SECTION – A

1. Select the pathogen mismatched with the symptoms of disease caused by it from the list given below : 1

(a) *Entamoeba histolytica* : Constipation, abdominal pain.

(b) *Epidermophyton* : Dry scaly lesions on nail.

(c) *Wuchereria bancrofti* : Chronic inflammation of lymphatic vessels of lower limb.

(d) *Haemophilus influenzae* : Blockage of the intestinal passage.

2. Important attributes belonging to a population but not to an individual are : 1

(i) Birth rate and death rate (ii) Male and female

(iii) Birth and death (iv) Sex-ratio

Select the correct option from the given options :

(a) (i) only (b) (ii) only

(c) (ii) and (iii) (d) (i) and (iv)

3. Many copepods live on the body surface of marine fish. This relationship is an example of : 1

(a) Commensalism (b) Parasitism

(c) Amensalism (d) Mutualism

4. Given below is the restriction site of a restriction endonuclease Pst-I and the cleavage sites on a DNA molecule. 1

5' C – T – G – C – A ↓ G 3'

3' G ↑ A – C – G – T – C 5'

Choose the option that gives the correct resultant fragments by the action of the enzyme Pst-I.

(a) 5' C – T – G C – A – G 3'
3' G – A – C – G – T C 5'

(b) 5' C – T G – C – A – G 3'
3' G – A – G – C T – C 5'

(c) 5' C – T – G – C A – G 3'
3' G – A – C – G T – C 5'

(d) 5' C – T – G – C – A G 3'
3' G A – C – G – T – C 5'

5. Given below is a sequence of bases in mRNA of a bacterial cell. Identify the amino acid that would be incorporated at codon position 3 and codon position 5 during the process of its translation. 1

3' AUCAGGUUUGUGAUGGUACGA 5'

(a) Phenylalanine, Methionine (b) Cysteine, Glycine

(c) Alanine, Proline (d) Serine, Valine

6. Given below are structural details of a human mammary gland : 1

(i) The glandular tissue in the breast has 15-20 clusters of cells called alveoli.

(ii) The milk is stored in the lumen of alveoli.

(iii) The alveoli join to form the mammary ducts.

(iv) Mammary ampulla is connected to lactiferous ducts.

Choose the option that gives the correct detail of human mammary gland.

(a) (i) and (ii) (b) (ii) and (iii)

(c) (ii) and (iv) (d) (i) and (iii)

7. Given below are the list of the commercially important products and their source organisms. Select the option that gives the correct matches. 1

List A		List B	
S. No.	**Bioactive Products**	**S. No.**	**Microbes (Source Organism)**
(A)	Cyclosporin A	(i)	*Streptococcus*
(B)	Statins	(ii)	*Tricoderma polysporum*
(C)	Streptokinase	(iii)	*Penicillium notatum*
(D)	Penicillin	(iv)	*Monascus purpureus*

Options :

(a) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)

(b) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(c) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)

(d) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

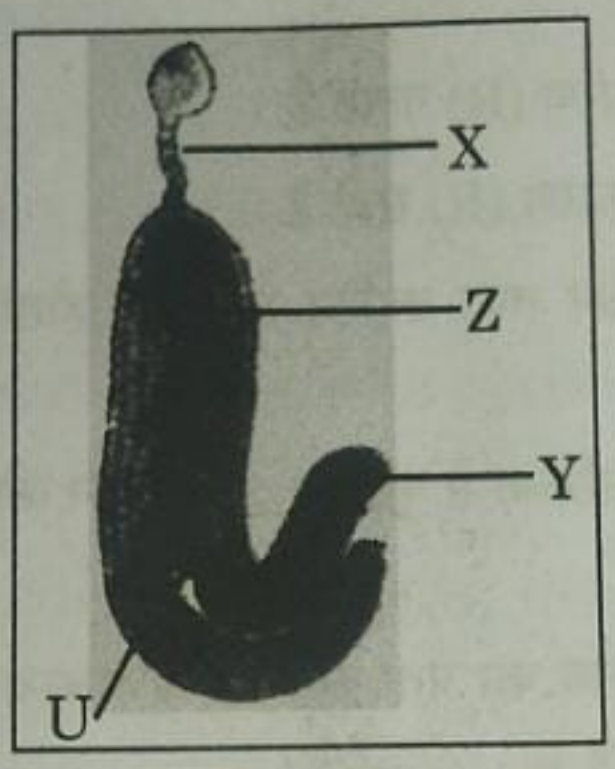
8. Tetanus antitoxin (Tetanus toxoid) when injected into the human body it immediately provides : 1

