

**CBSE 2016**  
**Class XII Biology**

**Time: 3 hrs**

**Total Marks: 70**

**General Instructions:**

1. There are total **26** questions and five sections in the question paper. All questions are compulsory.
  2. Section A contains questions number **1 to 5**; very short answer type questions of **1** mark each.
  3. Section B contains questions number **6 to 10**, short-answer type **I** questions of **2** marks each.
  4. Section C contains questions number **11 to 22**, short answer type **II** questions of **3** marks each.
  5. Section D contains question number **23**, value based question of **4** marks.
  6. Section E contains questions number **24 to 26**, long-answer type questions of **5** marks each.
  7. There is no overall choice in the question paper; however, an internal choice is provided in one question of **2** marks, one question of **3** marks and all the three questions of **5** marks. In these questions, an examinee is to attempt any of the two given alternatives.
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**Section - A**

1. According to de-Vries what is saltation?

**Solution**

A single step large mutation (which brings major change) is called saltation.

2. Excessive nutrients in a fresh water body cause fish mortality. Give two reasons.

**Solution**

- (a) Depletion of oxygen
- (b) Increase in toxic material in water body

3. Suggest the breeding method most suitable for animals that are below average in milk productivity.

**Solution**

Outcrossing or outbreeding

4. State a difference between a gene and an allele.

**Solution**

Gene is segment of DNA which controls one character.

Allele is one of the expressions of gene.

E.g. if gene controls height then allele is which gives either tallness or dwarfness.

5. Suggest a technique to a researcher who needs to separate fragments of DNA.

**Solution**

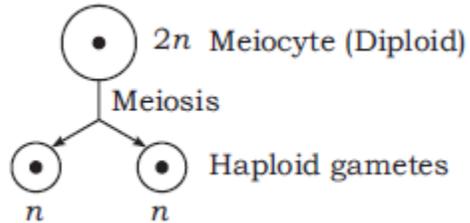
Gel electrophoresis

**Section - B**

6. Explain the significance of meiocytes in a diploid organism.

**Solution**

Meiocytes cells undergo meiosis and forms gametes. Generally, meiocytes are diploid which undergoes meiosis and forms haploid gametes.

**Gamete Mother cell:**

7. Mention the kind of biodiversity of more than a thousand varieties of mangoes in India represents. How is it possible?

**Solution**

Species diversity is a kind of biodiversity of more than a thousand varieties of mangoes in India. Diversity between species arises due to interbreeding among themselves. Sexual reproduction is responsible for diversity.

8. List the events that reduce the Biological Oxygen Demand (BOD) of a primary effluent during sewage treatment.

**Solution**

In secondary treatment the primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs. While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD.

9. Discuss the role the enzyme DNA ligase plays during DNA replication.

**Solution**

During replication, discontinuously synthesized fragments are later joined by the enzyme DNA ligase. Ligase always helps in the joining of two DNA strands.

**10.**

Name the causative organism of the disease amoebiasis. List three symptoms of the disease.

**Solution**

Amoebiasis: Caused by *Entamoeba histolytica*

Symptoms:

- (i) Stools with mucus and blood
- (ii) Diarrhoea, pain and stomach cramps
- (iii) Nausea and indigestion

**OR**

Identify 'A', 'B', 'C' and 'D' in the given table.

Crop	Variety	Resistance to diseases
A	Himgiri	Leaf rust
Cauliflower	Pusa Shubhra	B
Brassica	Pusa Swamim	C
Cowpea	D	Bacterial blight

