

Nagaland Board
Class XII
Biology
Sample Paper 1 – Solution

PART A

1. (c)

During embryo sac development, four nuclei are found at the chalazal and micropylar ends. Of the four nuclei at the chalazal end, three nuclei differentiate to form the antipodal cells

2. (d)

An explant which is used for plant tissue culture is surface sterilised by chemicals such as Clorox water, sodium hypochlorite, calcium hypochlorite or methiolate. UV radiation cannot be used for surface sterilisation as it can induce mutations in the explant.

3. (d)

Spinach (*Spinacia oleracea*) belongs to the genus *Spinacia*, while tomato (*Solanum lycopersicum*), potato (*Solanum tuberosum*) and brinjal (*Solanum melongena*) belong to the genus *Solanum*.

4. (a)

Aerobacter and *Desulphovibrio* can convert sulphate to H_2S , while *Beggiatoa*, *Thiobacillus thiooxidans* and *Neurospora* oxidise sulphide to sulphate

5. (a)

Flavr Savr is genetically modified tomato, which is modified to produce less amounts of polygalacturonase, a cell wall-degrading enzyme. This increases the shelf life of the fruit.

6. Each microsporangium has 100 microspore mother cells which form 400 microspores by meiosis (100×4).

In an anther, there are four microsporangia. So, the total number of microspores will be $4 \times 400 = 1600$.

As each microspore forms one male gametophyte, 1600 male gametophytes can be produced.

7. The process of mating more closely related plants within the same breed is called inbreeding.

The recessive alleles become homozygous and express themselves. These are then eliminated by selection.

- 8.** The vertical distribution of different species occupying different levels in an ecosystem is called stratification. Trees occupy the topmost vertical layer of a forest, shrubs occupy the second layer and herbs and grasses occupy the bottommost or base layers.
- 9.** Primary productivity is referred to as the amount of biomass or organic matter produced per unit area over a time period by the plants during photosynthesis. It is the weight of the organic matter stored by the producers in a unit area volume per unit time. Net primary productivity is equal to the rate of organic matter produced by photosynthesis minus the rate of respiration and other losses.

It is represented as $NPP = GPP - R$

- 10.** When the female gametophyte (embryo sac) develops from a single megaspore, it is called monosporic development. Usually, in most angiosperms, the megaspore mother cell divides by meiosis to form four haploid megaspores arranged in a linear fashion. The three haploid megaspores situated towards the micropyle degenerate, while one remains functional which develops into the female gametophyte.

Or

Microsporogenesis: Process of formation of microspore from the pollen mother cell.

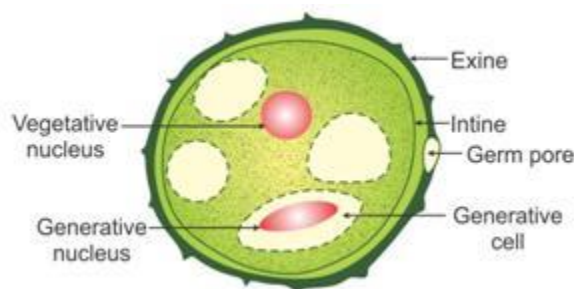
Megasporogenesis: Process of formation of megaspore from megaspore mother cell.

Meiotic division occurs in both the events.

Microsporogenesis results in the formation of pollen grains, while megasporogenesis results in the formation of megaspores.

- 11.** The explant from the plant is grown in a culture medium which is rich in inorganic nutrient, vitamins and growth regulators such as auxins and cytokinins. This method of producing plants through tissue culture is called micropropagation. The plants produced from the original plant are genetically identical, so they are called somaclones.

12. Structure of mature pollen grains in angiosperms.



Functions of the parts of pollen grain: A mature pollen grain has a two-layered wall—the outer exine and inner intine. The wall encloses a large vegetative cell containing vegetative nucleus and a lenticular generative cell. Their functions are as follows:

1. **Exine:** The outer thick exine layer is made up of sporopollenin which is resistant to physical and biological decomposition. It provides protection during the hazardous journey of pollen from the anther to stigma. There are one or many germ pores on the pollen surface which are directly or indirectly associated with its germination.
2. **Intine:** The intine is pecto-cellulosic in nature. It is associated with the formation of the pollen tube.
3. **Vegetative cell:** The vegetative cell is large and contains abundant food reserve. It has a large vegetative nucleus. The function of the vegetative cell is to provide the medium for the movement of male gametes inside the pollen tube.
4. **Generative cell:** The generative cell cytoplasm is highly reduced but it contains the usual cell organelles. It divides mitotically to produce two functional male gametes.

Or

Seeds contain food to nourish the embryo during germination and possess better adaptive strategies for dispersal to new habitats. These are formed by sexual reproduction with new variations and better genetic combinations. So, the seeds are advantageous to flowering plants.

