



Time: 3 hrs.

Aakash

Medical | IIT-JEE | Foundations

Max. Marks: 70

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Mock Test Paper for Class-XII

BIOLOGY

Answers & Solutions

1. Answer (d)
Endothecium, middle layers as well as the epidermis perform the function of protection and help in dehiscence of anther [1]
2. Answer (c)
Spermatid is produced by meiosis II, whereas secondary spermatocytes is a result of by meiosis I where reduction of chromosomes takes place, thus both of them are haploid. [1]
3. Answer (a)
IUD is one of the most widely accepted method of contraception in India [1]
4. Answer (d) [1]
Parents : Tt × Tt
Progeny : $\frac{TT}{\text{Tall}} \frac{Tt}{\text{dwarf}} \frac{Tt}{\text{dwarf}} \frac{tt}{\text{dwarf}}$
Homozygous Tall : $\frac{1}{3}$ (of tall individuals)
Heterozygous Tall (among tall individuals) : $\frac{2}{3}$
 $\therefore \frac{2}{3} \times 100 = 66.66\%$
5. Answer (b) [1]
Number of base pairs = 3
H-Bond = 6
Thus H-Bond per base pair = $\frac{6}{3} = 2$
Two H bonds are formed by adenine and thymine only. Thus, stretch contains only adenine and thymine. Hence, guanine and cytosin are not present.

6. Answer (c)

The most accepted line of descent in human evolution is [1]

Ramapithecus → *Australopithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens*

7. Answer (c)

→ Immunity developed through vaccination illustrates artificially acquired active immunity. [½]

→ The principle of immunisation or vaccination is based on the property of 'memory' of the immune system. [½]

8. Answer (d)

The interaction between *Balanus* and *Chathamalus* are an example of competition. [1]

9. Answer (b)

Trichoderma Polysporum – Cyclosporin A, *Aspergillus niger* – Citric acid, *Monascus purpureus* – Statins, *Clostridium butylicum*-Butyric acid [1]

10. Answer (b)

→ Bam HI can be used as it is rightly present within a selection marker and has a unique restriction site. On insertion of gene of interest at the BamHI site of *amp^R* gene, the recombinants will lose the ampicillin resistance. [1]

11. Answer (d)

Oncogene activation will cause cells to become cancerous, whereas other two are not permanently curative, thus option (d) where ADA gene isolated from marrow cells are introduced into cells at early embryonic stages is the right option. [1]

12. Answer (d) [1]

Solar energy incident = 10^4 J

1% is fixed by plants

$$\therefore \text{GPP} = \frac{1}{100} \times 10^4 = 100 \text{ J}$$

Now as per 10% law, only 10% energy is transferred to next trophic level.

\therefore Plants → A → B → C

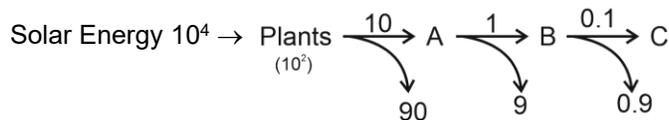
→ $100 \times \frac{10}{100}$: 10 J of energy is transferred to A in the form of Biomass of Plants,

→ A will transfer 10% of it to B

$$\rightarrow 10 \times \frac{10}{100} = 1 \text{ J}$$

→ Now 1 J is available to B of which it will lose 90% in respiratory losses and only 10% will become biomass.

$$\therefore 1 \times \frac{10}{100} = 0.1 \text{ J is the biomass present in B}$$



13. Answer (d)

Assertion is false, as segregation of one pair of character is not always independent of other pair until, present on different chromosomes all together (observed by Morgan) [½]

Reason is True Complete independent assortment of genes is possible only when they are present on different chromosomes. As Mendel's dihybrid cross, seed colour and seed shape were on different chromosomes. Thus giving dihybrid ratio of 9 : 3 : 3 : 1. [½]

14. Answer (a)

Assertion is true : BOD is a measure of the organic matter present in water.

Reason is also True : BOD measures the oxygen required by microorganisms to aerobically decompose the organic matter. Thus reason correctly explains assertion. [1]

15. Answer (d) [1]

Assertion is False : DNA molecules move from cathode to anode during gel electrophoresis.

Reason is True : DNA molecules are negatively charged molecules

16. Answer (b) [1]

Assertion is True : Predators are prudent as they do not overkill their prey, do not hurt prey until required for food.