(a) Innate immunity
(b) Passive immunity
(c) Auto immunity
(d) Active immunity

9. The primary productivity in an ecosystem is expressed as : 1

(a) $gm^{-2} yr^{-1}$
(b) $gm^{-2} yr$
(c) K cal $m^{-2} yr^{-1}$
(d) K cal m^{-2}

10. Select the option that shows the correctly identified 'U', 'X', 'Y' and 'Z' in a developing dicot embryo. 1



(a) X – Plumule (2n), Y – Suspensor (n), Z – Cotyledon (2n), U – Radicle (2n).
(b) X – Plumule (2n), Y – Suspensor (2n), Z – Radicle (2n), U – Cotyledon (2n).
(c) X – Suspensor (2n), Y – Cotyledon (2n), Z – Radicle (2n), U – Plumule (2n).
(d) X – Cotyledon (2n), Y – Radicle (n), Z – Plumule (n), U – Suspensor (n).

11. The sixth extinction in progress currently is different from all previous extinctions on earth as it is : 1

(a) 10-100 times faster
(b) 100-1000 times faster
(c) 100-10000 times faster
(d) 1000-10000 times faster

12. At which stage during evolution did human use hides to protect their bodies and buried their dead ? 1

(a) *Homo habilis*
(b) Neanderthal man
(c) Java man
(d) *Homo erectus*

Question Nos. **13** to **16** consists of two statements Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below :

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).

(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

13. **Assertion (A) :** Decomposition process is slower if detritus is rich in lignin and cutin.

Reason (R) : Decomposition is largely an oxygen requiring process. 1

14. **Assertion (A) :** Determining the sex of an unborn child followed by MTP is an illegal practice.

Reason (R) : Amniocentesis is a practice to test the presence of genetic disorders also. 1

15. **Assertion (A) :** In Thalassemia an abnormal myoglobin chain is synthesized due to a gene defect.

Reason (R) : α-Thalassemia is controlled by genes HBA1 and HBA2 on chromosome 16. 1

16. **Assertion (A) :** Synthetic oligonucleotide polymers are used during Annealing in a PCR.

Reason (R) : The primers bind to the double stranded DNA at their complementary regions. 1

SECTION – B

17. (a) Name (i) a GM cereal crop having enhanced nutritional value, (ii) the nutrient it is rich in.

(b) State any two benefits of Genetically modified crops. 2

18. By using Punnett square depict the genotypes and phenotypes of test crosses (where green pod colour (G) is dominant over yellow pod colour (g)) in Garden pea with unknown genotype. 2

19. (a) Certain specific bacterial spores are mixed in water and sprayed over *Brassica* crop to control butterfly catterpillars.

