively,

(a) 12, 24, 12

(b) 24, 12, 12

(c) 12, 24, 24

(d) 24, 12, 24.

Ans. (c) 12, 24, 24

Explanation: Gametes have haploid number of chromosomes, zygote and plant have diploid number of chromosomes.

7. Given below are a few statements related to external fertilization. Choose the correct statements.

(i) The male and female gametes are formed and released simultaneously

(ii) Only a few gametes are released into the medium

(iii) Water is the medium in a majority of organisms exhibiting external fertilization

(iv) Offspring formed as a result of external fertilization have better chance of survival than those formed inside an organism

(a) (iii) and (iv)

(b) (i) and (iii)

(c) (ii) and (iv)

(d) (i) and (iv)

Ans. (b) (i) and (iii)

Explanation: Release of both the gametes simultaneously is necessary to ensure fertilization. The male gametes need some medium through which they can travel up to the female gamete. Water is the medium for most the cases; while air is a medium in some cases.

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8. The statements given below describe certain features that are observed in the pistil of flowers.

(i) Pistil may have many carpels

(ii) Each carpel may have more than one ovule

(iii) Each carpel has only one ovule

(iv) Pistil have only one carpel

Choose the statements that are true from the options below:

(a) (i) and (ii)

(b) (i) and (iii)

(c) (ii) and (iv)

(d) (iii) and (iv)

Ans. (a) (i) and (ii)

Explanation: (i) and (ii)

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9. Which of the following situations correctly describe the similarity between an angiosperm egg and a human egg?

(i) Eggs of both are formed only once in a lifetime

(ii) Both the angiosperm egg and human egg are stationary

(iii) Both the angiosperm egg and human egg are motile transported

(iv) Syngamy in both results in the formation of zygote

Choose the correct answer from the options given below:

(a) (ii) and (iv)

(b) (iv) only

(c) (iii) and (iv)

(d) (i) and (iv)

Ans. (b) (iv) only

Explanation: In angiosperms, eggs are formed several times in the lifetime, hence option (i) is incorrect. In humans, eggs travel from ovary to fallopian tubes; so, option (ii) is incorrect. In angiosperms, eggs are stationary and hence option (iii) is incorrect.

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10. Appearance of vegetative propagules from the nodes of plants such as sugarcane and ginger is mainly because:

(a) Nodes are shorter than internodes

(b) Nodes have meristematic cells

(c) Nodes are located near the soil

(d) Nodes have non-photosynthetic cells

Ans. (b) Nodes have meristematic cells

Explanation: Presence of meristematic cells gives the ability of vegetative propagation.

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11. Which of the following statements, support the view that elaborate sexual reproductive process appeared much later in the organic evolution.

(i) Lower groups of organisms have simpler body design

(ii) Asexual reproduction is common in lower groups

(iii) Asexual reproduction is common in higher groups of organisms

(iv) The high incidence of sexual reproduction in angiosperms and vertebrates

Choose the correct answer from the options given below:

(a) (i), (ii) and (iii);

(b) (i), (iii) and (iv)

(c) (i), (ii) and (iv)

(d) (ii), (iii) and (iv)

Ans. (c) (i), (ii) and (iv)

Explanation: Asexual reproduction is not common in higher groups of organisms; especially in animals. Hence, option (iii) is incorrect. Rest or the options are correct.

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12. Offspring formed by sexual reproduction exhibit more variation than those formed by Asexual reproduction because:

(a) Sexual reproduction is a lengthy process

(b) Gametes of parents have qualitatively different genetic composition

(c) Genetic material comes from parents of two different species

(d) Greater amount of DNA is involved in sexual reproduction.

Ans. (b) Gametes of parents have qualitatively different genetic composition

Explanation: Fertilization during sexual reproduction results in gene pools from two different individuals and thus zygote has a somewhat different genotype than both the parents and show more variation.

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13. Choose the correct statement from amongst the following:

(a) Dioecious (hermaphrodite) organisms are seen only in animals

(b) Dioecious organisms are seen only in plants

(c) Dioecious organisms are seen in both plants and animals

(d) Dioecious organisms are seen only in vertebrates

Ans. (c) Dioecious organisms are seen in both plants and animals

Explanation: Many flowering plants are dioecious. Pheretima is an example of dioecious animal.

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14. There is no natural death in single celled organisms like Amoeba and bacteria because:

(a) They cannot reproduce sexually

(b) They reproduce by binary fission

(c) Parental body is distributed among the offspring

(d) They are microscopic

Ans. (c) Parental body is distributed among the offspring

Explanation: Binary fission results in culmination of parental generation and beginning of the next generation but the mother cell does not die in the process rather it gets divided into two daughter cells.