- 13.** Biofortification is the technology which has helped in improving public nutritional health by breeding crops with higher levels of vitamins and minerals or higher protein and healthier fats. In biofortification, protein, oil, vitamin, micronutrient and mineral content and their qualities are improved.

For example,

- (a) Maize hybrids with more quantity of amino acids such as lysine and tryptophan were developed.
- (b) To increase wheat cultivation, an improved variety, Atlas 66, has been used as the donor for having high protein content

Or

Decomposition of detritus is slow if it contains lignin, chitin, tannins and cellulose, whereas it is quick if detritus is made up of nitrogenous compounds and water-soluble substances like sugars. This is because the latter are easy to degrade. Oxygen is required for the activity of decomposers and detritivores. Therefore a reduced oxygen amount will slow down the process of decomposition

14.

- (i) Endosperm is the food laden tissue formed during the development of angiospermous seed which provides essential nutrients to the growing embryo and also the young seedling at the time of seed germination. So, most zygotes in angiosperms divide only after certain amount of endosperm is formed.
- (ii) The seeds in which the endosperm is used up are called exalbuminous seeds. In groundnut, the endosperm is used and the reserve food material is stored in cotyledons. So, groundnut seeds are exalbuminous. The seeds having ample amount of endosperm tissue are called albuminous seeds. Castor seeds have persistent endosperm. So, castor seeds are albuminous.
- (iii) Double fertilisation in angiosperms brings about some changes in the ovule during the development of seed. The micropyle remains in the form of a fine pore on the surface of seed to allow the entry of water during seed germination.
- (iv) Integuments of an ovule harden and the water content is highly reduced as the seed matures to ensure the survival of seeds.
- (v) The fruit derived from the ovary of a flower not associated with any non-carpellary part is called a true fruit. In apple and cashew, the main edible part of the fruit is the fleshy receptacle. So, they are not true fruits. Such fruits derived from the ovary along with other accessory floral parts are called false fruits.

Or

Budding is a type of asexual reproduction in which one or more unicellular or multicellular outgrowths called buds are formed on or inside the parental body.

Budding is seen in sponges, coelenterates, annelids and tunicates. In *Spongilla*, budding is endogenous as a number of buds called gemmules are formed inside the parental body.

Each gemmule of *Spongilla* is a mass of undifferentiated cells called archaeocytes surrounded by a protective coat of amphidisc spicules. Gemmules help in prenatation and dispersal

During favourable conditions, archaeocytes come out of a gemmule through a micropyle and form a new sponge.

PART B

1. (d)
Ornithophilous flowers or flowers pollinated by birds have a funnel-shaped corolla to allow access to the bird's beak or tongue to reach to the nectarines.
2. (a)
Triticale is a hybrid of wheat (*Triticum turgidum*) and rye (*Secale cereale*). Triticale is the first man-made crop derived by crossing wheat and rye.
3. (d)
The endotoxin gene (*cry* gene) responsible for the production of toxin (Bt toxin) has been isolated from *Bacillus thuringiensis* and introduced into a new number of crop plants using *Agrobacterium* Ti plasmid mediated transformation. The new genetically modified Bt cotton is resistant to the bollworm complex.
4. (a)
Reserpine is obtained from the plant *Rauvolfia serpentine*. It is used in the treatment of blood pressure and schizophrenia
5. (b)
Greenhouse gases are capable of absorbing long wave infrared radiation and hence are also known as radiatively active gases.
6. Parturition is the act of expelling the fully developed young one (foetus) from the mother's uterus at the end of gestation period. Oxytocin and relaxin hormones are involved in parturition.
7. A low level of lac operon occurs due to the absence of formation of permeases. Permeases are necessary for the transport of lactose from medium into cells. Due to the failure of transport of lactose into the cell, it will not act as inducer
8. Cro-Magnon man had large skull, strong jaws with teeth, wisdom teeth, high forehead, broad flat face, narrow elevated nose which resembles the characteristics of modern man. They also had developed art and have left paintings and carvings in the caves.

9. The phenomenon in which all organisms who reach reproductive stage reproduce with varying degree of success, some reproduce more offspring and some reproduce only few is called differential reproduction.

The phenomenon in which the individual belonging to same species reproduce among themselves to maintain the integrity of species is called reproductive isolation.

Differential reproduction and reproductive isolation are used in reference to natural selection.

10.

S-shaped curve	J-shaped curve
It comprises the lag phase, exponential phase and stationary phase.	It comprises only two phases - lag phase and exponential phase.
Population becomes stable with zero growth rate and the curve levels.	Population faces mass mortality, and the curve stops.
It is observed by most species including humans.	It is observed in few organisms such as reindeer and annual plants.

Or

A transgenic organism contains functional foreign gene experimentally introduced into their genome by genetic engineering from another species. Hence, it differs from the rest of the population in having one or more extra genes apart from the gene pool of that population.

