

Question Paper Code 57/2/3

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

- 1. Mention one example each from plants and animals exhibiting divergent evolution.**

Ans Thorn of Bougainvillea and tendrils of Cucurbita ,
forelimbs of whales , bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains
(Any one) /Any other correct example = $\frac{1}{2} + \frac{1}{2}$

[1Mark]

- 2. Give one reason to justify statutory ban on amniocentesis.**

Ans Check/prevent female foeticide.

[1 Mark]

- 3. Name any two physiological barriers that provide innate immunity ?**

Ans Acid in Stomach/Saliva in mouth/tears in eyes (Any two) = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

OR

Select two disease resistant crop varieties from the list of crop varieties given below:

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

Ans Himgiri; Pusa Komal = $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

- 4. Name a human genetic disorder due to the following :**

(a) An additional X-chromosome in a male

(b) Deletion of one X-chromosome in a female

Ans. a) Klinefelter's Syndrome

b) Turner's Syndrome

= $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

OR

State what does aneuploidy lead to.

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[1Mark]

5. Why is the rate of secondary succession much faster than that of primary succession ?

Ans Some soil or sediment is already present (due to destruction of natural biotic communities present earlier.)

[1 Marks]

SECTION – B

(Q. Nos. 6- 12 are of two marks each)

6. State two' observations made by German naturalist, Alexender von Humboldt during his extensive explorations in South American jungles.

Ans Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola.

= 1 + 1

[2 Marks]

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dT} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dT} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent ? Write any one significance of calculating 'r' for any population.

Ans r = intrinsic rate of natural increase , it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth .

= 1 + 1

[2 Marks]

7. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96 ?

Ans A + T = C + G , Given A=96 so T = 96, and A + T = 192

Given total Nucleotides = 546

G + C = 546 - 192 = 354 because G = C so C = 354 / 2 ,

1

Cytosine = 177

=1

[2 Marks]

8. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm ?

(b) The development of endosperm precedes that of embryo in plants. Justify.

Ans (a) Castor

= 1

(b) endosperm stores reserve food materials / provides nutrition to the developing embryo =1

[2 Marks]

9. Name a distinguishing structure seen in a mature black pepper seed and not in a pea seed. State how does it develop.

Ans Perisperm is seen in a mature black pepper seed , the residual persistent nucellus is perisperm.

=1+1

[2 Marks]

10. Why does the insecticidal protein produced by *Bacillus thuringiensis* not kill the bacterium , but kills the cotton bollworm ? Explain

Ans The Bt toxin protein exist as inactive protoxins , it becomes active due to alkaline pH of the gut of cotton bollworm. =1+1

[2 Marks]

11. Write the palindromic nucleotide sequence that EcoRI reads , and indicate the site of its action .

Ans 5' - G AATTC - 3'

3'-CTTAAG 5'

1+1

[2 Marks]

12. Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms ?

Ans Frog -External fertilization / in water / outside the body , release of motile gametes / large number of gametes/ synchronised maturation of ova and sperms = $\frac{1}{2}$ + $\frac{1}{2}$

Moss - Internal fertilization / inside the body of organism , male gametes are motile / large number of gametes. = $\frac{1}{2}$ + $\frac{1}{2}$

[2 Marks]

OR

Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

Ans. Egg laying (fertilised or unfertilised) , e.g. reptiles / birds / any other correct example = $\frac{1}{2} + \frac{1}{2}$

Give birth to young ones , e.g. majority of mammals / humans / any other correct example = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

SECTION C

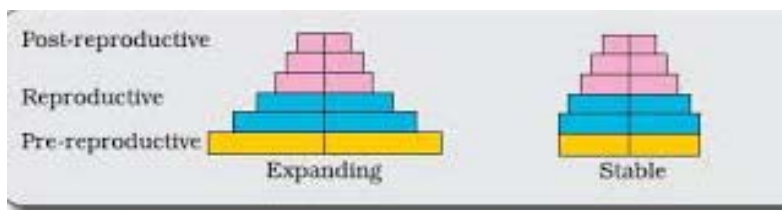
(Q Nos. 13-24 are of 3 marks each)

13. Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams.

Ans

Expanding age pyramid	Stable age pyramid
Population of pre-reproductive age is greater than population of reproductive age	Population of pre-reproductive age equals to population of reproductive age

= $\frac{1}{2} + \frac{1}{2}$



1+1

[3 Marks]

14. A child is born with ADA-deficiency

(a) Suggest and explain a procedure for possible life-long (permanent) cure.

(b) Name any other possible treatment for this disease.