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15. There are various types of reproduction. The type of reproduction adopted by an organism depends on:

(a) The habitat and morphology of the organism

(b) Morphology of the organism

(c) Morphology and physiology of the organism

(d) The organism's habitat, physiology and genetic makeup

Ans. (d) The organism's habitat, physiology and genetic makeup

Explanation: The organism's habitat, physiology and genetic makeup

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16. Identify the incorrect statement.

(a) In asexual reproduction, the offspring produced are morphologically and genetically identical to the parent

(b) Zoospores are sexual reproductive structures

(c) In asexual reproduction, a single parent produces offspring with or without the formation of gametes

(d) Conidia are asexual structures in Penicillium

Ans. (b) Zoospores are sexual reproductive structures

Explanation: Zoospores are asexual reproductive structures.

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17. Which of the following is a post-fertilisation event in flowering plants?

(a) Transfer of pollen grains

(b) Embryo development

(c) Formation of flower

(d) Formation of pollen grains

Ans. (b) Embryo development

Explanation: The sequence is as follows: formation of flower → formation of pollen grains → transfer of pollen grains → fertilization → Embryo development.

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18. The number of chromosomes in the shoot tip cells of a maize plant is 20. The number of chromosomes in the microspore mother cells of the same plant shall be:

(a) 20

(b) 10

(c) 40

(d) 15

Ans. (a) 20

Explanation: Microspore mother cell has same ploidy as the vegetative parts.

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Very Short Answer Type Questions

1. Mention two inherent characteristics of Amoeba and yeast that enable them to reproduce asexually.

Ans. Amoeba and yeast are able to reproduce asexually because of following reasons:

(a) They are unicellular organisms

(b) They have simple organization

2. Why do we refer to offspring formed by asexual method of reproduction as clones?

Ans. In asexual reproduction, a single parent is involved in reproduction and the process involves mitosis only. Due to this, variation is not possible in offspring and they are clones of their parent.

3. Although potato tuber is an underground part, it is considered as a stem. Give two reasons.

Ans. Following features on potato tuber are signs of it being a stem:

(a) Presence of nodes (eyes)

(b) Presence of scaly leaves

4. Between an annual and a perennial plant, which one has a shorter juvenile phase? Give one reason.

Ans. Annual plants have shorter juvenile phase compare to perennial plans. Moreover, it also depends on number of flowering seasons in a given year. Some perennial plants

produce flower only once in a year. Some others may produce flowers once in 50 years or even 100 years. This is not the situation in annual plants.

5. Rearrange the following events of sexual reproduction in the sequence in which they occur in a flowering plant: embryogenesis, fertilisation, gametogenesis, pollination.

Ans. Gametogenesis → Pollination → Fertilisation → Embryogenesis

6. The probability of fruit set in a self-pollinated bisexual flower of a plant is far greater than a dioecious plant. Explain.

Ans. A self-pollinated plant does not have to depend on agents of pollination. But a dioecious plant has to depend on the agents of pollination for carrying out sexual reproduction. In certain circumstances, the agents of pollination may not be available because of various external factors. For example; use of high level of pesticides has reduced the number of pollinating insects. This is playing havoc with sexual reproduction in many flowering plants. So, the probability of fruit set in a self-pollinated bisexual flowers of a plant is far greater than a dioecious plant.

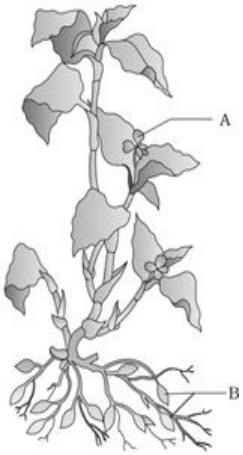
7. Is the presence of large number of chromosomes in an organism a hindrance to sexual reproduction? Justify your answer by giving suitable reasons.

Ans. The presence of large number of chromosomes in an organism is not a hindrance to sexual reproduction because number of chromosomes has no role in deciding a particular mode of reproduction. For example; there are 8 chromosomes in a somatic cell of fruit fly, while there are 380 chromosomes in a somatic cell of butterfly but both of them produce sexually.

8. Is there a relationship between the size of an organism and its life span? Give two examples in support of your answer.

Ans. There is no relationship between the size of an organism and its life span. For example; both mango and peepal tree are similar in size but a mango tree has a much shorter life span compared to a peepal tree. A tortoise is much smaller than an elephant yet the tortoise lives

more than hundred years.



9. In the figure given below the plant bears two different types of flowers marked 'A' and 'B'. Identify the types of flowers and state the type of pollination that will occur in them.

