Sample Question Paper - 9
Biology (044)
Class- XII, Session: 2021-22
TERM II

Time allowed : 2 hours ***Maximum marks : 35***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has three sections and 13 questions. All questions are compulsory.

(iii) Section–A has 6 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has a case-based question of 5 marks.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

1. Name the blank spaces a, b, c and d in the table given below :

Type of microbe	Name	Commercial product
Fungus	a	Penicillin
Bacterium	*Acetobacter aceti*	b
c	*Aspergillus niger*	Citric acid
Yeast	d	Ethanol

2. Name the group of viruses responsible for causing AIDS in humans. Why are these viruses so named?

OR

List any two ways of transmission of HIV infection in humans, other than sexual contact.

3. Name the interaction in each of the following :

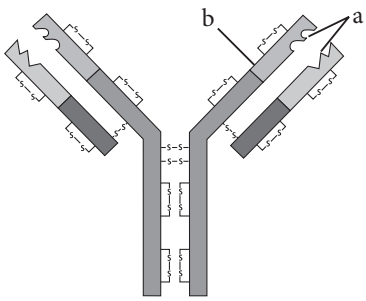
(a) *Ascaris* worms living in the intestine of human.

(b) Sucker fish attached to the shark.

(c) Smaller barnacles disappeared when *Balanus* dominated in the coast of Scotland.

(d) Wasp pollinating fig inflorescence.

4.



(a) What does the above diagram illustrate?

(b) Name the parts labelled 'a' and 'b'.

(c) Name the types of cells that produce this molecule.

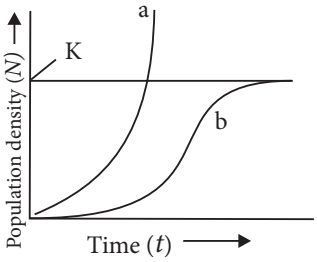
OR

(a) Name the lymphoid organ in humans where all the blood cells are produced.

(b) Where do the lymphocytes produced by the lymphoid organ mentioned above migrate and how do they affect immunity?

5. Explain the process of secondary treatment given to the primary effluent up to the point it shows significant change in the level of biological oxygen demand (BOD) in it.

6.



Study the population growth curves shown above.

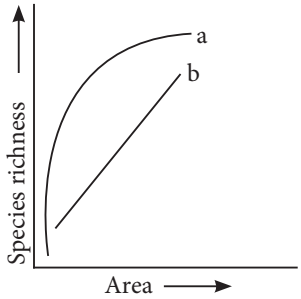
(a) Identify curves '*a*' and '*b*'.

(b) Mention the conditions responsible for the curves '*a*' and 'b' respectively.

(c) Give the necessary equation for the curve '*b*'.

SECTION - B

7.



The above graph shows Species-Area relationship. Write the equation of the curve 'a' and explain.

OR

Differentiate between *in situ* and *ex situ* approaches of conservation of biodiversity.

8. **(a)** Write the scientific names of the two species of filarial worms causing filariasis.

(b) How do they affect the body of infected person(s) ?

(c) How does the disease spread ?

9. Read the following base sequence of a certain DNA strand and answer the questions that follow:

5′	A	A	G	A	A	T	T	C	A	A	3′
3′	T	T	C	T	T	A	A	G	T	T	5′

(a) What is called a 'palindromic sequence' in a DNA ?

(b) Write the palindromic nucleotide sequence shown in the DNA strand given and mention the enzyme that will recognise such a sequence.

(c) State the significance of enzymes that identify palindromic nucleotide sequences.

10. **(a)** Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

(b) Give the characteristic feature and source organisms of the DNA polymerase used in PCR.

11. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species.

12. A person shows the characteristics symptom of frequently passing watery stools, rapid dehydration and abdominal cramps.

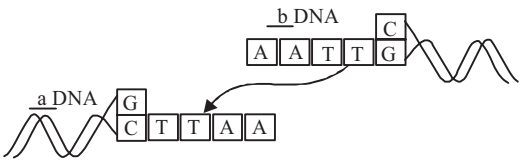
(a) Identify the disease.

(b) How can the fluid loss be maintained?

(c) How is the disease transmitted?

SECTION - C

13. **(a)**



Study the linking of DNA fragments shown above.

(i) Name 'a' DNA and 'b' DNA.

(ii) Name the restriction enzyme that recognises this palindrome.

(iii) Name the enzyme that can link these two DNA fragments.

(b) How and why is electroporation done in *E. coli*?

OR

Rice is an important food grain crop, the presence of which goes back thousands of years in India's agricultural history. In late 1997, an American company was being granted a patent right by US patent and trademark office to name the aromatic rice grown outside India as '*Basmati*'. Similarly, a foreign based company got patent on the anti-diabetic properties of '*Karela*', '*Jamun*' and '*Bengan*' few years ago. However, this is a false discovery as this is known since ages in India.

(a) Which problems have been exemplified by the above cited cases?

(b) Do you really think these problems have become an epidemic?

(c) What measures should be taken to eradicate such problems?

Solution

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1. a = *Penicillium notatum*

b = Acetic acid

c = Fungus

d = *Saccharomyces cerevisiae*

2. AIDS is caused by human immuno deficiency virus (HIV), a member of a group of viruses called retroviruses. These viruses are called retroviruses because they have RNA genome, enclosed within an envelope, capable of reverse transcribing into DNA inside the host cell.

OR

Other than sexual contact, transmission of HIV infection in humans could also occur by

(i) Transfusion of contaminated blood and blood products.