Ans (a) Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patient's body at early embryonic stage. = $\frac{1}{2} \times 4$

(b) Bone marrow transplantation , enzyme replacement therapy $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

15. Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product.

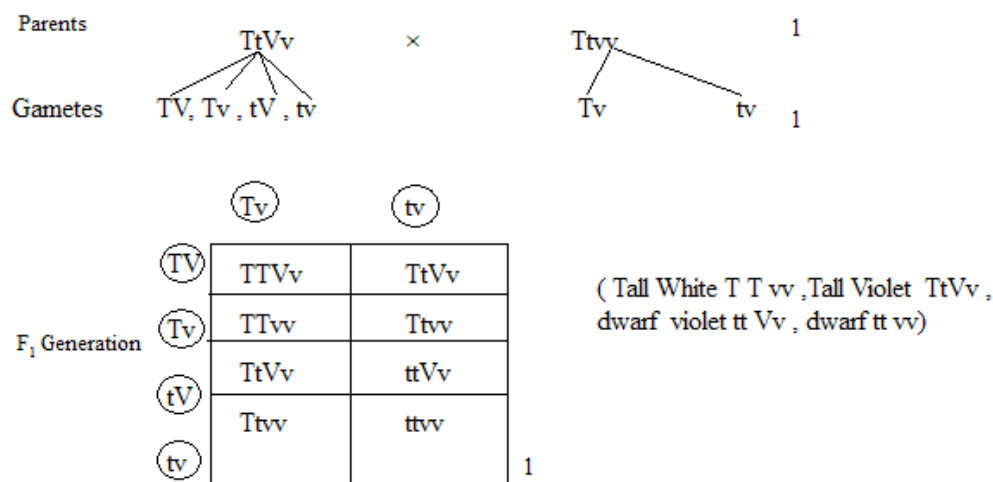
Ans Stirring type = $\frac{1}{2}$

agitator system, O₂ delivery system, foam control system, temperature control system, pH control system = $\frac{1}{2} \times 5$

[3 Marks]

16. A tall pea plant bearing violet flowers is crossed with a tall pea plant bearing white flowers. In the F₁ Progeny, there were tall pea plants with white flowers, tall pea plants with violet flowers, dwarf pea plants with violet flowers and dwarf pea plants with white flowers. Work out the cross to show how it is possible.

Ans



[3 Marks]

17. (a) Differentiate between inbreeding and outbreeding.
- (b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry.

Ans (a) Inbreeding - Mating of more closely related individuals within the same breed for 4-6 generations. = $\frac{1}{2}$

Outbreeding- Breeding of unrelated animals may be of the same breed but having no common ancestors for 4-6 generations/ different breeds/ different species. = $\frac{1}{2}$

- (b) Advantages develops pureline / increase homozygosity, accumulation of superior genes, elimination of less desired genes. = $\frac{1}{2} \times 3$

Disadvantages- Reduces fertility/ causes inbreeding depression.

= $\frac{1}{2}$

[3 Marks]

18. Explain Hardy-Weinberg principle

Ans The frequency of occurrence of alleles of a gene is constant from generation to generation, it is expressed as $p^2 + 2pq + q^2 = 1$,

p and q represent the frequency of different alleles

$1+1+1=3$

19. "Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi-conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion.

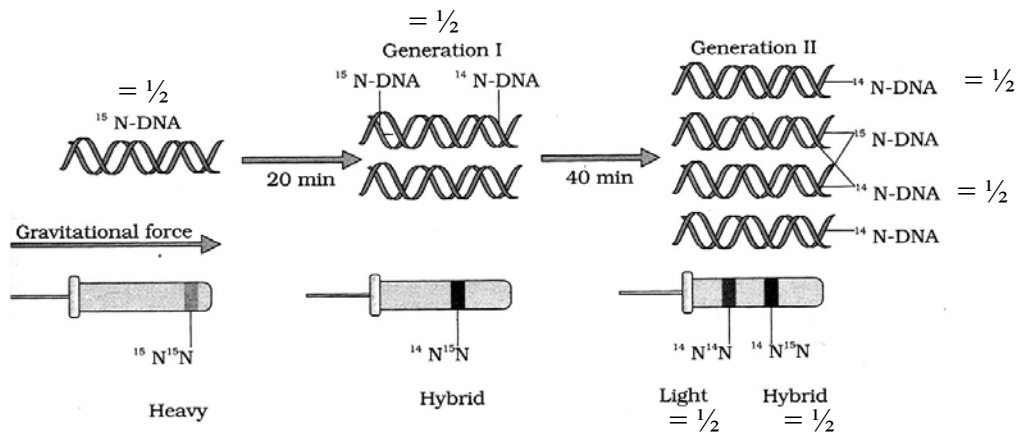
Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA, then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$. The extracted DNA are centrifuged in CsCl and measured to get their densities. DNA extracted from the culture after one generation (20 minutes), showed intermediate hybrid density. DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA

= $\frac{1}{2} \times 6 = 3$

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A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered

= 3



[3 Marks]

OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote.