Name this bacterium and its mode of action on the butterfly catterpillars. 2

OR

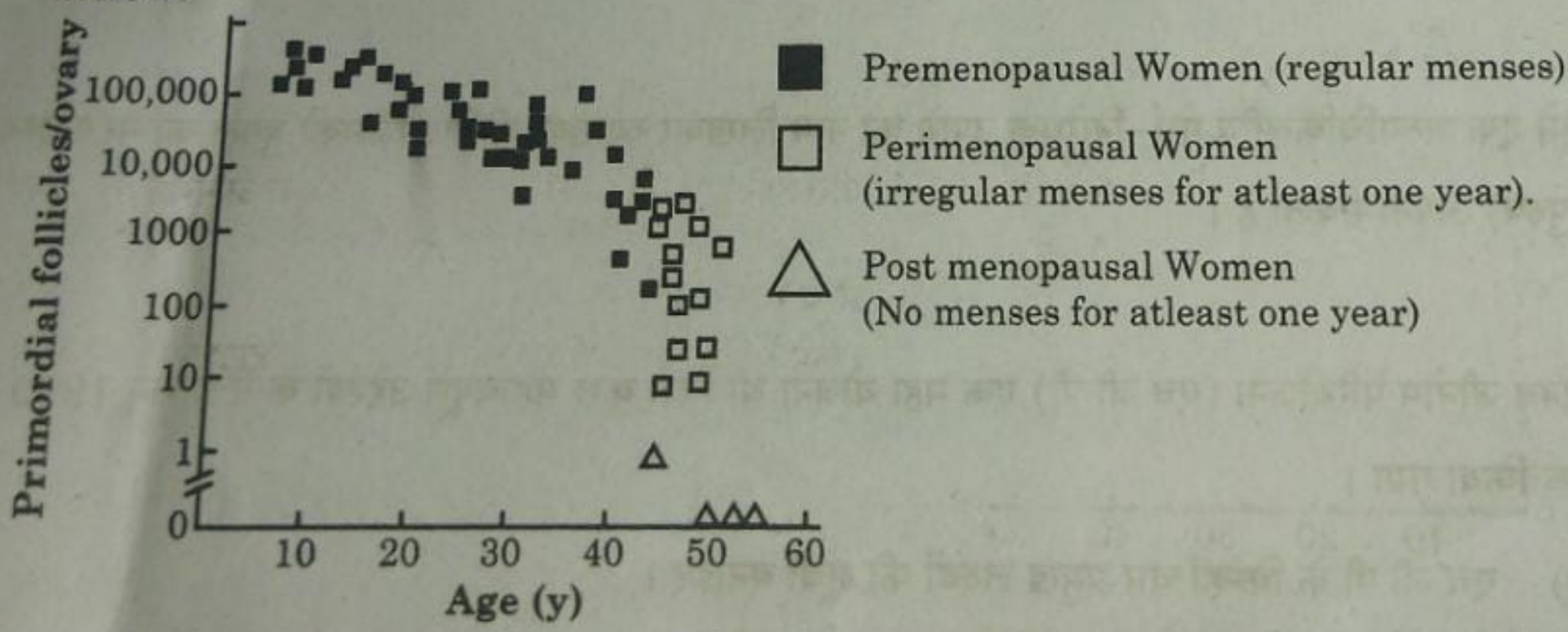
(b) Immunotherapy these days is one of the most efficient way of treatment of cancer. The therapy involved activates the immune system and destroys the tumour.

(i) Write an example of one such biological response modifier used in immunotherapy.

(ii) Why do patients need such substances if immune system is already working in body ?

(iii) State what is 'Contact inhibition'. 2

20. The graph given below shows the number of primordial follicles per ovary in women at different ages. Study the graph and answer the questions that follow.



(a) What is the average age of the women at the onset of menopause ?

(b) At what age are maximum primordial follicles present in the ovary, according to the given graph ? 1 + 1 = 2

21. "Some species of insects and frogs have evolved with various specific features that help them from being detected."

(a) Justify the statement giving reasons.

(b) Mention any two such features. 2

SECTION – C

22. (a) "*Plasmodium* protozoan needs both a mosquito and a human host for its continuity." Explain. 3

OR

(b) We all must work towards maintaining good health because 'health is wealth'. Enlist any six ways of achieving good health. 3

23. "Biodiversity plays a major role in many ecosystem services that nature provides."

(a) Describe any two broadly utilatarian arguments to justify the given statement.

(b) State one ethical reason of conserving biodiversity. 3

24. Name and explain a surgical contraceptive method that can be adopted by the male partner of a couple. 3

25. Human Genome Project (HGP) was a mega project launched in the year 1990 with some important goals.

(a) Enlist any four prime goals of HGP.

