Maharashtra State Board
Biology
Sample Question Paper - 1
Academic Year: 2024-2025

General Instructions: The question paper is divided into four sections.

1. **Section A:** Q.No.1 contains Ten multiple-choice types of questions carrying One mark each. Q.No.2 contains Eight very short answer type of questions carrying One mark each.
2. **Section B:** Q.No.3 to Q.No.14 are Twelve short answer type questions carrying Two marks each. (Attempt any Eight).
3. **Section C:** Q.No.15 to Q.No.26 are Twelve short answer type questions carrying Three marks each. (Attempt any Eight).
4. **Section D:** Q.No.27 to Q.No.31 are Five Long answer-type questions carrying Four marks each. (Attempt any Three).
5. Use of Log table is allowed. Use of calculator is not allowed.
6. Figures to the right indicate full marks.
7. For each multiple-choice type question, it is mandatory to write the correct answer along with its alphabet. e.g., (a) ..... /(b) ..... /(c) ..... /(d) ..... ,etc. No mark(s) shall be given if ONLY the correct answer or the alphabet of the correct answer is written.
   Only the first attempt will be considered for evaluation.
8. Begin the answer of each section on a new page.

SECTION - A

Q1. Select and write the correct answer for the following multiple-choice type of questions:

1.1. Secondary consumers are _____.

1. Herbivores
2. Producers
3. Carnivores

4. Autotrophs

Solution

Secondary consumers are **Carnivores.**

1.2. Lesser variation in biomass production over a period of time is called _____.

1. **Productivity Stability Hypothesis**
2. Species Area Relationship
3. Species Life Cycle
4. None of them

Solution

Lesser variation in biomass production over a period of time is called **Productivity Stability Hypothesis**.

1.3. The principle pathway of water translocation in angiosperms is _____

1. Sieve cells
2. Sieve tube elements
3. **Xylem**
4. Xylem and phloem

Solution

The principle pathway of water translocation in angiosperms is **Xylem.**

1.4. The interaction between cattle egret and the buffalo is _____.

1. Mutuolism
2. Parasitism
3. **Commensalism**
4. Predation

Solution

The interaction between cattle egret and the buffalo is **Commensalism**.

1.5. _____ is the smallest bone in the human body.

1. Malleus
2. Stapes
3. Incus
4. Femur

Solution

Stapes is the smallest bone in the human body.

1.6. _____ is known as pacemaker of heart.

Pacemaker of heart is _____.

1. SA node
2. AV node
3. His bundle
4. Purkinje fibers

Solution 1

SA node is known as pacemaker of heart.

Solution 2

Pacemaker of heart is **SA node**.

1.7. _____ was signed in 1987 to control emission of ozone depleting substances.

To control emission of ozone-depleting substances International Treaty was signed in 1987.

1. Kyoto protocol
2. Montreal protocol
3. Nagoya protocol
4. Cartagena protocol

Solution

Montreal protocol was signed in 1987 to control emission of ozone depleting substances.

1.8. Budding in Hydro is a form of _____.

1. apoptosis
2. sexual reproduction
3. asexual reproduction
4. None of these

Solution

Budding in Hydro is a form of **asexual reproduction**.

1.9. _____ is considered as connecting link between ape and man.

1. Australopithecus
2. Homo habilis
3. Homo erectus
4. Neanderthal man

Solution

Australopithecus is considered as connecting link between ape and man.

1.10. Which one of the following diseases is non-communicable?

1. Diphtheria
2. Flu
3. Cancer
4. Malaria

Solution

Cancer

Q2. Answer the following questions:

2.1. Answer the following question.

Define and or explain the term:

Guttation

What is guttation?

Solution

1. The loss of water in the form of liquid is called guttation.
2. It occurs through special structures called water stomata or hydathodes.

2.2. Explain the statement of Law of dominance is not universal.

Solution

1. According to the law of dominance, when two homozygous individuals with one or more sets of contrasting characters are crossed, the alleles (characters) that appear in F_1 are dominant and those which do not appear in F_1 are recessive.
2. In many cases, the dominance is not complete or absent. This can be explained by two deviations of Mendel's law of dominance: Incomplete dominance and codominance. Thus, the law of dominance is significant and true, but it is not universally applicable.

2.3. Write two varieties of sugarcane having high sugar content.

Solution

CO - 419, 421, 453 are high yielding and having high sugar contents are developed in India at Coimbatore (Tamilnadu).