**Solution**

A → Wheat B → Black rot and curl blight  
 C → White rust D → Pusa Komal

**Section - C**

11. Why is breast-feeding recommended during the initial period of an infant's growth? Give reasons.

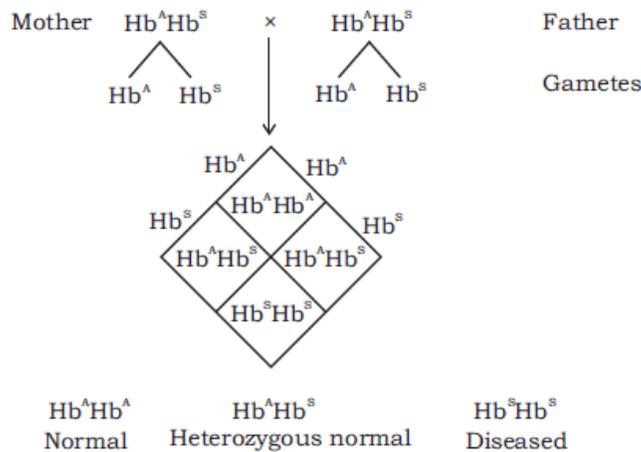
**Solution**

The infant cannot fight from various diseases as the immune system is not well developed. Mothers first milk is known as colostrum and it is rich in antibodies IgA which provides immunity to the infant.

12. Give an example of an autosomal recessive trait in humans. Explain its pattern of inheritance with the help of a cross.

**Solution**

Sickle cell anaemia:



It is an autosome linked recessive trait and the disease is controlled by a single pair of allele  $Hb^A$  and  $Hb^S$ . When both the parents are carrier of the gene then there are three possible genotypes. Homozygous individuals ( $Hb^S Hb^S$ ) are diseased and die.

13. Describe the experiment that helped Louis Pasteur to dismiss the theory of spontaneous generation of life.

**Solution**

Experiment of Louis Pasteur

- (i) He took two pre sterilized flasks and killed yeast were kept in them.
- ii) One flask was left open and the other was sealed.
- (iii) The flask which was left open shows new live organisms while in air tight flask no new life originated. Therefore, he disapproved the theory of spontaneous origin of life.

14. Plant breeding technique has helped sugar industry in North India. Explain how.

**Solution**

Plant Breeding Technique which helped Sugar Industry in North India:

- (i) *Saccharum barberi* was originally grown in north India, but had poor sugar content and yield.
- (ii) Tropical canes grown in south India *Saccharum officinarum* had thicker stems and higher sugar content but did not grow well in north India.
- (iii) These two species were successfully crossed to get sugar cane varieties combining the desirable qualities of high yield, thick stems, high sugar and ability to grow in the sugar cane areas of north India.

15. Suggest and describe a technique to obtain multiple copies of a gene of interest *in vitro*.

**Solution**

Polymerase Chain Reaction Technique.

Explanation:

- (i) Denaturation: The segment of double stranded DNA of interest is heated to separate the strands at 90-95°C.
- (ii) Annealing: A set of primers (chemically synthesized oligonucleotides which are complementary to the regions of DNA) are annealed to both the separated DNA segments and with the help of DNA polymerase (Taq polymerase) synthesis of complementary strands starts.
- (iii) Extension: The separated DNA segments acts as templates and primers synthesis new strands along the entire length of DNA strands.
- (iv) Amplification: The newly synthesized strands are amplified more than a billion times.

16. What is a GMO? List any five possible advantages of a GMO to a farmer.

**Solution**

Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called genetically modified organisms.

Advantages:

- (i) Made crop more tolerant to abiotic stresses (cold, drought, salt, heat)
- (ii) Reduced reliance on chemical pesticides (pest-resistant crops).
  - (iii) helped to reduce post-harvest losses.
  - (iv) Increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).
- (v) Enhanced nutritional value of food, e.g. vitamin 'A' enriched rice.

17. During a school trip to 'Rohtang Pass', one of your classmate suddenly developed 'altitude sickness'. But, she recovered after sometime.
- (a) Mention one symptom to diagnose the sickness.
  - (b) What caused the sickness?
  - (c) How could she recover by herself after sometime?

**Solution**

- (a) Symptom → Difficulty in breathing, Nausea, fatigue and heart palpitations.
- (b) Lack of oxygen and comparatively low RBC count.
- (c) Low oxygen availability triggers the body to produce more number of RBCs which sub sides the sickness.

18. How has RNAi technique helped to prevent the infestation of roots in tobacco plants by a nematode *Meloidegyne incognitia*?

**Solution**

Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells. These two RNA's being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA in the nematode. The consequence was that the parasite could not survive in transgenic host expressing specific interfering RNA. The transgenic plant therefore got itself protected from the parasite.