(ii) From infected mother to her child through placenta

3. **(a)** Parasitism

(b) Commensalism

(c) Competition

(d) Mutualism

4. **(a)** An antibody molecule.

(b) 'a' - Antigen binding site; 'b' - Heavy chain.

(c) B-lymphocytes.

OR

(a) Bone marrow, a primary lymphoid organ.

(b) The lymphocytes produced in primary lymphoid organ migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become effector cells and then affect immunity.

5. During secondary treatment, the primary effluent is taken to aeration tanks. A large number of aerobic heterotrophic microbes grow in the aeration tank. They form flocs which are masses of bacteria held together by slime and fungal filaments to form mesh like structures. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result the BOD of the waste matter is reduced to 10-15% of raw sewage, it is passed into settling tank.

6. **(a)** Growth curve '*a*' represents the J-shaped or exponential growth; '*b*' represents S-shaped or logistic growth.

(b) For curve '*a*'; population growth is not limited by the resources whereas, for curve '*b*' resources limit the population growth.

(c) $\frac{dN}{dt} = rN\left(\frac{K - N}{K}\right)$

7. The equation of curve 'a' is

$S = CA^z$

where,

S = Species richness

C = Y – intercept

A = Area

Z = Slope of the line (regression coefficient).

The graph on species- area relationship shows that within a region, species richness increases with increasing explorable area, but only upto a limit. The relation between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

OR

	In situ conservation	*Ex situ* conservation
1.	Conservation and protection of the whole ecosystem and its biodiversity at all levels in order to protect the threatened species.	Conservation of selected rare plants/ animals in place outside their natural homes.
2.	Two alternate methods are used, hotspots and protected areas.	The methods include offsite collections and gene banks.

8. **(a)** *Wuchereria bancrofti and Wuchereria malayi.*

(b) The filarial worms are deposited near the site of mosquito bite. They pass through the punctured skin and reach the lymphatic system where they slowly develop and cause chronic inflammation. They usually infect lymphatic vessels of the lower limbs. The inflammation of lymph nodes and lymph vessels leads to obstruction of lymph vessels which causes thickening of subcutaneous tissues and skin so that swelling of feet, legs, thighs, scrotal sacs occurs.

(c) The pathogens are transmitted to the healthy persons through the bite of the infected female *Culex* mosquito vectors.

9. (a) The palindrome sequence in DNA is a sequence of base pairs that reads same on the two strands when orientation of reading is kept the same.

(b) The palindrome sequence shown is

5′–GAATTC–3′

3′–CTTAAG–5′

This is the recognition sequence for restriction enzyme *Eco* R I.

(c) Each restriction endonucleases recognises a specific palindromic nucleotide sequences in the DNA. Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands. This leaves single stranded portions at the ends. These are overhanging stretches called sticky ends on each strand. These are named so because they form hydrogen bonds with their complementary cut counterparts. This stickiness of the ends facilitates the action of the enzyme DNA ligase.

10. (a) In PCR, (Polymerase Chain Reaction) multiple copies of the gene (or DNA) of interest are synthesised *in vitro* using two sets of primers (small chemically synthesised oligonucleotide that are complementary to the regions of DNA) and the enzyme DNA polymerase.

The two oligo-nucleotide primers are required for the DNA synthesis by polymerase. These primers get annealed with their ends facing each other allowing synthesis of DNA towards one another. DNA polymerase synthesises the DNA region between the primers, using dNTPs (deoxynucleoside triphosphate) and Mg^{2+}. The optimum temperature for this polymerization step is 72°C.

(b) The DNA polymerase used in PCR is called as *Taq* DNA polymerase. Its source organism is a thermophilic bacterium *Thermus aquaticus*. The characteristic feature of *Taq* DNA polymerase is that it is heat stable and remains active at high temperature induced denaturation of DNA required during PCR.

11. Extinction of species due to human activities is known as anthropogenic extinction. Various human activities have led to extinction of particular species. The most common example is Nile perch, a large predator fish introduced in Lake Victoria for commercial purpose turned out to be a problematic species. It started feeding on the native fish cichlid fish, which results in extinction of ecologically unique assemblage of over 200 native species of small cichlid fish.

12. (a) The disease is cholera.

(b) Fluid loss can be maintained by taking oral rehydration therapy.

(c) Disease is transmitted by taking contaminated food and drink.

13. (a) (i) a = Vector DNA

b = Foreign DNA

(ii) Restriction enzyme is *Eco* R I

(iii) DNA ligase.

(b) Electroporation is a method of vectorless gene transfer. In this method, the electrical impulses induce transient pores in the cell membrane through which DNA molecules are incorporated into cells. This is done because DNA is a hydrophilic molecule, it cannot pass the cell membrane. So by electroporation, pores are created through which DNA can enter the cell.

OR

(a) This is a case of biopiracy and biopatenting. Biopiracy is the theft of biological and genetic resources indigenous to a country. Biopatent is a government protection to an inventor of a biological material, securing him for a specific time the exclusive right of manufacturing, exploiting, using, and selling an invention.

(b) Yes, these problems have become an epidemic and need to be controlled. Companies are being granted patents for products and technologies that make use of biological resources, *viz*., genetic materials, plants and animals, which have long been identified, developed and used by farmers and indigenous people. There are strong protests from farmers and indigenous people against the grant of patent rights to companies because it is these communities which originally identified and evolved use of plants for food medicines and other purposes. Biopiracy and biopatenting is a double crime : (i) it is a theft of preexisting knowledge, and (ii) granting patent on stolen knowledge is against the law.

(c) Government and people should be extra vigilant so that the indigenous knowledge about the use of biological resources is not pirated by unscruplous companies.