

CBSE Question Paper 2017

Delhi Set-2

CBSE Class-12 Biology

General Instructions:

1. There are a total of 26 questions and five sections in the question paper, All questions are compulsory.
2. Section A contains question number 1 to 5, Very Short Answer type questions of one mark each.
3. Section B contains question number 6 to 10, Short Answer type I questions of two marks each.
4. Section C contains question number 11 to 22, Short Answer type II questions of three marks each.
5. Section D contains question number 23, Value Based Question of four marks.
6. Section E contains question number 24 to 26, Long Answer type questions of five marks each.
7. There is no overall choice in the question paper, however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks.

An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

Section A

Q1. What is "fitness of an individual" according to Darwin?

Ans.The ability of an organism to pass on its genes to the future generations is termed as "fitness of an individual" according to Darwin.

Q2. What is biopiracy?

Ans.The commercial exploitation of biological resources or genetic material without the

permission of the original inventor or the indigenous people is termed as biopiracy. For example, basmati is a type of fragrant rice variety grown in India. But some US based companies crossed this Indian basmati rice with their local variety and produced Texmati – a new American fragrant rice variety and used it commercially.

Q3. Suggest a method to ensure an anamnestic response in humans.

Ans. When a person encounters a particular antigen, he/she responds to it which is known as primary immune response. When this antigen is introduced again in the body of that person, the antibodies produced during primary response reappear rapidly. This is known as secondary response or anamnestic response. So by administering the dead pathogen/attenuated pathogen or antigen in the body of the person can ensure secondary immune response due to production of memory cells in the body.

Q4. State the fate of a pair of autosomes during gamete formation.

Ans. The homologous pair of autosomes will separate from each other and will move to different gametes during gamete formation.

Q5. Our government has intentionally imposed strict conditions for M.T.P. in our country. Justify giving a reason.

Ans. Our government has imposed strict conditions for M.T.P. to avoid its misuse. Such restrictions are very important to prevent illegal female foeticides in our country.

Section B

Q6. By taking two examples explain how has bio-fortification helped in improving food quality.

Ans. Biofortification is the idea of breeding crops with higher levels of nutritional value. In 2000, maize hybrids that had twice the amount of amino acids, lysine and tryptophan, compared to existing maize hybrids were developed. Wheat variety, Atlas 66, having a high protein content, has been used as a donor for improving cultivated wheat.

Q7. Plenty of algal bloom is observed in a pond in your locality.

(a) Write what has caused this bloom and how does it affect the quality of water.

(b) Suggest a preventive measure.

Ans. a) Cause - Algal blooms are caused by the increased nutrient availability in the waterbodies. This high availability of phosphorus and nitrogen is in turn caused by the chemicals present in fertilisers that get dissolved in the soil and eventually get washed away to the water bodies.

Affect - These algal blooms may shade out plants that would normally live lower in the water column resulting in a loss of biodiversity. Eutrophication can also result in the development of hypoxic conditions. This oxygen deficiency may cause the death of aquatic animals. They ultimately degrade the quality of water.

b) Farmers in areas that are affected by algal blooms need to find alternative ways to fertilize the soil like using manures and techniques such as vermicomposting. Also, people must use cleaning agents and detergents that are biodegradable and that do not contain phosphates. To further reduce the amount of nutrients that are causing an overgrowth of algae in lakes and streams, laws need to be created that regulate the dumping of waste water.

Q8. How does the application of cyanobacteria help improve agricultural output?

Ans. Cyanobacteria are free living or symbiotic blue green algae which are capable of converting atmospheric molecular nitrogen into soluble forms like nitrites or nitrates. They enrich the nitrogen content of the soil, thus, acting as a natural fertilizer. They replenish the soil with the nitrogenous compounds and hence are useful in agriculture.

Q9. In a flowering plant a microspore mother cell produces four male gametophytes while a megaspore mother cell forms only one female gametophyte. Explain.

Ans. Male gametophytes are formed by the meiosis of a single microspore mother cell whereas in case of formation of female gametophyte, the process is different at the end. A single megaspore mother cell undergoes meiosis to form 4 megaspores, out of which 3 degenerate and only one survives. This surviving megaspore undergoes 3 rounds of mitotic divisions to form the female gametophyte inside the ovule.