Reason is True : Prey species have evolved various defenses to protect them against the predators. But Reason does not explain assertion.

SECTION-B

17. (a) Luteinizing Hormone (LH) secreted by anterior pituitary [0.5 +0.5]

(b) Corpus Luteum mainly secretes progesterone and small amounts of estrogen. [0.5 +0.5]

OR

(a) Luteinizing Hormone (LH) secreted by anterior pituitary [0.5 +0.5]

(b) Spermiogenesis is the process in which spermatids (immature sperm cells) transform into mature, motile spermatozoa (sperm cells). This involves the development of the acrosome, the formation of the flagellum (tail), condensation of the nucleus, and shedding of the excess cytoplasm. [0.5]

Spermiation is the process where the mature spermatozoa are released from the Sertoli cells into the lumen of the seminiferous tubules of the testis, [0.5]

18. (a) Synergids. They have special cellular thickenings at micropylar tip which guides the entry of pollen tube into the ovule through filiform apparatus [0.5+0.5]

(b) Polar nuclei after going into fertilization with male nuclei forms 'Primary Endosperm Nucleus' which further divides to form triploid endosperm [1]

OR

In a majority of aquatic plants, pollination by insects or wind is more common than by water. This is primarily because water pollination, or hydrophily, is less efficient and more difficult in terms of the precise transfer of pollen grains. Additionally, insects are more reliable and targeted methods of pollen transfer, even in aquatic environments. [0.5]

Example:

Water Lilies: These are rooted in the mud below water but have flowers that emerge above the water surface. Their large, vibrant flowers attract insects, such as bees, for pollination. Therefore, pollination is carried out predominantly by insects. [0.5]

Aquatic Plant with Water Pollination:

Vallisneria is an excellent example where pollination happens through water. In *Vallisneria*, male flowers detach and float on the surface of the water, while the female flowers reach the surface of water by long stalk. The male flowers then come into contact with the female flowers, allowing pollination to occur [1]

19. Benefits of organic Farming and biofertilizers:

1. Reduction in Chemical Runoff: Organic farming eliminates the use of synthetic chemicals, which reduces runoff into water bodies, preventing water pollution. [0.5]
2. Soil Health: Organic farming practices improve soil structure, increase microbial activity, and enhance nutrient cycling, leading to healthier and more fertile soils. [0.5]

Examples of Biofertilizers:

1. *Rhizobium*: Used in legumes to fix atmospheric nitrogen, reducing the need for chemical fertilizers. [0.5]
2. *Azospirillum*: fix atmospheric nitrogen, benefits crops like maize and wheat by enhancing root growth and nutrient availability, leading to higher yields. [0.5]

20. (a) Inverted Pyramid: In forest ecosystems, a single large tree (producer) supports many herbivores, such as insects, leading to an inverted pyramid of numbers where one producer supports many consumers. [1]



21. (a) 16; Haplodiploid Sex determination [0.5 +0.5]
 (b) Parthenogenesis [1]

OR

Features in *Drosophila melanogaster* that make it suitable material for genetic studies are:

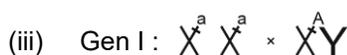
- (i) It could be grown on simple synthetic medium in the laboratory.
- (ii) It has a short life cycle of about two weeks.
- (iii) A single mating produces hundreds of offsprings.
- (iv) Females are easily distinguishable from the males by the larger body size and presence of ovipositor.

OR

(v) It has many types of hereditary variations that can be seen with low power microscopes. [Any four] ...[½×4 = 2 Marks]

SECTION-C

22. (i) Both recessive sex linked inheritance and autosomal recessive inheritance pattern [1]
 (ii) Colour-blindness/Haemophilia [1]



where, A – normal allele [1]

- Evolutionary Response: Both adaptations evolved in response to similar threats, showcasing how different plant lineages can develop analogous structures to solve the same problem. [1]
- (b) Non-Deterministic Nature of Evolution: Evolution is a process driven by natural selection, genetic drift, mutations, and gene flow, none of which are deterministic. Here's why:
- Natural selection: Acts on random genetic variations, selecting traits that offer a survival or reproductive advantage.
 - Genetic drift: Random changes in allele frequencies, especially in small populations, leading to unpredictable evolutionary paths.
 - Mutations: Random changes in DNA that can introduce new traits.
 - Gene flow: Movement of genes between populations, adding to genetic variability.