19. "In a food-chain, a trophic level represents a functional level, not a species." Explain.

**Solution**

- (a) In a food-chain the first level is represented by different types of plants which represents the PRODUCER LEVEL.
- (b) The second trophic level consists of herbivores which represents, the PRIMARY CONSUMER LEVEL.
- (c) The third trophic level consists of carnivores which represents SECONDARY CONSUMER LEVEL.
- (d) The fourth trophic level consists of normally top carnivores thus represent TERTIARY CONSUMER LEVEL.

**OR**

- (a) Name any two places where it is essential to install electrostatic precipitators. Why it is required to do so?
- (b) Mention one limitation of the electrostatic precipitator.

**Solution**

- (a) In thermal power plants and coal industries.  
These type of industries release particulate matter in the air. The particulates which are of 2.5 micrometers or less in diameter get inhaled and cause respiratory symptoms.  
So to reduce particulate matter from air these precipitators are installed.
- (b) Electricity consumption exceeds.

20. Prior to a sports event blood & urine samples of sportspersons are collected for drug tests.
- (a) Why is there a need to conduct such tests?

- (b) Name the drugs the authorities usually look for.
- (c) Write the generic names of two plants from which these drugs are obtained.

**Solution**

- (a) The blood test is conducted to check the level of certain drugs in the blood which are banned by sports authorities.
- (b) Authorities look for certain drugs like narcotic analgesics, anabolic steroids, diuretics and certain hormones.
- (c) *Cannabis, Opioids*

**21.** Describe the experiment that helped demonstrate the semi-conservative mode of DNA replication.

**Solution** Meselson and Sthal Experiment:

- (a) They grew *E. coli* in a medium containing  $^{15}\text{NH}_4\text{Cl}$  ( $^{15}\text{N}$  is the heavy isotope of nitrogen) as the only nitrogen source for many generations. The result was that  $^{15}\text{N}$  was incorporated into newly synthesized DNA (as well as other nitrogen containing compounds). This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient (Please note that  $^{15}\text{N}$  is not a radioactive isotope, and it can be separated from  $^{14}\text{N}$  only based on densities).
- (b) Then they transferred the cells into a medium with normal  $^{14}\text{NH}_4\text{Cl}$  and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA.
- (c) Thus, the DNA that was extracted from the culture one generation after the transfer from  $^{15}\text{N}$  to  $^{14}\text{N}$  medium [that is after 20 minutes; *E. coli* divides in 20 minutes] had a hybrid or intermediate density. DNA extracted from the culture after another generation [that is after 40 minutes, II generation] was composed of equal amounts of this hybrid DNA and of 'light' DNA.

**22.** Given below is a list of six micro-organisms. State their usefulness to humans.

- (a) *Nucleopolyhedrovirus* (b) *Saccharomyces cerevisiae*
- (c) *Monascus purpureus* (d) *Trichoderma polysporum*
- (e) *Penicillium notatum* (f) *Propionibacterium sharmanii*

**Solution**

- (a) ***Nucleopolyhedrovirus***: This virus is one of the candidates for species specific narrow spectrum insecticidal applications.
- (b) ***Saccharomyces cerevisiae***: Used for bread making as well as in fermentation.
- (c) ***Monascus purpureus***: Commercialised as blood cholesterol lowering agents.
- (d) ***Trichoderma polysporum***: Used as an immunosuppressive agent in organ transplant patients.
- (e) ***Penicillium notatum***: Useful for antibiotics preparation. Full potential is an effective antibiotic.
- (f) ***Propionibacterium sharmanii***: Used in the preparation of cheese for texture, flavour and taste.

**Section - D**

**23.** Reproductive and Child Healthcare (RCH) programmes are currently in operation. One of the major tasks of these programmes is to create awareness amongst people about the wide range of reproduction related aspects. As this is important an essential for building a reproductively healthy society.

- (a) “Providing sex education in schools is one of the ways to meet this goal. Give four points in support of your opinion regarding this statement.
- (b) List any two ‘indicators’ that indicate a reproductively healthy society.