(b) Name any one common non-human animal model organism which has also been sequenced thereafter. 3

26. One of the major approaches of crop improvement programme is Artificial Hybridisation. Explain the steps involved in making sure that only the desired pollen grain pollinate the stigma of a bisexual flower by a plant breeder. 3

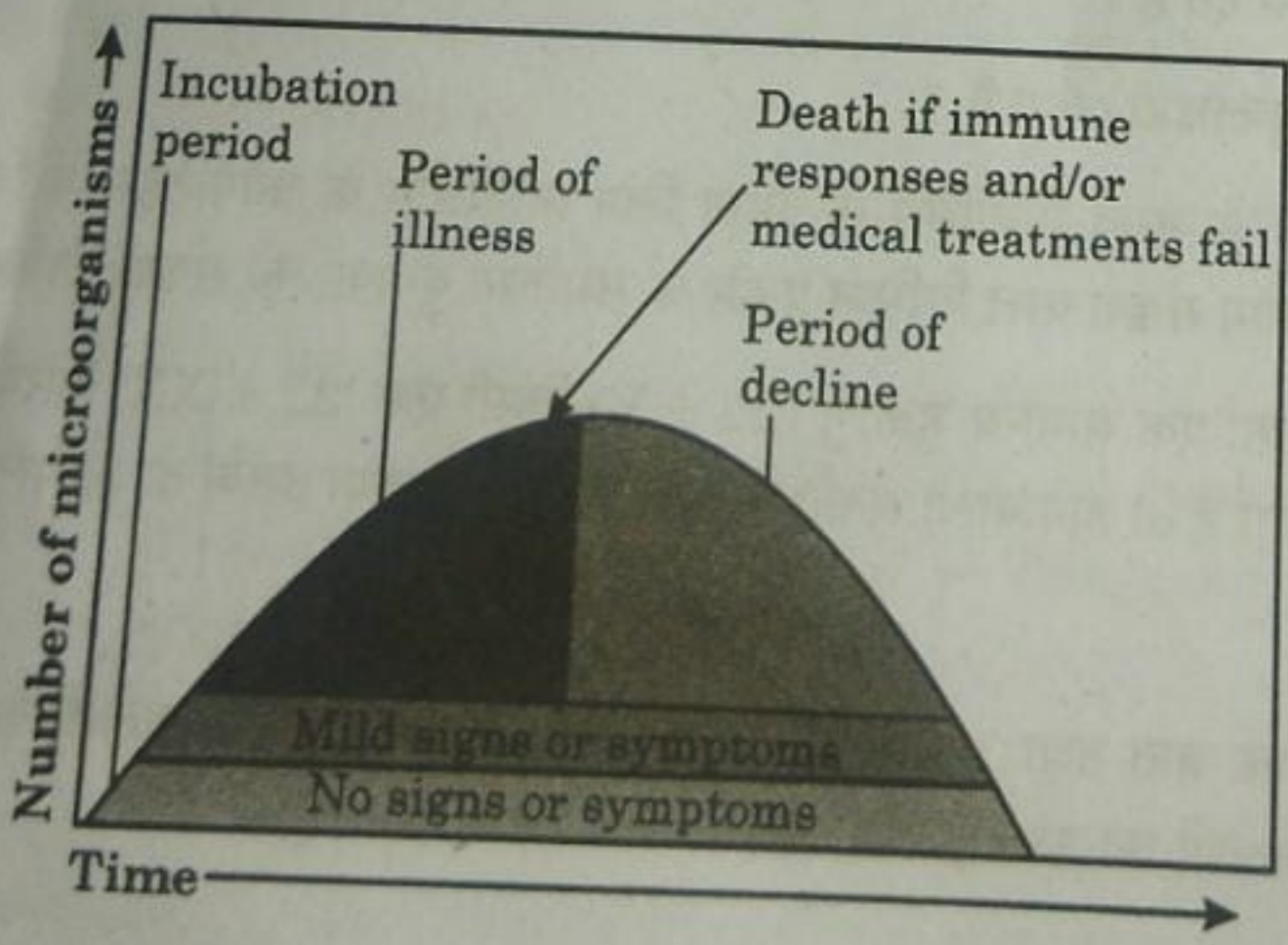
27. Mention Darwin's observations made on finches during his visit to Galapagos Islands. Write the explanation given by Darwin on his observations. 3

28. "RNA interference has been used to produce transgenic tobacco plants to protect them from the infestation by specific nematodes." Explain the novel strategy exploited by the biotechnologists. 3

SECTION – D

Q. Nos. **29** and **30** are case based questions. Each question has subparts with internal choice in one subpart.

29. When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow :



P.T.O.