2.4. Very very short answer question.

Name the hormone secreted by the pineal gland.

Solution

Melatonin s secreted by Pineal gland

2.5. What is erythropoiesis?

Solution

The process of formation of RBCs is called erythropoiesis.

2.6. How malarial parasite plasmodium is transmitted from person to person?

Solution

The malarial parasite Plasmodium is transmitted through an insect vector - the female Anopheles mosquito.

2.7. Name two hormones of adenohypophysis.

Solution

a. Somatotropin or growth hormone.

b. Thyroid Stimulating Hormone (TSH).

2.8. Very short answer question.

What is the symplast pathway?

Solution

When water passes across from one living cell to another living cell through plasmodesmata, then it is called the symplast pathway. It is also called the trans-membrane pathway.

SECTION - B

Attempt any EIGHT of the following questions:

Q3. Write short note on

Green House Effect

Solution

1. Global warming is caused by the increase of greenhouse gases such as carbon dioxide, methane, water vapour and Chloro Fluoro Carbons (CFC), carbon monoxide, photochemical oxidants and hydrocarbons.
2. They are responsible for the heat retention ability of the atmosphere.
3. Global warming causes climate change, ozone layer depletion, rise in sea level and drowning of coastal inhabited land, melting of ice, etc.,
4. They are posing an even greater threat to human existence and so, man must start thinking of protecting the environment from pollution.

Q4. What is Cardiac output?

Solution

i. It is the volume of blood pumped out per min.

ii. For a normal adult human being it is calculated as follows :
Cardiac output = Systolic volume × Heart Rate

= 70 × 72

= 5040 ml/min

Q5. Explain the properties of a good or ideal cloning vector for rDNA technology.

Solution

Following characteristic properties, a cloning vector must possess in order to be used in rDNA technology:

i. A good vector should have the ability of independent replication so that as the vector replicates (through ori gene) and a large number of copies of the DNA insert will be formed.

ii. The vector should be able to easily introduce into host cells.

iii. A vector should have marker genes for antibiotic resistance.

iv. A vector must contain a unique cleavage site in one of the marker genes for the restriction enzyme.

v. It should have at least suitable control elements like a promoter, operator, ribosomal binding sites, etc.

vi. The plasmids obtained naturally do not possess all the characteristics. Hence, they are constructed by inserting a gene for antibiotic resistance. eg. pBR322, pBR320, pACYC177 are the constructed plasmids. pBR322 is mostly used in rDNA technology in plants.

Q6. Give any three differences between an artery and a vein

Distinguish between artery and vein.

Solution

Artery	Vein
Arteries carry blood from the heart to various body parts.	Veins carry blood from different body parts to the heart.
These carry oxygenated blood (except the pulmonary artery).	These carry deoxygenatec blood (except the pulmonary vein).

Blood flows with high speed and under high pressure.	Blood flows with low speed and under low pressure.
Valves are absent.	Valves are present.
Thick elastic walls present.	Walls thinner than arteries present

Q7. Describe the different communities involved in the process of succession.

Solution

i. **Pioneer Community:**

   a. The species that invade a bare area, are called pioneer species.

   b. In primary succession on rocks these are usually crustose lichens which are able to secrete acids to dissolve rock, helping in weathering of rocks and soil formation.

   c. These pave the way for bryophytes, mosses that are able to take hold in the small amount of soil.

ii. **Climax Community:**

   a. They are, with time, succeeded by herbaceous plants, and after several more stages, ultimately a stable climax forest community is formed.

   b. The climax community remains stable as long as the environment remains unchanged.

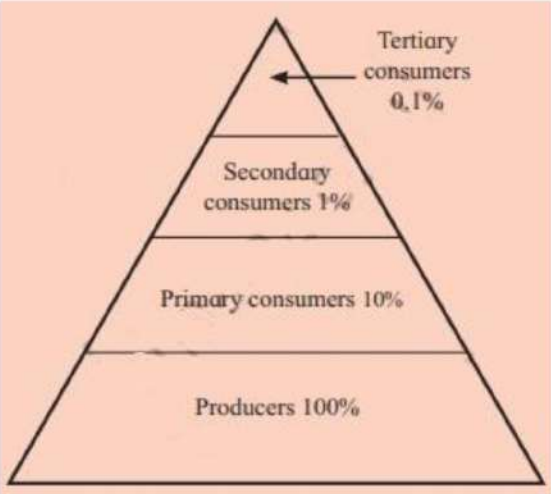
Q8. Name some drugs which are commonly abused?

