Mock Board Exam
Biology
Solutions

SECTION-A

1. Lymphoid organs are the organs where origin, maturation and proliferation of lymphocytes occur. These are of two types:- **[1]**

   (a) Primary lymphoid organs:-Eg:- Bone marrow and thymus

   (b) Secondary lymphoid organs:- Eg: Spleen, lymph nodes, Peyer's patches of small intestine and appendix. **[1]**

2. The figure represents fermentors. Production on an industrial scale requires growing microbes in very large vessels called fermentors. It is used for making fermented beverages. **[1+1]**

   OR

   The yeast *Saccharomyces cerevisiae* is used for fermenting fruit juices. It is also used commercially for bread making or baking industry. **[1+1]**

3. The plant shown in the diagram is that of poppy plant. **[½]**

   Morphine is extracted from the latex of poppy plant *Papaver somniferum.* Properties or features related to morphine are:- **[1½]**

   (i) It is very effective sedative and pain killer and is very useful for patients who have undergone surgery.

   (ii) These drugs bind to specific receptors present in the central nervous system and gastrointestinal tract.

   (iii) Heroin, commonly called *smack* is chemically diacetylmorphine which is a white, odourless, bitter crystalline compound.

4. Biofertilizers are organisms that enrich the nutrient quality of the soil.

   Azospirillum and *Azotobacter* are free living bacteria in soil which can fix atmospheric nitrogen. **[1 + ½ × 2]**

5. The process in which the organism maintains the constancy of its internal environment despite varying external environmental conditions is called homeostasis. Humans maintain their body temperature by sweating profusely in summers and shivering in winters. **[1+1]**

6. 'Gause's competitive exclusion principle' states that two closely related species competing for the same resources cannot coexist indefinitely and the competitively inferior one will be eliminated eventually.

   Organisms avoid exclusion by resource partitioning. They avoid competition by choosing different times for feeding or different foraging patterns. **[1+1]**

   OR

   When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.

   Example: When a host species becomes extinct, its unique assemblage of parasites also meets the same fate. Also, in a co-evolved plant pollinator showing mutualism, extinction of any one leads to extinction of the other. **[1+1]**

SECTION-B

7. A person suffering from AIDS is advised to take antiretroviral drugs. AIDS is caused by Human Immunodeficiency Virus (HIV). Transmission of HIV infection generally occurs by **[1]**

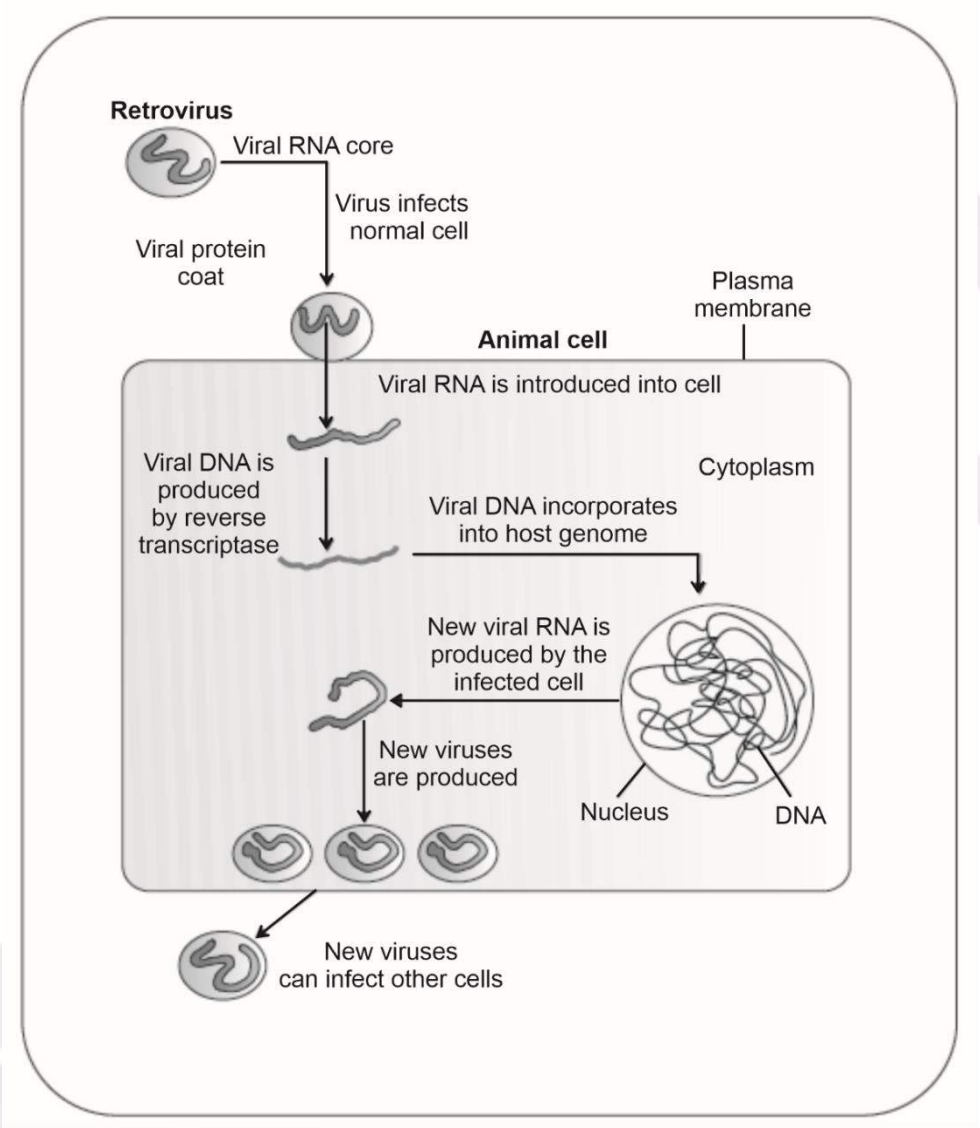
   (a) Sexual contact with infected person