Ans Charging of tRNA / aminoacylation of tRNA,

small subunit of ribosome binds to mRNA (5' end),

for initiation the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA (forming complementary base pairs with tRNA anticodon),

Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sites of the large subunit joined by peptide bond,

Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

$$\frac{1}{2} \times 6$$

[3 Marks]

20. (a) Name the causative agents of pneumonia and common cold.

(b) How do these differ in their symptoms ?

(c) Mention two symptoms common to both.

Ans (a) *Streptococcus pneumoniae*/ *Haemophilus influenzae*, Rhinoviruses

$$= \frac{1}{2} + \frac{1}{2}$$

(b) Different symptoms (any two)

$$= \frac{1}{2} + \frac{1}{2}$$

Pneumonia	Common cold
Infects alveoli of lungs	Infects nose & respiratory passage
chills	Sore throat
Lips /fingers may turn grey to black	Hoarseness

(c) Common symptoms (any two)

$$= \frac{1}{2} + \frac{1}{2}$$

Pneumonia	Common cold
Cough	Cough
Headache	Headache

[3 Marks]

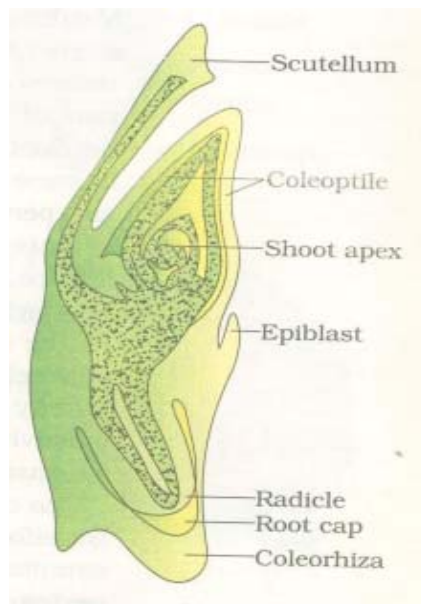
OR

(a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms.

(b) Name any two diseases spread by *Aedes* sp.

- Ans (a) *Plasmodium vivax* / *P. falciparum* / *P. malariae*, vector-Female *Anopheles* mosquito = $\frac{1}{2} + \frac{1}{2}$
- Symptoms - chill & high fever = $\frac{1}{2} + \frac{1}{2}$
- (b) Dengue, Chikungunya (or any other correct example) = $\frac{1}{2} + \frac{1}{2}$
- [3 Marks]

21. Draw L.S of an embryo of grass and label its parts.



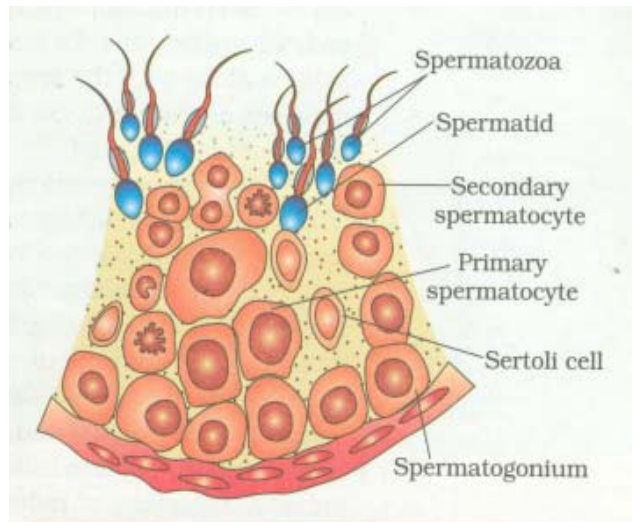
1 × 3

[3 Marks]

(Any Three Correctly Labelled Parts)