Solution

The drugs, which are commonly abused, are opioids, cannabinoids and alkaloids of coca.

Q9. Draw a diagram of pyramid of energy.

Solution



Q10. Enlist the meninges of human brain.

Write a note on meninges of Brain.

Solution

Meninges are the protective membranes surrounding the brain and spinal cord. They are as follows:

i. **Dura mater**: It is the outermost tough, non-vascular, thick and fibrous meninx and is attached to the inner side of the cranium. Sub-dural space filled with serous fluid is present between dura mater and arachnoid mater.

ii. **Arachnoid mater**: It is the middle, thin and non-vascular layer of connective tissue having web like appearance. Sub-arachnoid space is present between arachnoid mater and pia mater. It is filled with Cerebrospinal fluid (CSF).

iii. **Pia mater**: It is the innermost delicate, highly vascular membrane. It lies in close contact with the CNS.

Q11. Distinguish between active immunity and passive immunity.

Solution

No.	Active Immunity	Passive Immunity
a.	When resistance is developed by individuals as a result of an antigenic stimulus it is called active immunity.	When ready-made antibodies are directly given to protect the body against foreign agents, immunity is called 'Passive immunity'.

b.	The types of active immunity are natural acquired active immunity and artificial acquired active immunity.	The types of passive immunity are natural acquired passive immunity and artificially acquired passive immunity.
c.	It has no side effects.	It may cause a reaction.
d.	It provides relief only after a long period.	It provides immediate relief.
e.	It is long-lasting immunity.	It is short-lived immunity.
f.	e.g. Polio vaccine, BCG vaccine, etc.	e.g. Rabies vaccine, maternal antibodies, etc.

Q12. Match the pairs:

	Column A		Column B
(i)	Compost making biofertilizer	(a)	Azotobacter
(ii)	N_2 fixing biofertilizer	(b)	Mycorrhiza
(iii)	Fungal biofertilizer	(c)	Agrobacterium
(iv)	Phosphate solubilizing biofertilizer	(d)	Actinobocteria

Solution

	Column A		Column B
(i)	Compost making biofertilizer	(d)	Actinobocteria
(ii)	N_2 fixing biofertilizer	(a)	Azotobacter

(iii)	Fungal biofertilizer	(b)	Mycorrhiza
(iv)	Phosphate solubilizing biofertilizer	(c)	Agrobacterium

Q13.

13.1. Answer the following question.

What is transpiration?

Solution 1

The loss of water in the form of vapour is called transpiration that occurs through leaves, stem, flowers, and fruits.

Solution 2

The evaporation of water from the leaves of a plant in the form of water vapour is called transpiration.

13.2. Answer the following question.

Explain the role of transpiration.

Solution

Role of transpiration:

i. It removes excess of water.

ii. It helps in the passive absorption of water and minerals from the soil.

iii. It helps in the ascent of sap.

iv. As stomata are open, gaseous exchange required for photosynthesis and respiration is facilitated.

v. It maintains the turgor of the cells.

vi. Transpiration helps in reducing the temperature of leaf and in imparting a cooling effect.

Q14. Describe any three adaptations in anemophilous flowers.

Give adaptations in anemophilous flowers.

Solution

1. The flowers are small, inconspicuous, colourless, and without nectar and fragrance (odour).
2. The pollen grains are light in weight, dry and produced in large numbers to increase chances of pollination considering the wastage of pollen grains.
3. Stigma is feathery to trap pollens carried by wind currents.
4. Stamens are exserted with long filaments and versatile anthers.
5. Stamens and stigmas are exposed to air currents.

SECTION - C

Attempt any EIGHT of the following questions:

Q15. Write a note on the significance of Palaeontology.

Solution

1. It is useful in the reconstruction of the phylogeny.
2. It helps in studying various forms and structures of extinct animals.
3. It provides a record of missing links between two groups of organisms.
4. It helps to reconstruct the palaeoecology and palaeoenvironment of a selected area.
5. It helps in the study of the habits of extinct organisms.

Q16.

16.1. Define Population.

Solution

Population: Organisms of the same kind inhabiting a geographical area constitute the population.

OR

Individuals live in groups in a well-defined geographical area, share or compete for similar resources, potentially interbreed and thus form a population.