**Solution**

- (a) Providing sex education to students will help in following ways:
- (i) It will discourage school children to believe in myths and misconceptions about sex related aspects.
- (ii) It provides proper informatios about reproductive organs and adolescence related changes.
- (iii) It will encourage students to follow safe and hygienic sexual practices and prevent STDs.
- (iv) It will make students aware about importance of small families and emphasize importance of post-natal care of mother and child, etc.
- (b) A reproductively healthy society will have:
- (i) lesser number of reported cases of STDs.
- (ii) reduced infant mortality and maternal mortality rate.

**Section - E**

24.

- (a) Explain the post-pollination events leading to seed production in angiosperms.
- (b) List the different types of pollination depending upon the source of pollen grain.

**Solution**

- (a) Post-pollination changes leading to seed production are
- (i) Germination of pollen tube which will ultimately transfer two male gametes to the embryo sac.
- (ii) **Double fertilization:** In this one male gamete will fuse with egg forming zygote (syngamy).  
 Male gamete ( $n$ ) + Egg ( $n$ )  $\rightarrow$  Zygote ( $2n$ )  
 Other male gamete will fuse with central cell (2 polar nuclei) forming triploid primary Endosperm Nucleus (PEN).  
 Male gamete ( $n$ ) + Central cell ( $2n$ )  $\rightarrow$  PEN ( $3n$ ) (Tripple fusion)
- (iii) Zygote will eventually form *embryo* (after cell division) and PEN will form endosperm. Together the two will form seed.
- (b) There are two different types of pollination are
- (i) *Self pollination:*
- (I) *Autogamy:* Where pollen of same flower reaches the stigma of the same flower.
- (II) *Gietonogamy:* Pollen grain of one flower reaches the stigma of another flower of same plant.
- (ii) *Cross pollination:* When pollen grain of a flower from one plant pollinates the stigma of a flower on another plant.

**OR**

- (a) Briefly explain the events of fertilization and implantation in an adult human female.
- (b) Comment on the role of placenta as an endocrine gland.

**Solution**

- (a)
- (i) On the 14th day of menstrual cycle *ovulation* takes place which releases *secondary oocyte*.
- (ii) This secondary oocyte is caught by fimbriae and it starts moving up the fallopian tube.
- (iii) In the meantime sperm which has been deposited in vagina will start moving up and reach the fallopian tube.
- (iv) The two meet at ampullary isthmus junction and fuse together.

- (v) After entry of sperm secondary oocyte complex it's meiosis II, changes the ovum and fuse with sperm pronuclei leading to zygote formation.
- (vi) This zygote after sometime starts dividing. It changes to morula (8-16 celled) and then into blastula.
- (b) Placenta as endocrine gland:
  - (i) It releases HCG (Human Chorionic Gonadotropin)
  - (ii) HPL (Human Placental Lactogen)
  - (iii) Oestrogen
  - (iv) Progesterone
  - (v) In the later stages of pregnancy it also releases relaxin.

25.

- (a) How are the following formed and involved in DNA packaging in a nucleus of a cell?
  - (i) Histone octamer (ii) Nucleosome
  - (iii) Chromatin
- (b) Differentiate between Euchromatin and Heterochromatin.

**Solution**

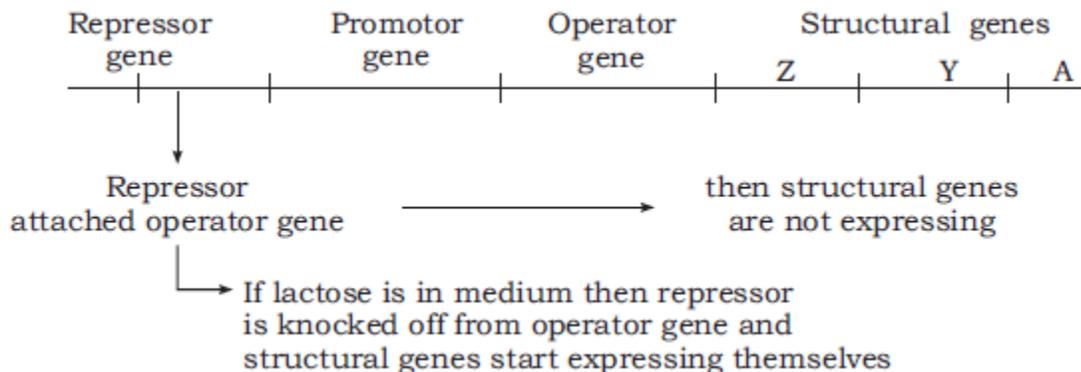
- (a) (i) **Histone octamer:** It comprises of 2 molecules each of four histones namely, H2A, H2B, H3 & H4. These histone molecules are positively charged. DNA being negatively charged wraps around the histones and this structure is now called nucleosome which on the whole is neutral.
- (ii) **Nucleosome:** Each nucleosome comprises of histone octamer. Around which DNA (200 bp long) is coiled. It gives beaded appearance to chromosome.
- (iii) **Chromatin:** It is packed in form of chromatin fibres which get coiled & condensed with the help of none histone proteins is chromosome.
- (b)