Q10. Describe the structure of a nucleosome.

OR

Mention the evolutionary significance of the following organisms:

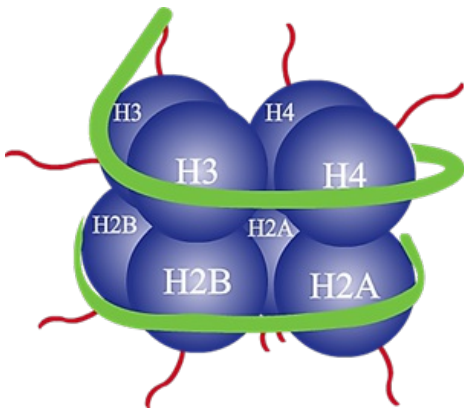
(a) Shrews

(b) Lobefins

(c) Homo habilis

(d) Homo erectus

Ans. In eukaryotes, the packaging of DNA helix is very complex, as the amount of DNA is very high. When we analyze the structure of eukaryotic chromosome, we find that it is composed of DNA and proteins. These proteins, known as **histones**, are basic in nature and are positively charged. Thus, they can easily interact with the negatively charged DNA molecule. The histone proteins first organise to make a unit of eight molecules, which is known as histone octamer. The negatively charged DNA molecule gets wrapped around this positively charged histone octamer. This complex structure is called nucleosome. In a typical nucleosome, around 200 base pairs of DNA are present.



OR

(a) Shrews were the first mammals. These were the long-tailed insectivorous, squirrel-like creatures, which gave rise to the primitive primates, namely lemurs and tarsiers, in the beginning of the tertiary period (Palaeocene epoch).

(b) Lobefins were the first amphibians, from which the modern day frogs and salamanders evolved.

(c) Homo habilis were the first human-like primate who lived in Africa about 2 million years ago. Their brain capacities were between 650-800cc and they probably didn't eat meat.

(d) Homo erectus were the next primates evolved from Homo habilis about 1.5 mya. They had a large brain with capacities around 900cc and they had an erect posture. They probably ate meat.

Section C

Q11. During a medical investigation, an infant was found to possess an extra chromosome-21. Describe the symptoms the child is likely to develop later in the life.

Ans. An additional copy of chromosome number 21 (trisomy of 21) leads to Down's syndrome. The affected individual will have:

- (i) short statured with small round head
 - (ii) furrowed tongue
 - (iii) partially open mouth
 - (iv) broad palm with characteristic palm crease
 - (v) retarded physical, psychomotor and mental development.
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Q12. 'In-situ' Conservation can help endangered/threatened species. Justify the statement.

OR

Name and describe any three causes of bio-diversity losses.

Ans. It is the process of conservation of living resources in their natural habitats. It is a type of onsite conservation. The endangered plants and animals are protected inside their natural surroundings. Eg national park, wild life sanctuary, biosphere reserves.

It also includes the introduction of plants and animal species back into agricultural, horticultural and animal husbandry practices so that they are cultivated/reproduced for their reuse by their farmers.

1.It also maintains genetic diversity of crop plants/flowers by saving seeds for next planting season.

2.Biodiversity is permanently protected

3. Ecological integrity is maintained and managed

4. Facilitates scientific research of the site

5. It may be possible to improve the ecological integrity of the area and restore it if it has been damaged by poaching etc.

Or

Three causes of biodiversity losses are:

1. Habitat destruction- It is considered as the primary cause of biodiversity loss. It is generally caused by deforestation, fire and over-use and urbanization. It leads to the extinction or decrease in the number of animals living in that particular habitat.

2. Alien species invasion - Sometimes the alien species introduced in a geographical area unintentionally or deliberately may turn invasive and can cause decline or extinction of the indigenous species.

3. Over exploitation of natural resources- Over-exploitation of resources has been one of the major contributor to this. Due to increasing human population, resource demands have increased which has resulted into exploitation of already present resources and development of various forms of energy resources. Development of these energy sources modifies natural habitat and accelerates loss of biodiversity.