OR

The population is defined as a group of individuals of a species occupying a definite geographic area at a given time.

16.2. Define the term Biome.

Solution

Biome constitutes a large regional terrestrial unit delimited by a specific climatic zone having a major vegetation zone (plant communities) and the associated fauna.

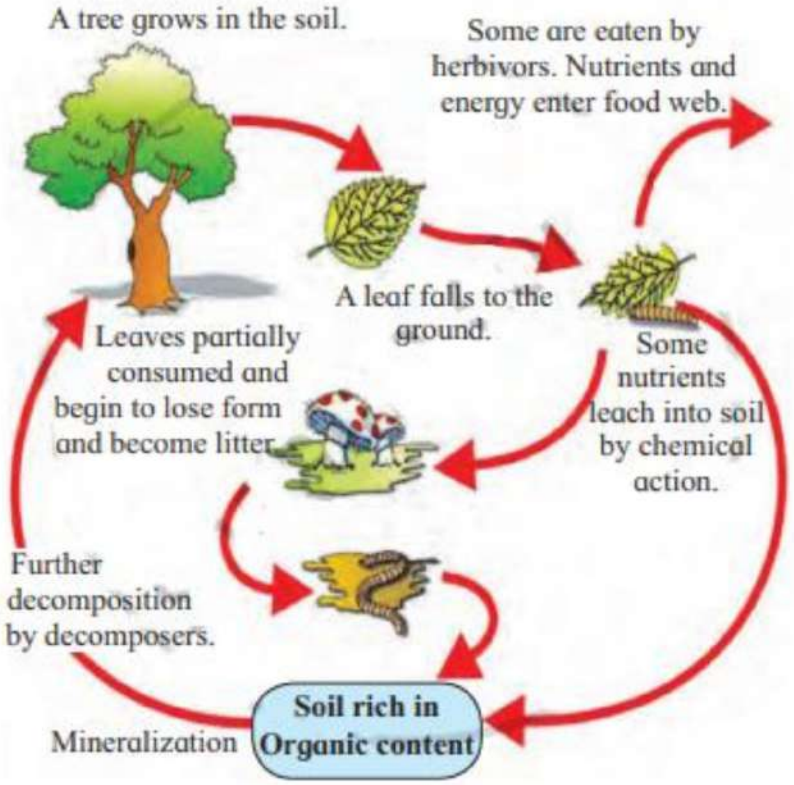
16.3. Define Niche.

Solution

Niche describes the position of a species in an environment and also the functional role played by an organism.

Q17. Outline salient features of decomposition cycle in an ecosystem.

Solution



Q18. Match the following pairs:

Column A		Column B	
Antibiotic produced		Microbial source	
(i)	Penicillin	(a)	Streptomyces venezuelae
(ii)	Chloromycetin	(b)	Bacillus licheniformis
(iii)	Bacitracin	(c)	Streptomyces aurifaciens
(iv)	Erythromycin	(d)	Streptomyces griseus
(v)	Streptomycin	(e)	Penicillium chrysogenum
(vi)	Terramycin	(f)	Streptomyces erythreus

Solution

Column A		Column B	
Antibiotic produced		Microbial source	
(i)	Penicillin	(e)	Penicillium chrysogenum
(ii)	Chloromycetin	(a)	Streptomyces venezuelae
(iii)	Bacitracin	(b)	Bacillus licheniformis
(iv)	Erythromycin	(b)	Streptomyces erythreus
(v)	Streptomycin	(d)	Streptomyces griseus
(vi)	Terramycin	(c)	Streptomyces aurifaciens

Q19. Write avian characters of Archaeopteryx.

Solution

i. Feathery exoskeleton.

ii. Forelimbs are modified into wings.

iii. Jaws are modified into beak.

iv. Skull bone is completely fused.

v. Large rounded cranium.

vi. Cranium with large orbits and a single condyle.

vii. Limb bones are bird like.

viii. Hind limbs with four toes first toe is opposible.

Q20. Describe the term Niche.

Solution

1. The term niche was coined by J. Grinnell in 1917.
2. Niche not only describes the position of a species in an environment but also describes the functional role played by an organism.
3. Niche is specific to each species and no two species can share the same niche.
4. It includes various aspects of the life of an organism like diet, shelter, etc.
5. Niche deals with the flow of energy from one organism to another.
6. There are three types of niches; Spatial or habitat niche, Trophic niche, and Multi-dimensional or hypervolume niche.
7. Organisms Living in the same habitat differ in their niches because of different eating habits.