   (b) By transfusion of contaminated blood and blood products

   (c) By sharing infected needles as in the case of intravenous drug abusers

(d) From infected mother to her child through placenta **[1+1=2]**

OR



[3]

8. Two types of acquired immunity present in body are:-

(i) Humoral immunity-The B-lymphocytes produce an army of proteins in response to the pathogens. As soon as any pathogen enters into the blood, B-lymphocytes get activated and differentiate into plasma cells that secrete a large number of antibodies in response to pathogens into our blood to fight them. **[2]**

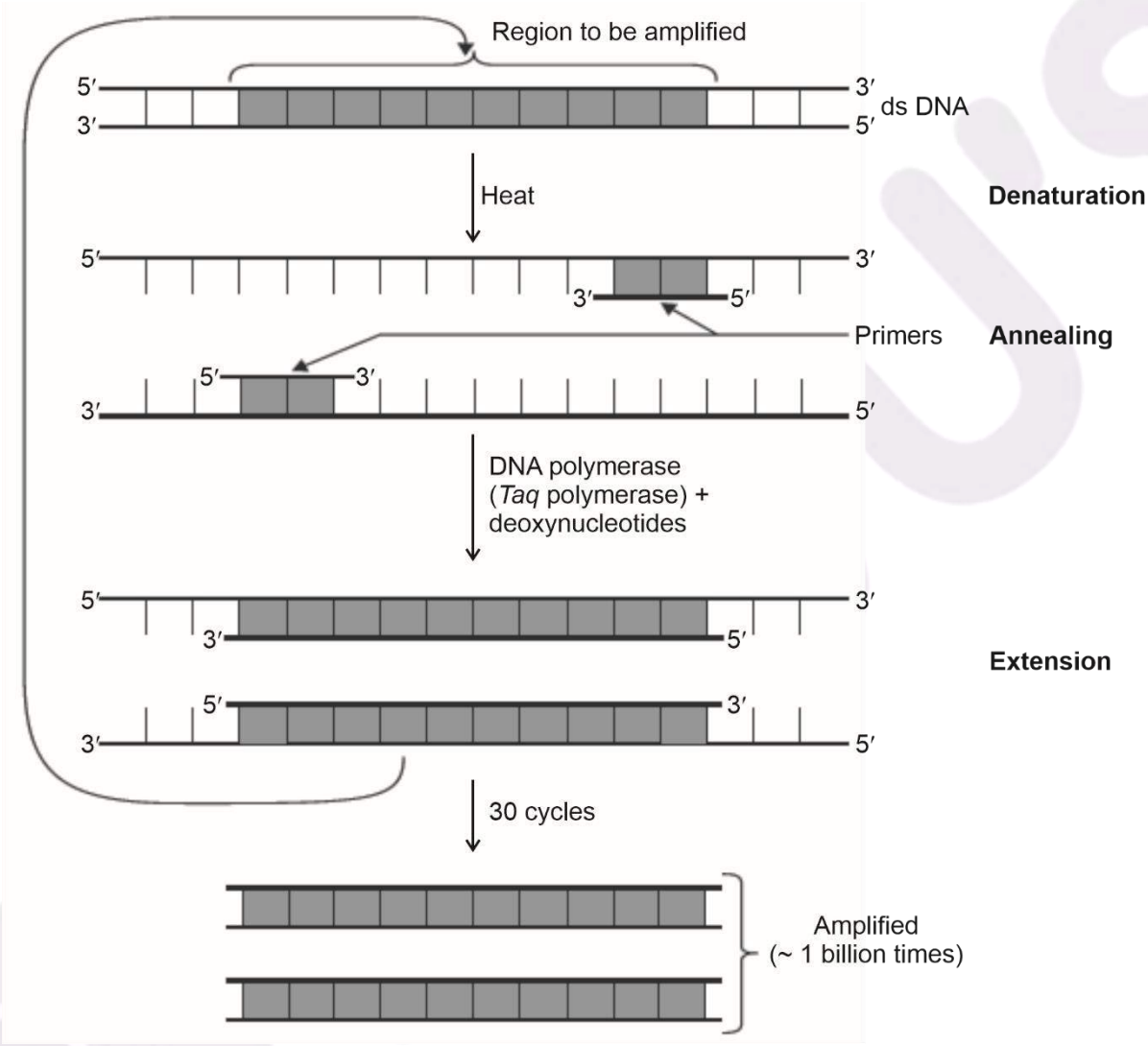
(ii) Cell-mediated immunity – It is T-lymphocytes mediated. T-lymphocytes themselves do not secrete antibodies but help B-cells to produce them.