Q13. Difference between an annual and biennial plants. Provide one example of each.

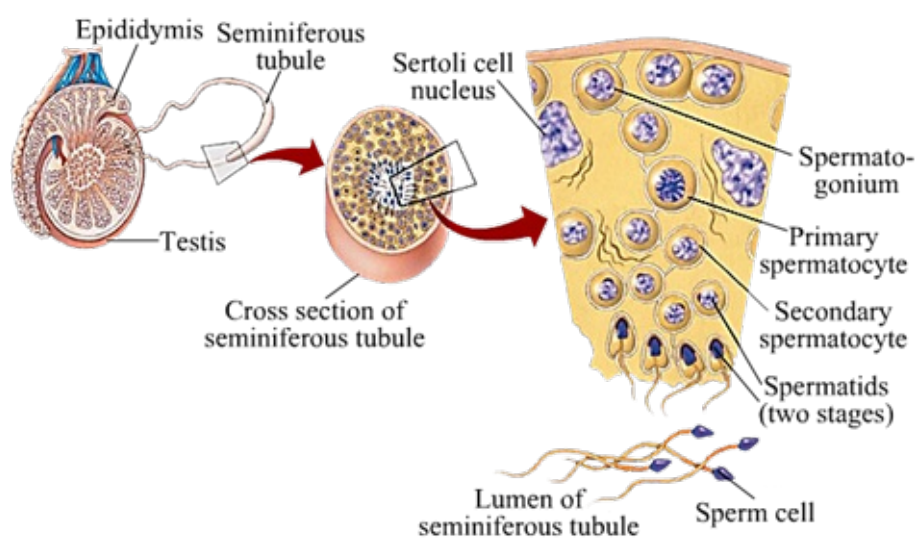
Ans.

Annual Plants	Biennial Plants
The plants that require a single season to complete their whole life cycle are termed as annual plants.	The plants that require two seasons to complete their total life cycle are called biennial plants
	In the first year the plants grow a healthy root system, leaves

They grow, set seeds and die all within one year.	and a short stem before becoming dormant over the winter months. In the second year the plants grow quickly before flowering, setting seed and then die.
E.g. rice, wheat etc.	E.g. onion, parsley, carrot etc.

Q14. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.

Ans. Labelled sectional view of seminiferous tubules of humans:



Q15. A criminal blew himself up in a local market when was chased by cops. His face was beyond recognition. Suggest and describe a modern technique that can help establish his identity.

Ans. The technique that will help the authorities to establish the identity of the dead is known as DNA finger printing.

Basis of DNA Fingerprinting - DNA fingerprinting is a method for comparing the DNA sequences of any two individuals. 99.9% of the base sequences in all human beings are identical. It is the remaining 0.1% that makes every individual unique. In this, certain specific regions called repetitive DNA sequences that are different for every individual are used for comparative study. This repetitive DNA is separated from the bulk DNA as different peaks during density gradient centrifugation in which bulk DNA forms major peak and the other small peaks are referred to as **satellite DNA**. These sequences show high degree of

polymorphism and form the basis of DNA fingerprinting.

Methodology of DNA fingerprinting-

The DNA fingerprinting technique involves following steps:

- (i) Isolation of DNA
- (ii) Digestion of DNA by restriction endonucleases
- (iii) Separation of DNA fragments by electrophoresis
- (iv) Transfer of separated DNA fragments to synthetic membranes
- (v) Hybridisation of separated fragments using labelled VNTR probes
- (vi) Detection of hybridised DNA fragments by autoradiography

After autoradiography, different bands are obtained which are characteristics of an individual.

Q16. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg's principle.

Ans. The Hardy-Weinberg equation is a mathematical equation that can be used to calculate the genetic variation of a population at equilibrium.