(a) In which period, according to the graph there are maximum chances of a person transmitting a disease / infection and why ? 1

(b) Study the graph and write what is an incubation period. Name a sexually transmitted disease that can be easily transmitted during this period. Name the specific type of lymphocytes that are attacked by the pathogen of this disease. 2

OR

(b) Draw a schematic labelled diagram of an antibody. 2

(c) In which period, the number of immune cells forming antibodies will be the highest in a person suffering from pneumonia ? 1

Name the immune cells that produce antibodies.

). The chromosome number is fixed for all normal organisms leading to species specification whereas any abnormality in the chromosome number of an organism results into abnormal individuals. For example, in humans 46 is the fixed number of chromosomes both in male and female. In male it is '44 + XY' and in female it is '44 + XX'. Thus the human male is heterogametic, in other words produces two different types of gametes one with '22 + X' chromosomes and the other with '22 + Y' chromosomes respectively. Human female, on the other hand is homogametic i.e. produces only one type of gamete with '22 + X' chromosomes only.

Sometimes an error may occur during meiosis of cell cycle, where the sister chromatids fail to segregate called nondisjunction, leading to the production of abnormal gametes with altered chromosome number. On fertilisation such gametes develop into abnormal individuals.

(a) State what is aneuploidy. 1

(b) If during spermatogenesis, the chromatids of sex chromosomes fail to segregate during meiosis, write only the different types of gametes with altered chromosome number that could possibly be produced. 1

(c) A normal human sperm (22 + Y) fertilises an ovum with karyotype '22 + XX'. Name the disorder the offspring thus produced would suffer from and write any two symptoms of the disorder. 2

OR

(c) Name a best known and most common autosomal aneuploid abnormality in human and write any two symptoms. 2

SECTION - E

31. (a) (i) How and why is charging of tRNA essential in the process of translation ?

(ii) State the function of ribosome as a catalyst in bacteria during the process of translation.

(iii) Explain the process of binding of ribosomal units to mRNA during protein synthesis. 5

OR

(b) Describe the dihybrid cross upto F_2 generation as conducted by Gregor Mendel using pure lines of Garden Pea for characters seed shape and seed colour. 5

2. (a) Bioreactors are the containment vehicles of any biotechnology-based production process. For large scale production and for economic reasons the final success of biotechnological process depends on the efficiency of the bioreactor. 5

Answer the following questions w.r.t. the given paragraph :

(i) List the operational guidelines that must be adhered to so as to achieve optimisation of the bioreactor system. Enlist any four.

(ii) Mention the phase of the growth we refer to in the statement "Optimisation of growth and metabolic activity of the cells".

(iii) Is the biological product formed in the bioreactor suitable for the intended use immediate ? Give reason in support of your answer.

OR

(b) (i) *'EcoRI'* has played very significant role in r-DNA technology. 3

(I) Explain the convention for naming EcoRI.

(II) Write the recognition site and the cleavage sites of this restriction endonuclease.

(ii) What are the protruding and hanging stretches of DNA produced by these restriction enzymes called ? Describe their role in formation of r-DNA. 2

13. (a) (i) Explain the monosporic development of embryo sac in the ovule of an angiosperm. 3

(ii) Draw a diagram of the mature embryo sac of an angiospermic ovule and label any four parts in it. 2

OR

(b) (i) Explain the formation of placenta after the implantation in a human female. 3

(ii) Draw a diagram showing human foetus within the uterus and label any four parts in it. 2