Q21. How particulate air pollutants affect human health?

Solution

i. These fine particulates can be inhaled deep into the lungs and are responsible for irritation, inflammation and damage to lungs.

ii. In addition to this, it causes breathing and respiratory disorders and premature deaths.

iii. Smoke, smog, pesticides, heavy metals, dust and radioactive elements are the examples of particulate pollutants.

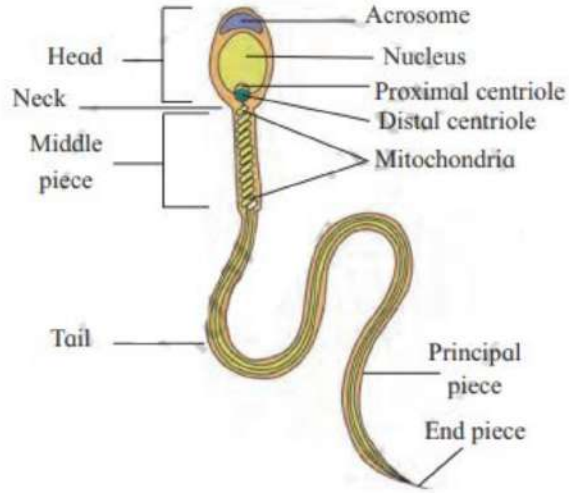
iv. Significant illnesses like asthma, lung, cancer, atherosclerosis, birth deformities, and early mortality are brought on by these pollutants.

v. Additionally, these contaminants adversely damage plants by delaying photosynthesis.

Q22. Write a note on human sperm

Describe the structure of human sperm.

Solution



Structure of Sperm

(Sperm = seed, zoon = animal)
It is a microscopic, elongated haploid motile male gamete or paternal gamete measuring about 0.055 mm (60 mu) in length. Sperm remains viable for seventy – two hours, but can fertilize the ovum in the first 12 to 14 hours only.

Human sperm is divisible into three parts - head, middle piece and tail.

1. **Head:** It is a flat and oval region consisting of a large nucleus and an acrosome. Acrosome secretes hydrolytic enzymes like hyaluronidase which helps in the penetration of the egg during fertilization. The acrosome and anterior half of the nucleus are covered by a fibrillar sheath.

2. **Neck:** It is a very short region having two centrioles. The proximal centriole plays a role in the first cleavage of the zygote. The distal centriole gives rise to the axial filament of the sperm.
3. **Middle piece:** It serves as the powerhouse for sperm. It has many mitochondria spirally coiled (Nebenkern) around the axial filament. The mitochondria provide energy for the movement of the sperm in the female genital tract. The posterior half of the nucleus, neck, middle piece of sperm are covered by a sheath.
4. **Tail:** The tail is a long, slender and tapering structure formed of cytoplasm. A fine thread, the axial filament arises from the distal centriole and traverses the middle piece and tail.

Q23.

23.1. Define ornithophily.

Solution

Ornithophily is bird pollination, where the pollen grains of the flower are distributed by specialised birds for pollination. They usually have small sizes and long beaks e.g. Sun birds and humming birds. Some ornithophilous plants are Bombax, Callistemon (Bottle Brush), Butea, etc.

23.2. Enlist adaptations in ornithophilous flowers.

Solution

Adaptation for the pollination in ornithophilous flowers:

1. Flowers are usually brightly coloured, large and showy.
2. They secrete profuse, dilute nectar.
3. Pollen grains are sticky and spiny.
4. Flowers are generally without fragrance, as birds have a poor sense of smell.

Q24. Write a short note on facilitated diffusion.

Solution

i. The passive absorption of solutes when mediated by a carrier, is called Facilitated diffusion.

ii. Particles that are lipid soluble can easily diffuse through lipoproteinous cell membrane.

iii. The diffusion of hydrophilic solutes has to be facilitated because their diffusion across the membrane is difficult.

iv. Membrane proteins provide such sites for facilitated diffusion.

v. These proteins are aquaporins and ion- channels. These proteins help move substances across membranes without the expenditure of energy.

vi. Concentration gradient must be present for the molecules to be diffused through facilitated diffusion.

Q25. Explain capillarity theory.

Answer the following question.

Explain capillarity theory of water translocation.