The Hardy-Weinberg equation is expressed as:

$$p^2 + 2pq + q^2 = 1$$

where p is the frequency of the "A" allele and q is the frequency of the "a" allele in the population. In the equation, p^2 represents the frequency of the homozygous genotype AA, q^2 represents the frequency of the homozygous genotype aa, and $2pq$ represents the frequency of the heterozygous genotype Aa. In addition, the sum of the allele frequencies for all the alleles at the locus must be 1, so $(p + q)^2 = 1$. If the p and q allele frequencies are known, then the frequencies of the three genotypes may be calculated using the Hardy-Weinberg equation. In population genetics studies, the Hardy-Weinberg equation can be used to measure whether the observed genotype frequencies in a population differ from the frequencies predicted by the equation. If there is any difference in the frequencies, it indicates the extent of evolutionary change.

Q17. Explain the role(s) of the following in Biotechnology:

(a) Restriction endonuclease

(b) Gel – electrophoresis

(c) Selectable markers in pBR322

Ans. (A) Restriction endonuclease- These are enzymes that make cuts at specific positions within the DNA. They bind to their specific recognition sequence and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbones. They are used in biotechnology to form recombinant molecules which are composed of DNA from different sources. To insert a foreign DNA into an intact DNA, it must be cut from its source and the intact DNA also must be cut open. Both these processes are carried by using the same restriction endonucleases.

(B) Gel electrophoresis- It is a technique that allows us to separate DNA fragments on the basis of their size. In this technique, the negatively charged DNA fragments are forced to move under an electric field through a medium or matrix. All the DNA fragments thus move towards anode and get separated according to their size through sieving effect provided by the agarose gel. The DNA of desired length can then be isolated and used in constructing recombinant DNA by joining them with cloning vectors.

(c) pBR322 has two antibiotic resistance genes, one for ampicillin and other one for tetracycline. Antibiotic resistance serves as selectable marker. If the foreign DNA is ligated at the site of tetracycline resistance gene in pBR322 vector, the recombinant plasmid will lose tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinants by plating the transformants on ampicillin containing medium. The transformants growing on ampicillin containing medium are then transferred on a medium containing tetracycline. The recombinants will grow in ampicillin containing medium but not on the tetracycline-containing medium. However the non recombinants will grow on both. Thus by using antibiotic resistant genes as selectable markers, we can differentiate between recombinants and non-recombinants.

Q18. Why do lepidopterans die when they feed on Bt cotton plant? Explain how does it happen.

Ans. *Bacillus thuringiensis* is a bacterium that produces proteins to kill certain insects such as lepidopterans (armyworm), coleopterans (beetles), and dipterans (flies/ mosquitoes). *B. thuringiensis* produces a protein crystal containing a toxic protein (inactivated state). This

toxin is encoded by a gene called **cry** in the bacterium. Proteins encoded by genes cryIAc and cryIIAb control cotton bollworms and those encoded by cryIAb control corn borer.

When this inactivated toxin is ingested by the insect, it is converted into activated form due to alkaline pH of the gut. The alkaline pH of the gut results in the solubalisation of the crystal, thus converting it into the activated toxin.

Inactivated toxin $\xrightarrow{\text{alkaline pH}}$ Activated toxin (gut of insect)

Activated toxin binds to the epithelial cells in the midgut of insect and creates pores that cause lyses and swelling and eventually death of insect.

Q19. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

Ans. Recombinant DNA technology is used to obtain foreign gene product.

It involves following steps-

1. Identification and isolation of gene of interest
 2. Adding or ligating the gene of interest into suitable vector, resulting in formation of a complete recombinant DNA molecule
 3. Transfer of this recombinant DNA molecule into suitable host cell
 4. Selection of recombinants and non-recombinant cells
 5. Expression of gene of interest by culturing recombinant cells under suitable conditions
 6. Culturing of cells in bioreactors for large scale production of desired product.
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Q20. Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment.

Ans. After the primary treatment, the primary effluent is taken for secondary treatment where it is passed into large aeration tanks and is constantly agitated and air is pumped into it. This leads to the vigorous growth of useful aerobic microbes into flocs. **Flocs** are masses of bacteria associated with fungal filaments to form mesh like structures. These microbes in the flocs consume the major part of the organic matter in the effluent and reduces the BOD (biological oxygen demand) of the effluent. Less BOD means that the waste water is less polluted.