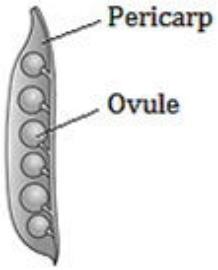
Ans. 'A' shows chasmogamous flowers with exposed anthers and stigma and cross pollination will happen in them. 'B' shows flowers which do not open at all. These are bisexual flowers and self-pollination will happen in them. On the other hand, agents of pollination can easily work in flower 'A' as its anthers and stigma are exposed.

10. Give reasons as to why cell division cannot be a type of reproduction in multicellular organisms.

Ans. Most of the multicellular organisms have complex organization. Especially the animals show tissue level and organ system level organization. For a single cell, it is not possible to produce different tissues just by undergoing mitosis. Hence, cell division cannot be a type of reproduction in multicellular organisms.

11. In the figure given below, mark the ovule and pericarp.

Ans.



12. Why do gametes produced in large numbers in organisms which exhibit external fertilization?

Ans. In case of external fertilization, gametes are at the mercy of surrounding. Gametes can get blown off by wind, washed away by water or eaten by predators. So, most of the gametes perish before fertilization. To ensure the survival of the species, it is necessary to produce as many gametes as possible so that at least some of them would be able to carry out fertilization. Hence, organisms which exhibit fertilization produce a large number of gametes.

13. Which of the followings are monoecious and dioecious organisms.

(a) Earthworm_____

(b) Chara_____

(c) Marchantia_____

(d) Cockroach_____

Ans. (a) Dioecious

(b) Monoecious

(c) Dioecious

(d) Monoecious

14. Match the organisms given in Column-'A' with the vegetative propagules given in

column 'B'.

Column A	Column B
(i) Bryophyllum	(a) Offset
(ii) Agave	(b) Eyes
(iii) potato	(c) Leaf buds
(iv) Water hyacinth	(d) Bulbils

Ans. (i) → (c)

(ii) → (d)

(iii) → (b)

(iv) → (a)

15. What do the following parts of a flower develop into after fertilisation?

(a) Ovary _____

(b) Ovules_____

Ans. (a) Fruits

(b) Seeds

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Short Answer Type Questions

1. In haploid organisms that undergo sexual reproduction, name the stage in the life cycle when meiosis occurs. Give reasons for your answer.

Ans. In haploid organisms that undergo sexual reproduction, gametes are usually formes by meiotic division and chromosome numbers is reduced to half of the total. The stage in the life cycle when meiosis occurs is called sporophytic generation and is represented by one-celled zygote. In such plants, the dominant phase is gametophytic phase which is haploid. This kind of life cycle is called haplontic. Volvox, Spirogyra and some species of Chlamydomonas shows this type of life cycle.

2. The number of taxa exhibiting asexual reproduction is drastically reduced in higher plants (angiosperms) and higher animals (vertebrates) as compared with lower groups of plants and animals. Analyse the possible reasons for this situation.

Ans. Asexual reproduction involves mitosis. In organisms with complex level of organization, mitosis alone cannot produce all kinds of differentiation which is required for making various types of tissue. Due to this, asexual reproduction is frequently seen in lower groups of plants and animals which show simple level of organization. But incidence of asexual reproduction drastically reduces as go higher in terms of complexity of body design.

3. Honeybees produce their young ones only by sexual reproduction. Inspite of this, in a colony of bees we find both haploid and diploid individuals. Name the haploid and diploid individuals in the colony and analyse the reasons behind their formation.

Ans. In a colony of bees, the females and workers are diploid while the male drones are haploid. The male drones are developed from unfertilized eggs. Development of an individual from unfertilized eggs is called parthenogenesis. This phenomenon is also seen in

many plants, e.g. banana. In that case, the fruit is called parthenocarpic fruit.

4. With which type of reproduction do we associate the reduction division? Analyse the reasons for it.

Ans. Reduction division is associated with sexual reproduction. We know that fertilization is an important step in sexual reproduction. Since fertilization involves fusion of two gametes, the number or chromosomes becomes diploid in zygote. To ensure continuity of characters in a species, it is necessary to develop some mechanism by which number of chromosomes can be haploid in the gametes. Hence, gametogenesis involves reduction division and thus gametes have haploid number of chromosomes.

5. Is it possible to consider vegetative propagation observed in certain plants like Bryophyllum, water hyacinth, ginger etc., as a type of asexual reproduction? Give two/three reasons.

Ans. Vegetative propagation in certain plants; like Bryophyllum, water hyacinth, ginger, etc. can be termed as asexual reproduction. Following are some to the reasons for this:

(a) Reproduction involves a single parent

(b) Meiosis does not happen during any stage of reproduction.