Solution

Capillarity theory of water translocation:

i. This theory was put forth by Boehm in (1863).

ii. According to this theory, physical forces and dead cells are responsible for the ascent of sap. For e.g. Wick dipped in an oil lamp, shows capillarity due to which oil is raised upwards. The conduction of water in a straw dipped in water is raised to a certain height because of capillarity. The height to which water is raised depends on the diameter of the straw.

iii. Capillarity is because of surface tension, and forces of cohesion (attraction between like molecules) and adhesion (attraction between unlike molecules).

iv. Xylem vessel/ tracheid with its lumen can be compared with straw.

v. Water column exists because of combined cohesive and adhesive forces of water and xylem wall, due to capillarity.

vi. Due to capillarity, water is raised or conducted upwards against gravity, to few centimeters only.

Q26.

26.1. Give the name, type and origin of the following cranial nerve:

Number-II

Solution

Number	Name	Type	Origin
II	Optic	Sensory	Side of diencephalon

26.2. Give the name, type and origin of the following cranial nerve:

Number-IV

Solution

Number	Name	Type	Origin
IV	Pathetic	Motor	Floor of mid-brain

26.3. Give the name, type and origin of the following cranial nerve:

Number-IX

Solution

Number	Name	Type	Origin
IX	Glossopharyngeal	Mixed	Side of medulla oblongata

SECTION - D

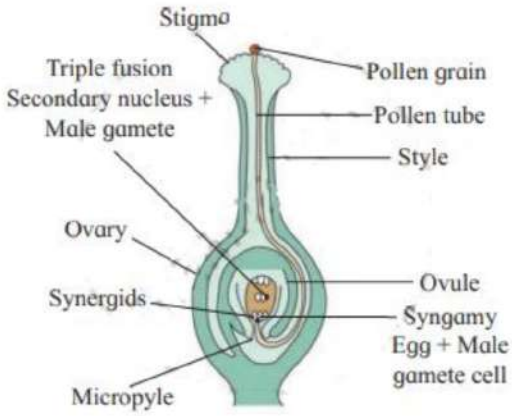
Attempt any THREE of the following questions:

Q27.

27.1. Describe the process of double fertilization.

Solution

Double fertilization:



1. The fusion of one male gamete with an egg and that of another male gamete with a secondary nucleus is called double fertilization.
   It is the characteristic feature of angiosperms.
   It was discovered by Nawaschin in the liliaceous plants like Lilium and Fritillaria.
2. When pollen grain reaches the surface of the stigma, it germinates and forms a pollen tube.
3. The pollen tube penetrates the stigma, style, and ovary chamber and then enters the ovule.
4. The growth of the pollen tube is guided by the chemicals secreted by the synergids.
5. Usually, when a pollen tube enters the ovule through the micropyle, it is termed porogamy.
   But in some cases, it enters through chalaza which is known as chalazogamy.
   In some plants, it enters by piercing the integuments which are called mesogamy.
6. A pollen tube penetrates the embryo sac of the ovule through its micropylar end.
7. The pollen tube carrying male gametes penetrates in one of the synergids.
8. Watery contents of synergid are absorbed by the pollen tube, due to which it ruptures and releases the contents, including the two non-motile male gametes.
9. As non-motile male gametes are carried through a hollow pollen tube, it is known as siphonogamy that ensures fertilization to take place.

10. Fertilization mainly involves two processes: Syngamy and Triple fusion.
    a. Syngamy:
    It is the fusion of haploid male gamete with a haploid female gamete (egg). It results in the formation of a diploid zygote which develops to form an embryo. Syngamy is a type of generative fertilization.
    b. Triple fusion:
    It is the fusion of a second haploid male gamete with the diploid secondary nucleus. It results in the formation of a Primary Endosperm Nucleus (PEN) which develops into triploid endosperm. Triple fusion is a type of vegetative fertilization.
11. In this process, both the male gametes participate, due to which fertilization occurs twice in the same embryo sac, hence it is described as double fertilization.

27.2. What is Geitonogamy?

Solution

It is the transfer of pollen grain to a stigma of a different flower produced on the same plant. It is functionally similar to cross-pollination as it involves pollinating agents, but it cannot bring about genetic variations and is only of ecological significance e.g. Cucurbita maxima. It is similar to autogamy as pollen grains come from same plant.

Q28. What are the different strategies for biodiversity conservation in India?

Solution

There are two main strategies for the conservation of biodiversity:

(i) **In-situ conservation:** The natural habitat of the organisms is protected so the protection of organisms takes place automatically.