<b><i>Euchromatin</i></b>	<b><i>Heterochromatin</i></b>
It is highly condensed chromatin.	It is densely coiled.
It stains lightly.	It stains darkly.
It is transcriptionally active.	It is transcriptionally inactive.

OR

Explain the role of lactose as an inducer in a *lac* operon.

**Solution**



Lac operon operates in *E. coli*. It uses lactose. It breaks it into glucose and galactose and uses glucose as source of energy. In this operon there are three structural genes which when express themselves produce three enzymes namely  $\beta$ -galactosidase, permease and transacetylase.

Under normal condition this operon is switched off. The repressors produced by regulator are attached to operator gene and keeps the operator switched off.

When lactose enters the medium, *E. coli* increases its cell permeability to lactose. The increased amount of lactose knocks repressor off from operator and this switches the operator gene on. Since lactose induces structural genes to express themselves that's why lactose is called as inducer.

26.

- (a) Why should we conserve biodiversity? How can we do it?
- (b) Explain the importance of biodiversity hot-spots and sacred groves.

### Solution

(a) We should conserve bio-diversity because of following reasons.

(i) **Narrow utilitarian:** Humans derives countless economic benefits from nature like

(1) Food (Cereals, pulses, fruits)

(2) Wood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes) and

(3) Products of medicinal importance

(4) More than 25% drugs are sold in market and 25000 species of plants contribute to traditional medicines.

(ii) **Broadly utilitarian:** Says that biodiversity plays a major role in many ecosystem services that nature provides.

(1) E.g. 20% of total oxygen in earth's atmosphere, is produced from Amazon rain forest

(2) Pollination without which plants cannot give us fruits and seeds. Pollinators include bees, bumble bees, birds and bats.

(3) Asthetic pleasures of walking through thick woods.

(iii) **Ethical argument:** For conservation of biodiversity states that it is our moral duty to care for wellbeing and pass on our biological legacy in good order to future generations.

We can conserve it by:

(i) *In situ* conservation: when we conserve and protect the whole ecosystem. It is biodiversity at all levels in protected e.g. we save entire forest to save species.

(ii) However when an animal or plant is endangered or threatened and needs urgent measures to save it from extinctions, *ex. situ* (off site) conservation.

(b) Maximum protection areas which have high levels of species richness and high degree of endemism is known as Biodiversity hot spots.

These biodiversity hot spots in the world are 34. Three regions of India which shows biodiversity are western ghats, Sri Lanka–Indo Burma and Himalaya sacred groves are the region where endangered species are protected due to religious and cultural traditions that emphasize on protection of nature.

**OR**

(a) Represent diagrammatically three kinds of age-pyramids for human populations.

(b) How does an age pyramid for human population at given point of time helps the policy-makers in planning for future.

### Solution

- (a) The age pyramids of human population, at any given point of time, points to the fact that it is expanding, then various policies are adapted in future. Example,
- (i) Motivating smaller families by using various contraceptive methods.
  - (ii) Using slogans like Hum do Hamare do.
  - (iii) Many urban families have adopted one child norm.
  - (iv) Incentives are given to couples with small families.
  - (v) Raising the marriageable age of the female to 18 years and that of males to 21 years.



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