(c) Offspring get the set of DNA from a single parent.

6. 'Fertilisation is not an obligatory event for fruit production in certain plants'. Explain the statement.

Ans. Many plants have an inbuilt ability to produce fruits without fertilisation. Fruits produced in that way are called parthenocarpic fruit. Banana is a very good example of parthenocarpic fruit. Many other fruits are produced by artificially inducing parthenocarpy in plants, e.g. papaya and watermelon. Such plants do not produce seeds because sees cannot be produced without fertilization. Hence, it can be said that fertilization is not mandatory for fruit production in certain plants.

7. In a developing embryo, analyse the consequences if cell divisions are not followed by cell differentiation.

Ans. During development of an embryo, cell differentiation is necessary to produce different kinds of tissues which could later develop various organs and organ system. If cell differentiation does not happen, then different tissues would not be produced and the embryo would only develop into a mass of identical cells; unable to develop into a new individual. This can be compared with differentiation of meristematic cell in plants. In vascular plants, it is differentiation which ultimately results in formation of specialized tissues which performs various functions.

8. List the changes observed in an angiosperm flower subsequent to pollination and fertilisation.

Ans. Following changes take place in an angiosperm flower after pollination and fertilization:

(a) Sepals, petals and stamens wither and fall off

(b) Zygote develops into the embryo and ovule develops into the seed

(c) Ovary develops into fruit

(d) Fruit develops a thick outer covering; called pericarp.

9. Suggest a possible explanation why the seeds in a pea pod are arranged in a row, whereas those in tomato are scattered in the juicy pulp.

Ans. In a pea pod, the pericarp is not differentiated into many layers. In a tomato fruit, the pericarp is differentiated into epicarp, mesocarp and endocarp. Most of the edible part or tomato is composed of mesocarp which is juicy and fleshy. Moreover, placentation is responsible for arrangement of seeds in a fruit. A pea flower shows marginal placentation, while a tomato shows axial placentation.

10. Draw the sketches of a zoospore and a conidium. Mention two dissimilarities between them and atleast one feature common to both structures.

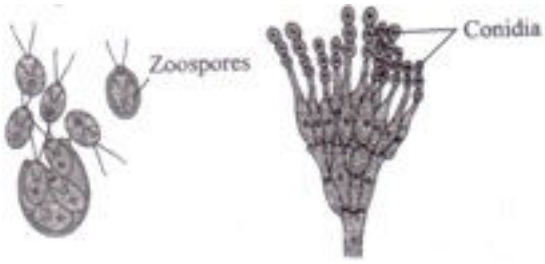
Ans. Difference

Zoospores	Conidium
(i) They are motile.	(i) They are non-motile.
(ii) Flagella is present.	(ii) Flagella is absent.

Similarities

(i) Both are involved in asexual reproduction.

(ii) Both help the organism to tide over the bad phase.



11. Justify the statement 'Vegetative reproduction is also a type of asexual reproduction'.

Ans. It is true that vegetative reproduction is also a type of asexual reproduction. In vegetative reproduction, a single parent is involved. There is no gamete formation. Reduction division never takes place during vegetative propagation. Offspring; produced after vegetative propagation are clones of their parent. These features justify that vegetative reproduction is a type of asexual reproduction.

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Long Answer Type Questions

1. Enumerate the differences between asexual and sexual reproduction. Describe the types of asexual reproduction exhibited by unicellular organisms.

Ans.

Asexual Reproduction	**Sexual Reproduction**
(i) A single parent is involved in the process.	(i) Two parents are involved in the process.
(ii) Meiosis does not happen.	(ii) Meiosis happens during gametogenesis.
(iii) Gametogenesis does not happen.	(iii) Gametogenesis happens.
(iv) Genotype of offspring is identical to that of parent.	(iv) Genotype of offspring is a combination of two parents and is hence different from parents.
(v) It is mostly seen in simple organisms.	(v) It is prevalent in complex organisms.

Type of Asexual Reproduction in Unicellular Organisms:

A. Binary Fission: In this case, the unicellular organism undergoes cell division and two daughter cells are produced. The parent generation ceases to exist after binary fission.

Example: Amoeba.

B. Multiple Fission: In this case, the nucleus of the mother cell divides into multiple nuclei. A cyst develops around the mother cell. The cyst helps the mother cell to tide over unfavourable circumstances. On resumption of favourable circumstances, the cyst disintegrates and daughter nuclei develop into new individuals. Example: Plasmodium, Entamoeba

C. Budding: In this case, a bud develops at one end of the cell. The nucleus produces a daughter nucleus which then goes to the bud. The bud then gets detached from the mother cell and develops into a new individual. Example: yeast

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2. Do all the gametes formed from a parent organism have the same genetic composition (identical DNA copies of the parental genome)? Analyse the situation with the background of gametogenesis and provide or give suitable explanation.