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



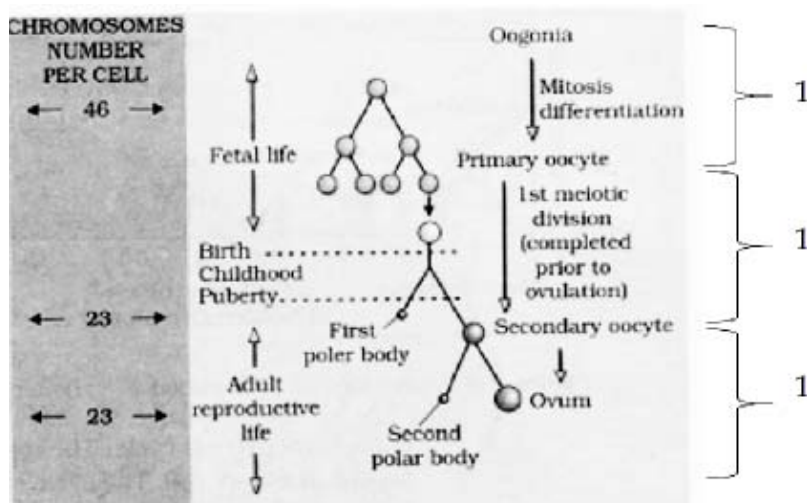
(Any Three Labelled Parts)

= 1×3

[3 Marks]

22. Construct a flow chart exhibiting sequential events of oogenesis.

Ans



1×3

[3 Marks]

23. When and where do tapetum and synergids develop in flowering plants ? Mention their functions.

Ans Tapetum- Microsporogenesis , Microsporangium(Anther), nourishes the developing pollen grains.

Synergids -Megasporogenesis, Megasporangium(ovule), synergids have filiform apparatus to guide the pollen tube into it. $\frac{1}{2} \times 6$

[3 Marks]

OR

**Where are the following structures present in a male gametophyte of an angiosperm ?
Mention the function of each one of them.**

- (a) Germ pore
- (b) Sporopollenin
- (c) Generative cell

Ans (a) Germ pore- Pollen grain exine , site from where pollen tube emerges .

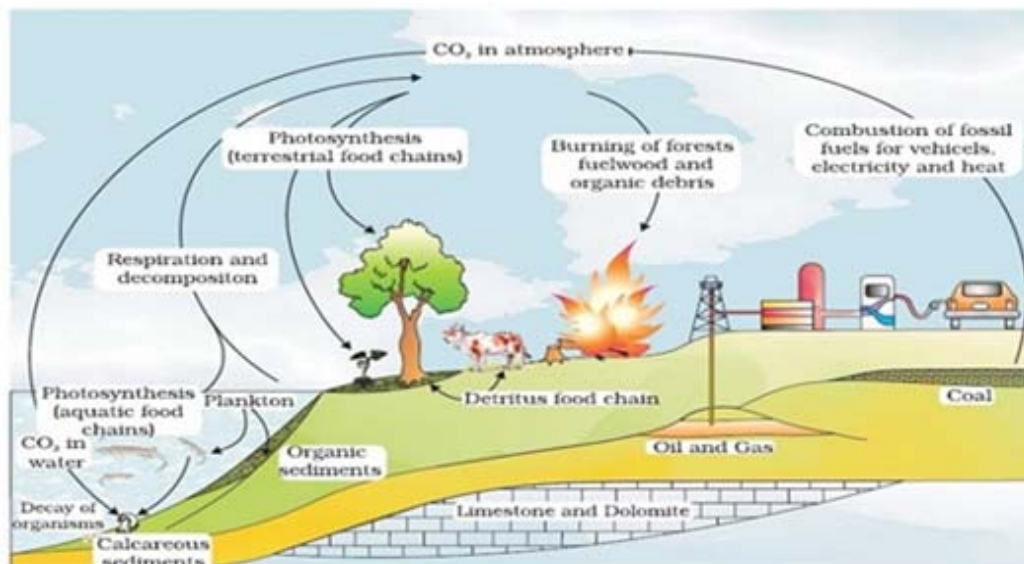
(b) Sporopollenin-Exine of pollengrains , protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition

(c) Generative Cells - Pollen grains , give rise to two male gametes

$\frac{1}{2} \times 6$
[3 Marks]

24. Draw the carbon cycle in nature. How does deforestation affect this cycle ?

Ans



For marking the diagram -

Sources -respiration/ burning of forest / combustion of fuel (Any Two) $\frac{1}{2} + \frac{1}{2}$

CO₂ Fixation-Photosynthesis / limestone / Dolomite / oil , gas coal (Any Two) $\frac{1}{2} + \frac{1}{2}$

Effect of deforestation is enhanced CO_2 concentration in the atmosphere (because trees hold a lot of carbon in their biomass by photosynthesis).