It includes:

a. **Biosphere reserves:** There are 425 biosphere reserves worldwide, 14 of which are in India. India is home to three of the world's biodiversity hotspots. Hotspots are places with a high concentration of endemic and endangered species.

b. **National parks or wildlife sanctuaries:** There are around 90 national parks and 448 wildlife sanctuaries in India. There are 5 national parks and 11 sanctuaries in Maharashtra.

c. **Sacred groves:** These are untouched tracts of forest that have been protected in the name of God. Some endangered plant and animal species can be found here.

(ii) **Ex-situ conservation:** It is the process of protecting the endangered species of plants or animals by removing it from threatened habitats and placing them under the care of humans.

It includes:

a. Botanical gardens, zoological parks, and arboreta are examples of traditional ex-situ conservation practices.

b. Seed banks to preserve wild food grains and vegetables.

c. Cryopreservation refers to the freezing of materials.

Q29. Describe the process of transcription.

Solution

i. During transcription, information of only one strand of DNA is copied into RNA.

ii. DNA transcription takes place in nucleus in eukaryotes whereas translation occurs in cytoplasm.

iii. The promotor is located towards 5′ end of structural gene.

iv. DNA dependent RNA polymerase catalyses polymerisation in 5′→3′ direction. So the DNA strand having 3′→5′ polarity acts as template strand. The other strand of DNA having 5′→3′ polarity is complementary to template strand.

v. The information on this strand of DNA is copied on mRNA.

vi. The terminator is located at 3′ end of coding strand i.e. downstream. It defines the end of the transcription process.

vii. As the mRNA grows, the transcribed region of DNA molecule becomes spirally coiled and attains (regains) double helical form.

Q30. Explain mechanism of hormone action through membrane receptor.

Solution

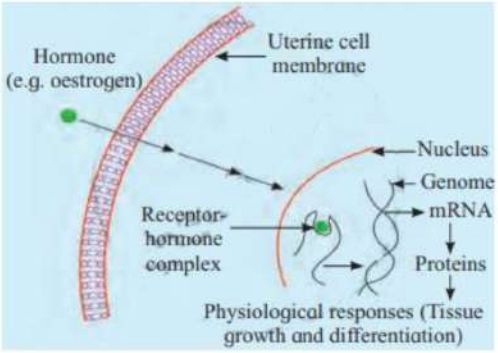
i. The endocrine system controls body activities by means of chemical messengers called hormones. Hormones are released directly into the blood.

ii. Hormones like catecholamines, peptide and polypeptide hormones are not lipid soluble. Therefore they cannot enter their target cells through plasma membrane.

iii. These non steroid water soluble hormones interact with surface receptor, which initiate metabolic activity.

iv. Molecules of amino acid derivatives, peptide hormones bind to specific receptor molecules located on the plasma membrane.

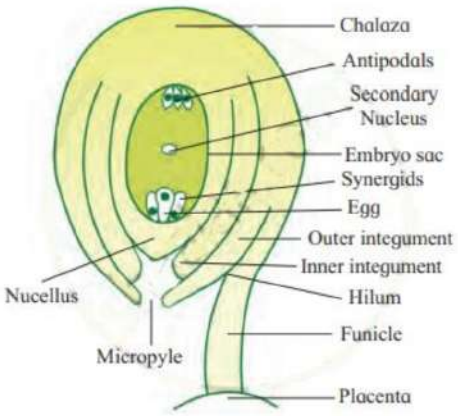
v. The hormone receptor complex causes the release of an enzyme adenylate cyclase from the receptor site. This enzyme forms cyclic AMP from ATP of the cell. cAMP activates enzymatic actions.



Q31.

31.1. Draw a labelled diagram of the LS. of Anatropous ovule.

Solution



31.2. Write the function of LS of Anotropous ovule.

Solution

i. **Funiculus:** ovary and is attached to the placenta by a small stalk called funiculus.

ii. **Hilum:** The place of attachment of funiculus with the main body of ovule, is called hilum.

iii. **Integuments:** Which is surrounded usually by two protective coverings called integuments viz. Outer and an inner integument.

iv. **Microphyle:** Narrow opening at the apex of the ovule is called micropyle.

v. **Nucellus:** Provides nutrition to the developing embryo.

vi. **Embryo sac:** Embryo sac (female gametophyte) is oval, multicellular structure embedded in the nucellus.