Implications:

- Unpredictability: Evolution does not follow a predetermined path; it is influenced by random events and environmental pressures.
 - Adaptive flexibility: Organisms evolve on the basis of current conditions, not towards a specific goal.
27. (a) B-lymphocytes, Humoral immunity [0.5+0.5]
- (b) 1. Chemotherapy 2. Radiotherapy 3. Surgical intervention 4. Biological response modifiers [0.5 × 4]
28. (i) 'B' is recombinant transformants as it is transformed with recombinant vector, 'A' is non-recombinant whereas 'C' is non transformants [1]
- (ii) The recombinant plasmids will lose tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on tetracycline 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 that containing tetracycline. But, non-recombinants will grow on the medium containing both the antibiotics [1]
- (iii) By plating them on ampicillin containing medium [1]

SECTION-D

29. (a) To verify semi-conservative mode of DNA replication [1]
- (b) Meselson and Stahl [1]
- (c) In this experiment, observation relied on the detection of radiolabelled thymidine, thus tracing the new DNA strand by detecting radioactivity but in Meselson and Stahl experiment, observation was based on density difference between ^{15}N and ^{14}N strand [1+1]

OR

- (d) (i) It is semi-discontinuous (ii) It always happens in 5'-3' direction [1+1]
30. (a) x — Primary [1]
- Y — Secondary

DNA polymerase: The enzyme that synthesizes new DNA strands by adding nucleotides to the primers. Taq polymerase is commonly used because it's heat-resistant.

Nucleotides (dNTPs): The building blocks (A, T, C, G) that DNA polymerase uses to create the new DNA strands.

- (b) PCR is widely used to detect the presence of pathogens like viruses (e.g., HIV, COVID-19) and bacteria in a patient's sample by amplifying the specific genetic markers. [1]

PCR is used to amplify DNA from crime scene samples (e.g., blood, hair) to create a genetic profile that can be matched to suspects or victims. [1]

OR

- (a) Principle behind PCR (Polymerase Chain Reaction) [1]

The principle of PCR is based on the natural process of DNA replication. It aims to amplify a specific DNA sequence exponentially, enabling the production of millions of copies of a particular DNA segment from a small initial sample. This is achieved through repeated cycles of DNA denaturation, annealing, and extension.

Key Steps Involved in the PCR Process [2]

Denaturation: The double-stranded DNA is heated to around 94-98°C, causing the hydrogen bonds between the complementary bases to break. This results in the separation of the DNA into two single strands.

Annealing: The reaction mixture is then cooled to around 50-65°C, allowing the primers to bind (anneal) to their complementary sequences on the single-stranded DNA template.

Extension: The temperature is raised to around 72°C, the optimal temperature for DNA polymerase (usually *Taq polymerase*), which synthesizes new DNA strands by adding nucleotides to the primers, extending the DNA strands and creating new double-stranded DNA molecules.

These steps are repeated for 25-35 cycles, resulting in exponential amplification of the target DNA sequence.

- (b) Using the formula [1+1]

$2^n \times$ initial number of molecules

For 5 cycles starting with 10 DNA molecules: [$2^5 \times 10 = 32 \times 10 = 320$]

After 5 PCR cycles, 320 copies of the DNA molecules

33. (a) (1) Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification, [1]
- (2) Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity [1]
- (3) There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity [1]

- (b) Habitat Loss and Fragmentation [0.5 × 4]

Overexploitation

Invasion of Alien Species

Coextinction

OR

(a) Narrowly Utilitarian Arguments

Biodiversity provides numerous economic benefits, including food, firewood, fiber, construction materials, and industrial products like tannins and lubricants. Over 25% of drugs come from plants, with 25,000 species used in traditional medicine. Bioprospecting in biodiverse nations can lead to enormous economic gains. [1]

Broadly Utilitarian Arguments

Biodiversity supports essential ecosystem services like oxygen production and pollination. For example, the Amazon produces 20% of the Earth's oxygen, and natural pollinators like bees and birds are crucial for fruit and seed production, saving immense costs of artificial pollination. It also provides aesthetic and spiritual benefits. [1]

Ethical Arguments

Beyond economic and ecosystem services, biodiversity holds ethical value. Every species has intrinsic value, and we have a moral duty to protect their well-being and preserve our biological legacy for future generations [1]

(b) Biodiversity hotspots' regions with

1. Very high levels of species richness
2. High degree of endemism

[1 + 1]