$=\frac{1}{2}+\frac{1}{2}$

SECTION D

(Q Nos. 25-27 are of 5 marks each)

25. A normal couple has a colour-blind child, whereas a child suffering from thalassemia is born to normal parents.

Compare the pattern of inheritance of these two traits in the said cases. State the reasons how is it possible.

Ans $\text{X}^{\text{C}}\text{X} \times \text{XY}$ 1

Carrier mother

Normal Father

	X^{C}	X
X	$\text{X}^{\text{C}}\text{X}$	XX
Y	$\text{X}^{\text{C}}\text{Y}$	XY

1



Colourblind Son

Colourblindness -Sex linked recessive , mother carrier($\text{X}^{\text{C}}\text{X}$)

$= 1 + \frac{1}{2}$

Thalassemia - Autosomal recessive , both the parents are carrier

$= 1 + \frac{1}{2}$

[5 Marks]

OR

- (a) State the reasons for which Hershey and Chase carried out their experiments.
- (b) Answer the following questions based on the experiments of Hershey and Chase :
- (i) Name the different radioactive isotopes they used, and explain how they used them
- (ii) Why did they need to agitate and spin their culture ?
- (iii) Write their observations and the conclusions they arrived at.

Ans (a) To find out that DNA is the genetic material . 1

(b) P^{32} labelled DNA , S^{35} labelled protein capsule of Bacteriophage $\frac{1}{2}+\frac{1}{2}$

(ii) To remove virus coat from bacteria, separation of virus particles from bacteria by agitation

and spinning.

$\frac{1}{2} + \frac{1}{2}$

- (iii) S^{35} Radioactive detected in supernatant, Radioactive P^{32} detected in the cell, the proteins did not enter the bacteria from the viruses therefore DNA is the genetic material (that is passed from virus to bacteria)

1+1

[5 Marks]

26. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

Ans Developed polyblend- a fine powder of recycled modified plastic 1

Polyblend mixed with bitumen and used to lay roads (in collaboration with R V engineering college and Bangalore city corporation) 1

It enhanced water repellent property of bitumen and increase the road life. 1

Khan offered a price to rag pickers which enhanced their income and improved their livelihood. 1

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city 1

[5 Marks]

OR

- (a) What does an ecological pyramid represent? State any two limitations that these pyramids have.
- (b) Describe an inverted pyramid of biomass with the help of an example.

Ans (a) Ecological pyramids represent the relationship between different trophic levels in terms of number, biomass or energy 1

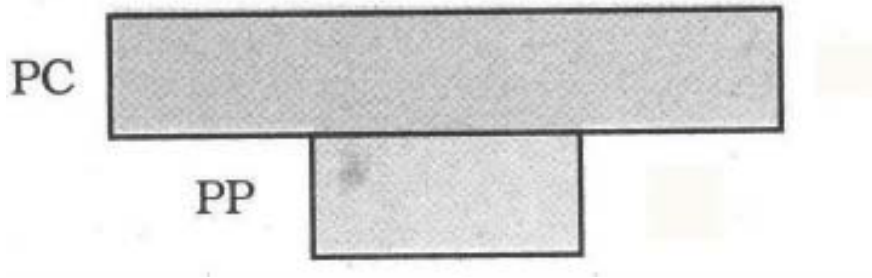
Limitations of pyramid:

It does not take into account the same species belonging to two or more trophic levels / It assumes a single food chain which almost never exists in nature / It does not accommodate a food web / Saprophytes are not given any place even though they play a vital role in the ecosystem.

(any two) $1 \times 2 = 2$

(b) The pyramids of biomass in aquatic ecosystem/ sea is generally inverted

//



1

e.g biomass of fishes is much more than biomass of phytoplanktons.

1

[5 Marks]

27. (a) Differentiate between active and passive immunity.

(b) Comment on the role of vaccination and immunization in keeping human population healthy.

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans (a)	Active immunity	Passive immunity
	Production of antibodies on exposure to antigen in host body	Introduction of readymade antibodies to protect against pathogen
	Slow process and takes time to give full effective response	T lymphocyte production is fast and responds quickly by checking growth of pathogen
	Natural infection induces active immunity	Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination

(Any two) 1 + 1

(b) **Role of vaccination / immunization:**

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies

- preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom

1×3 = 3

[5 Marks]

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans **Process of secondary treatment :**

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs



Microbes consume major part of organic matter in effluent which significantly reduces BOD



Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge



Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.



Resulted in production of Bio gas (CH_4 , H_2S and CO_2) which can be used as source of energy

1 × 5

[5 Marks]