Ans. Gamete formation happens after meiosis. During the pachytene stage of Prophase I in meiosis, crossing over takes place. Crossing over is an important steps of meiotic cell division. Non-sister chromatids combine during crossing over. This leads to recombination of various genes.

Thus, the daughter cells produced after meiosis have slightly different genotype compared to the mother cell. In fact, crossing over is responsible for bringing variations in subsequent generations. We know the evolution becomes possible because of accumulation of minor variations over thousands of generations.

In the context of above facts about meiosis, it is clear that the gametes do not have the same genetic composition as the parental genome.

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3. Although sexual reproduction is a long drawn, energy-intensive complex form of reproduction, many groups of organisms in Kingdom Animalia and Plantae prefer this mode of reproduction. Give atleast three reasons for this.

Ans. Sexual reproduction gives various survival benefits and hence higher organisms in Kingdom Animalia and Plantae prefer this mode of reproduction.

Asexual reproduction is a fast process through which a large number of offspring can be produced in shorter time span. However, since offspring are clones of their parents hence they have same shortcomings as their parents. They will be equally susceptible to diseases and various other stresses as their parents. But offspring; produced after sexual reproduction have better genotype because it is a combination of genotype of two individuals.

Sexual reproduction helps an organism to easily tide over a bad phase. Many plants utilize asexual reproduction as a preferred mode when the conditions are favourable; like plenty of food, water and sunlight. But under unfavourable conditions, they resort to sexual reproduction.

Asexual reproduction can only depend on mutation for bringing evolution, while sexual reproduction can easily bank on variation for bringing evolution.

4. Differentiate between (a) oestrus and menstrual cycles; (b) ovipary and vivipary. Cite an example for each type.

Ans.

Oestrus Cycle	**Menstrual Cycle**
(i) Female is sexually active only during the ovulation phase.	(i) Ovulation has no correlation with sexual activity of the female.
(ii) Endometrium is absorbed in case conception does not take place.	(ii) Endometrium is shed in fragments if conception does not take place.

(iii) Is marked by visible signs on female genitalia.	(iii) Is marked by discharge of blood and tissue fragments from female genitalia.
(iv) Examples: cat, dog, horse, 1etc.	(iv) Examples: humans, chimpanzee, monkey

Ovipary	**Vivipary**
(i) Animal lays eggs	(i) Animal gives birth to young ones.
(ii) Less demand of resources from the female's body.	(ii) Greater demand of resources from the female's body.
(iii) Chances of survival of progeny is low.	(iii) Chances of survival or progeny is high.
(iv) Examples: reptiles and aves	(iv) Examples: most of the mammals, shark, dolphin

5. Rose plants produce large, attractive bisexual flowers but they seldom produce fruits. On the other hand a tomato plant produces plenty of fruits though they have small flowers. Analyse the reasons for failure of fruit formation in rose.

Both these plants - rose and tomato - both selected by human beings for different characteristics, the rose for its flower and tomato for its fruit. Roses, being vegetatively propagated do not need to produce seeds.

Ans. Production of fruits or absence of fruits in these plants is result of human intervention through horticulture. To understand this issue, we first need to keep in mind the specific purpose for which a particular plant growth by humans.

Rose plants are mainly grown for ornamental purpose. Rose flowers are considered to be epitome of beauty. Additionally, most varieties of rose produce nice fragrance which further

adds to its value. Seeds or fruits are not important for rose plants. Rose is grown by the horticulturists worldwide through vegetative propagation. Usually, a portion of the stem is cut off and is put in the soil to produce a new plant. Sometimes, the stem is peeled off at a small section and clay is applied to produce a new plantlet. Since producing a plant through vegetative propagation requires less time, so it is much beneficial for growing ornamental plants.

- Rose is a natural seed bearing plant but in domestically grown varieties, the petals are so tightly fit that they may do not permit pollination and hence fruits do not develop in these plants.
- Rose plants may not produce viable cell or functional egg.
- Rose plants may have abortive ovule.
- They may be self-incompatible
- There may be internal barriers for pollen tube growth and/or fertilization.

Tomato, on the other hand, is produced for its juicy fruits. Hence, cultivators have to follow a method which enables them to get as many fruits as possible.

In both the cases, the number or size of flowers on a particular plant is not the deciding factor. But the purposes for which a particular plant is grown is the main deciding factor whether a plant produces a fruit or not.