After this, the effluent is passed into a settling tank where the flocs are allowed to settle and this sediment is called **activated sludge**. A small part of the activated sludge is pumped back

to serve as the inoculum. Inoculum is the small amount of a material containing microbes that can start a new culture. This way same microbial culture is recycled and reused to start a new culture for the treatment.

Q21. (a) What is inbreeding depression?

(b) Explain the importance of "selection" during inbreeding in cattle.

Ans.(a) Inbreeding refers to the mating of more closely related individuals within the same breed for 4-6 generations. This results in the reduction in the fertility and productivity of an organism. This is called inbreeding depression.

(b) Inbreeding is done to evolve a pureline and to express desirable superior genes in any animal. To carry out this, superior males and superior females are selected for mating which contain those desirable characteristics. In case of cattle, a superior female is a cow or buffalo that produces more milk per lactation and a superior male is the bull which gives rise to superior progeny as compared to those of other males.

Q22. A group of youth were having a 'rave party' in an isolated area and was raided by police. Packets of 'smack' and syringes with needles were found littered around.

(a) Why is taking 'smack' considered an abuse?

(b) Write the chemical name of 'smack' and the name of its source plant.

(c) Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why?

Ans. (a) Taking smack is considered as abuse because it is highly addictive drug. It is a depressant and slows down body functions. It can cause psychological and physical dependence. It causes constipation, nausea/vomiting, lightheadedness, histamine launch, itching, xerostomia, excessive sweating, somnolence (sleepy or perhaps tired sensation), hypotension (reduced blood pressure), inspiration (sense of intensive satisfaction, pleasure, excitement along with joy), inflammation of the liver organ.

(b) Chemical name of smack is diacetylmorphine. Its source plant is *Papaver somniferum* (poppy).

(c) Syringes and needles are used to inject drugs usually intravenously so that the abusers can have the effects of drug very quickly and have a stronger effect. This mode of drug administration ensures availability of drug in higher amounts in the body which has

increased chances of overdose which has proven fatal in most of the cases. Chances of addiction are higher in these cases. Infected syringes also predisposes the user to catch diseases like AIDS.

Section D

Q23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

(a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons)

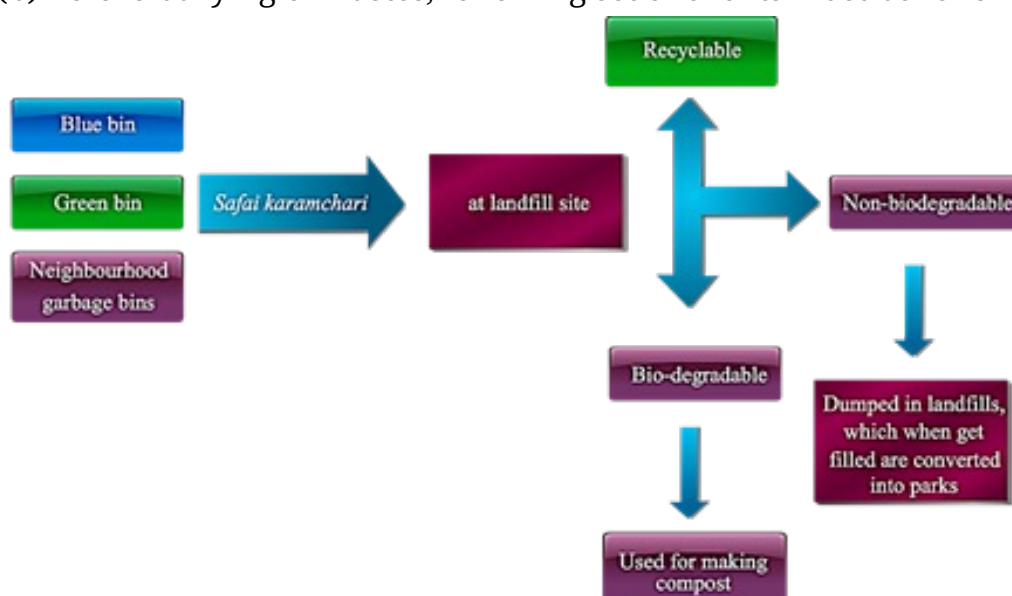
(b) With the help of flow charts, one for each practice depict the chain of events that follow.