Cell-mediated immunity is responsible for the graft rejection and tissue matching, blood group matching are essential before undertaking any graft/transplant. **[1]**

9. PCR (Polymerase Chain Reaction) is used for increasing the amount of extinct reptile DNA available for testing.

In this reaction, multiple copies of the gene (or DNA) of interest is synthesized *in vitro* using two sets of primers (small chemically synthesized oligonucleotides that are complementary to the regions of DNA and the enzyme

DNA polymerase. The enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as template. **[1]**



[2]

Figure: Process of PCR

10. (a) In ex-situ conservation, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected under given special care. *eg*. Zoological parks, botanical gardens.

(b) At high altitudes, due to low atmospheric pressure, the body does not get enough oxygen. This is called altitude sickness. Its symptoms include nausea, fatigue and heart palpitations.

(c) Desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone but move into shade when ambient temperature starts increasing. **[1 + 1 + 1]**

11. (a) Insects are the most species rich taxonomic group among animals. Yes, insect and plant species show mutualism. For example, Fig species can be pollinated only by its partner wasp species and no other species. The female wasp uses fruit for oviposition and uses developing seeds within fruit for nourishing its larvae.

(b) Conventional taxonomic methods are not suitable for identifying microbial species and many species are not culturable under laboratory conditions. Biochemical or molecular criteria cannot be used for delineating their species, as their diversity may alone run into millions. **[1½ + 1½]**

12. (a) Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the positive electrode (anode) under an electric field through a medium/matrix. The DNA fragments separate (resolve) according to their size through the sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves. **[1½]**

Lane 1 represents undigested DNA and lane 4 represents digested DNA fragments.

(b) The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. Orange coloured bands of DNA are visualised after staining with ethidium bromide exposed to UV light. **[1½]**

SECTION-C

13. (a) The sticky ends generated after restriction enzyme digestion form hydrogen bonds with their complementary cut counterparts. This stickiness of the ends facilitates the action of the enzyme DNA ligase. **[1]**

(b) If a gene 'X' is introduced at *Pst*I site of ampicillin resistance gene in the vector pBR322. The recombinant plasmid containing host cells will be ampicillin sensitive but can still be selected out from non-recombinant ones by plating the transformants on ampicillin containing medium. The transformants growing on tetracycline containing medium are then transferred on a medium containing ampicillin. The recombinants will grow in tetracycline containing medium but not on that containing ampicillin. But, non-recombinants will grow on the medium containing ampicillin as well as on the medium containing tetracycline antibiotic. **[3]**

(c) There are several methods of introducing the ligated DNA into recipient cells. Recipient cells are first made 'competent' to receive, taking up DNA present in its surroundings. Some of the techniques to introduce DNA are:- micro-injection, gene gun and transformation. **[1]**

OR

(a) Insulin 'X' can be the insulin extracted from the pancreas of slaughtered cattle and pigs. Although this source of insulin worked well for many diabetics, as it is not human insulin, some people can show allergic reactions to the foreign protein. **[1]**

(b) Insulin is administered subcutaneously. It cannot be administered orally because it degrades in the alimentary canal. **[1]**

(c) Insulin 'Y' is the human insulin produced by rDNA technology and named Humulin. The procedure behind production of human insulin by the use of recombinant DNA technology:-

(i) Preparation of two DNA sequences corresponding to A and B chains of human insulin.

(ii) Introduction of these two sequences in plasmid like pBR322 and then transformed *E.coli* to produce insulin chains.

(iii) Chains A and B are produced separately, extracted and combined by creating disulphide bonds to form human insulin. **[3]**

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