Examples of transgenic organisms:

- (i) Transgenic *E. coli* with gene for human insulin
- (ii) Transgenic mice with gene for human growth hormone

11.

- (a) Male heterogamety
- (b) Female heterogamety
- (c) Male heterogamety

12. Corpus luteum secretes progesterone which is important for the maintenance of endometrium for the implantation of fertilized egg in the uterus. So, corpus luteum is important even though it is the remains of a ruptured follicle.

(b) Progesterone/estrogen can be used as birth control pills. These hormones will inhibit ovulation and thus, prevent conception.

(c) Estrogen causes proliferation of endometrium to replace the layer lost during previous menstruation. In this way, it regulates menstrual cycle.

(d) FSH stimulates ripening of follicles, maturation of ovum and secretion of estrogen. LH stimulates ovulation, development of corpus luteum and synthesis of progesterone by corpus luteum.

Or

(a) As the BOD of sewage or waste water is reduced to about 10-15%, the effluent is passed into a settling tank where the bacterial flocs undergo sedimentation. The sediment is called activated sludge.

(b) A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. The aerobic microbes get killed and the anaerobic bacteria digest the organic matter as well as the aerobic bacteria and fungi in the sludge and produce a mixture of gases like methane, hydrogen sulphide and CO₂ which constitute biogas.

13. Adaptation is the quality of the organism which enables the organism to survive and reproduce in its habitat. It helps organisms to live in different types of habitats.

The adaptations of desert plants are

(i) Desert plants have a cuticle to minimise transpiration.

(ii) In some desert plants, the leaves modify into spines to minimise loss of water.

(iii) They have long roots and adaptations to reduce transpiration. Example: Acacia

The adaptations of desert animals are

(i) Urine of desert animals is concentrated for minimum loss of water. Example: Kangaroo rat

(ii) Desert animals absorb heat from the Sun when the body temperature drops below the comfort zone.

(iii) They live in burrows during the hot season and have little water requirement.

Or

Five factors are known to affect Hardy- Weinberg genetic equilibrium such as genetic drift, gene flow, mutation, non-random mating and natural selection.

- (i) Genetic Drift- This represents random changes in small gene pools due to sampling errors in propagation of alleles. The bottleneck effect and founder effect are prime examples of genetic drift.
- (ii) Gene Flow- The movement of alleles into and out of a gene pool is called gene flow. Migration of an organism into different areas can cause the allelic frequencies of that population to increase.
- (iii) Mutation- These changes in the genome of an organism are an important source of natural selection.
- (iv) Nonrandom mating- Inbreeding is a popular form of nonrandom mating. Individuals will mate more frequently with close individuals than more distant ones.
- (v) Natural Selection- Populations vary in the types of individuals and their reproductive success. Those individuals, who leave more offspring behind than others, pass on more of their alleles and have a better success rate in dominating the population.

14.

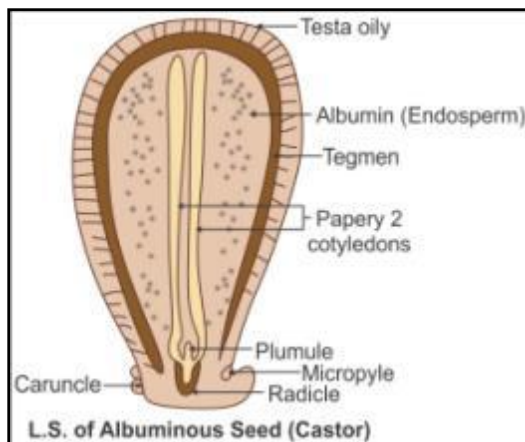
(i) The Earth Summit was held at Rio de Janeiro (Brazil) in which representatives of more than 170 countries were present. The summit promoted Convention on Biological Diversity (CBD). India became a member of this convention in May 1994.

The important objectives were-

- (a) Finding and supporting various methods to conserve biological diversity.
- (b) Use of biodiversity only up to sustainable limit.
- (c) The benefits derived from use of genetic resources should be fairly and equitably shared.
- (ii) A second World Summit on biological diversity was held in 2002 in Johannesburg in which 190 countries pledged to reduce the current rate of biodiversity loss at global, regional and local levels by 2010.
- (iii) Indian government passed the Biodiversity Bill in December 2003 to protect India's biodiversity.
- (iv) Government of India has also established a Biodiversity Board at Chennai to ensure proper utilization of biodiversity.
- (v) Organizations like World Wildlife Fund (WWF) and World Conservation Union (WCU) provide financial assistance for conservation programmes.

Or

a) Longitudinal view of an albuminous seed



(b) Seeds contain food to nourish the embryo during germination and possess better adaptive strategies for dispersal to new habitats. These are formed by sexual reproduction with new variations and better genetic combinations. So, the seeds advantageous to flowering plants.