Ans. (a) Following arguments can be put to promote burying and discourage burning:

(i) Burning wastes result in generation of various gases like CO_2 and oxides of nitrogen and sulphur. These gases are very harmful to environment and cause various environmental issues like global warming, acid rain, etc.

(ii) The gases released during burning have various health hazards also, like nausea, headache, respiratory diseases, etc.

(b) Before burying of wastes, following set of events must be followed:



Section E

Q24. (a) What is an age-pyramid?

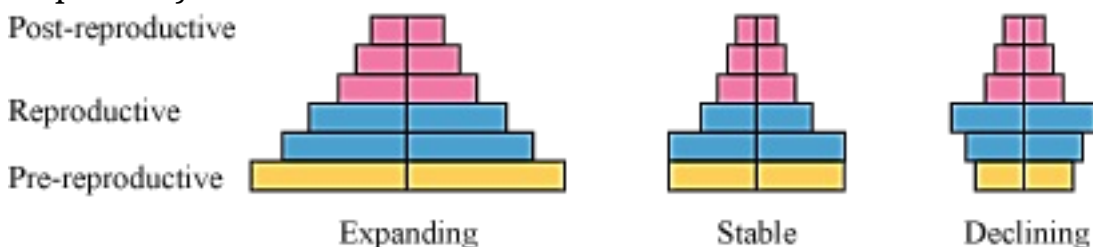
(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

Ans. (a) An age pyramid is a graphical representation of the distribution of various age groups within a population of a region forming the shape of a pyramid when the population is growing.

(b) For human population, the age pyramid shows age distribution of males and females in a combined diagram. These age groups are pre-reproductive, reproductive and post-reproductive. The shape of the pyramids reflects the growth status of the population. Three types of pyramids namely, pyramid with broad base, bell-shaped and an urn-like structure indicate rapidly growing population, stable population and a declining population respectively.



OR

Healthy ecosystem is the base for a wide range of economic, environmental and aesthetic goods and services.

The products of ecosystem processes are named as ecosystem services, as they are of great help to the organisms living within an ecosystem.

Healthy forest ecosystem purifies air and water.

The plants in the ecosystem release a lot of oxygen during photosynthesis and, thus, help in replenishing the gas consumed in respiration and combustion.

It also mitigates droughts and floods as well as cycles nutrients.

A number of pollinators present in forests help in reproduction of various crop plants, fruit plants and others.

Healthy ecosystem generates fertile soil and provides wildlife habitat.

Maintenance of biodiversity is also an important aspect of healthy ecosystem.

It also provides aesthetic, cultural and spiritual values.

Q25. Read the statement and answer the questions that follow. (5)

A flower of brinjal has 520 ovules in its ovary. However, it produces a fruit with only 480 viable seeds.

(a) What could have prevented the rest of the 40 ovules from maturing into viable seeds? Explain giving a reason.

(b) Describe the development of a dicot embryo in a viable seed.

(c) Why certain angiospermic seed albuminous while others are exalbuminous? Explain.

OR

(a) Name the hormones secreted and write their functions:

(i) by corpus luteum and placenta (any two).

(ii) during Follicular phase and parturition.

(b) Name the stages in a human female where:

(i) Corpus luteum and placenta co-exist.

(ii) Corpus luteum temporarily ceases to exist.

Ans. (a) Ovules develop into viable seeds which are capable of germination under suitable environmental conditions. Viability is influenced by various conditions like humidity, temperature and availability of oxygen. Viability can be lost due to:

(i) exhaustion of food around the embryo

(ii) damage to embryo

(iii) denaturation of enzymes

(iv) extremely high temperatures

(v) excessive dry or damp weather

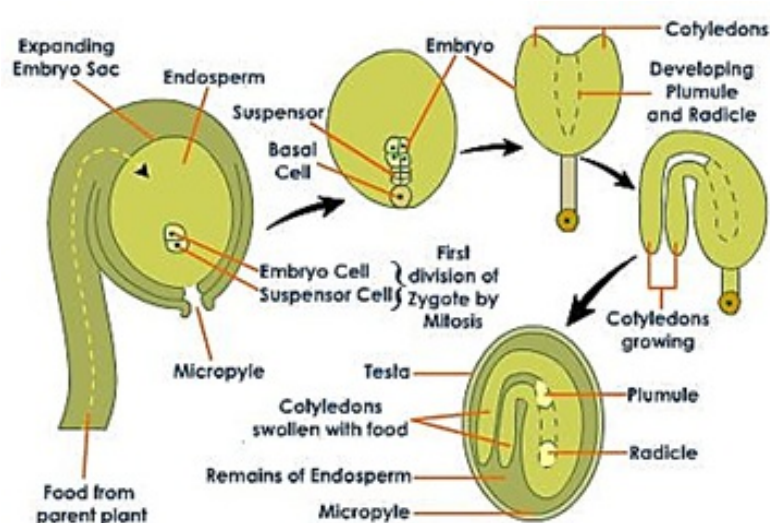
(b) Development of a dicot embryo:

Zygote is the first cell of early embryo development in flowering plants including bean plant.

The zygote develops after the fusion of male sperm nuclei released from pollen grain with the egg present in the embryo sac. This fusion is called syngamy.

The embryo develops at the micropylar end of the embryo sac where the zygote is situated. The zygote divides into a larger cell called suspensor cell towards micropylar end and a smaller cell called embryonal cell towards antipodal cells.

The suspensor cell divides mitotically to form 6-10 celled structure called suspensor. The last suspensor cell is called hypophysis that forms radicle tip. The zygote divides mitotically and gives rise first to the pro-embryo, then to the globular and heart-shaped mature embryo. A typical dicot embryo consists of an embryonal axis and two cotyledons. The portion of the embryonal axis above the level of cotyledons is called epicotyl. It contains the plumule (shoot tip). The portion below the axis is called hypocotyl. It contains the radicle (root tip). The root tip is covered by the root cap.



(c) When zygote forms the embryo the endosperm provides nourishment to the growing embryo. During this, the endosperm is utilised and eaten up. In the seeds like pea, gram etc, endosperm is completely eaten up by the growing embryo and the food for later development of embryo is stored in cotyledons which become massive. Such seeds are exalbuminous. While in seeds like castor and maize the endosperm persists in the seed as food storage tissue and such seeds are albuminous.

Or

(a) (i) Corpus luteum secretes large amounts of progesterone and some small amount of

estradiol hormone. Both these hormones are essential for the maintenance of the endometrium which is necessary for the implantation of fertilised ovum. It also inhibits the release of FSH so that it may not develop additional follicles and eggs. Placenta secretes human placental lactogen which ensures energy supply to the foetus by modifying the metabolism of the mother during pregnancy. It has anti insulin property which reduces the maternal insulin sensitivity thereby increasing the level of blood glucose. It also secretes Human chorionic gonadotropin (hCG) hormone. It maintains the corpus luteum in the pregnancy and stimulates the release of progesterone.

(ii) Gonadotropins like LH and FSH are secreted during follicular phase. They stimulate the follicular development as well as secretion of estrogens by the growing follicles.

During parturition, oxytocin is released which leads to the contraction of smooth muscles of myometrium of the uterus, and directs the full term foetus towards the birth canal.

(b) (i) Corpus luteum and placenta co-exist in case of pregnancy.

(ii) Corpus luteum ceases to exist during menstruation.

Q26.State and explain the "law of independent assortment" in a typical Mendelian dihybrid cross.

OR

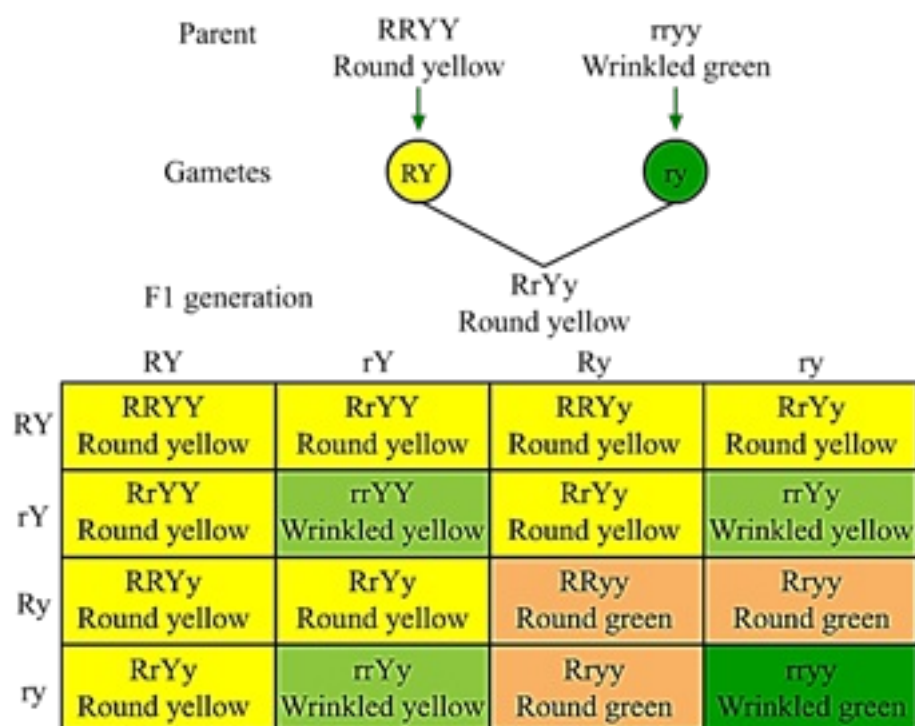
(a) How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection?

(b) Explain the phenomenon that is well represented by Darwin's finches other than natural selection.

Ans. The law of independent assortment states that, when two pairs of traits are combined in a hybrid, one pair of character segregates independent of the other pair of character.

In a dihybrid cross, Mendel crossed varieties of pea plants that differ in two characters and each character was controlled by two alleles of a gene.

He crossed a plant having **round and yellow seeds** with a plant having **green and wrinkled seeds**.



In the F₂ progeny he observed nine plants with round yellow seeds, three plants with round green seeds, three plants with wrinkled yellow seeds and one plant with wrinkled green seeds.

In this he found that round yellow and green wrinkled are parental combinations whereas round green and yellow wrinkled are new combinations, which meant that two characters are inherited independent of each other and hence produced new combinations.

From this experiment, he concluded that when two pairs of traits are combined in a hybrid, one pair of character segregates independent of the other pair of character. This is known as law of independent assortment.

OR

(a) **Industrial melanism** is an example of the natural selection of a particular form of an organism in an environment which has changed due to the ill effects of pollution created by industrial activities. The peppered moth *Biston betularia* is found in Manchester, England. It exists in two forms, one a light patchy white and the other a sooty black. Under normal conditions, the majority of the white moths survive because the trees they rest on have white bark. The black moths have negligible numbers. Due to the industrial revolution in Manchester, the number of industrial establishments increased manifold, and the soot released from their chimneys started coating the tree trunks nearby, turning them black. The black variety now started getting camouflaged better on these blackened trunks, and their

numbers rose and stabilized. The number of the white variety dwindled due to predation as they started getting easily spotted on the black trunks and get easily picked up by predators. This represents a very clear example of the natural selection.

(b) 'Darwin's Finches' illustrated adaptive radiation. In this, the species, all deriving from a common ancestor, have over time successfully adapted to their environment *via* natural selection. Previously, the finches occupied the South American mainland, but somehow managed to occupy the Galapagos islands, over 600 miles away. They occupied an ecological niche with little competition. As the population began to flourish in these advantageous conditions, intraspecific competition became a factor, and resources on the islands were squeezed and could not sustain the population of the finches for long. Due to the mechanisms of natural selection, and changes in the gene pool, the finches became more adapted to the environment. As competition grew, the finches managed to find new ecological niches, that would present less competition and allow them and their genome to be continued. Thus the finches adapted to take advantage of the various food sources available on the island, which were being used by other species. Over the long term, the original finch species may have disappeared, but by diversifying, would stand a better chance of survival. All in all, the finches had adapted to their environment via natural selection, which in turn, has allowed the species to survive in the longer term, the prime directive of any species.