



# PRINCE ACADEMY

## OF HIGHER EDUCATION

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### SAMPLE PAPER- SET-2 (2024-25)

Time : 03 : 00 Hours

CLASS :- XII-BIOLOGY (044)

M.M. : 70

#### General Instructions:

- (1) All questions are compulsory.
- (2) The question paper has five sections and 33 questions. All questions are compulsory.
- (3) Section-A has 16 questions of 1 mark each; Section-B has 5 questions of 2 marks each; Section-C has 7 questions of 3 marks each; Section-D has 2 case-based questions of 4 marks each; and Section-E has 3 questions of 5 marks each.
- (4) 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.
- (5) Wherever necessary, neat and properly labeled diagrams should be drawn.

#### SECTION - A

1. Placed below is a karyotype of a human being.



On the basis of the karyotype, which of the following conclusions can be drawn ?

- (a) Normal human female
  - (b) Person is suffering from colour blindness
  - (c) Affected individual is a female with Down's syndrome
  - (d) Affected individual is a female with Turner's syndrome
2. An Australian mole is actually a marsupial rather than a placental mammal like the North American or European mole. The two animals are similar in appearance because
    - (a) There are practically no placental mammals in Australia
    - (b) The selection process on both were similar
    - (c) They have undergone a long period of coevolution
    - (d) Marsupials and placental mammals are closely related

3. The image below is that of an extinct angiosperm species *Archaeofructus*.



In a science fiction movie, scientists find fossilised pollen grains of *Archaeofructus* and use them to fertilise a modern genus of *Archaeofructus*. Nitya thinks that these pollen grains can be found under polar ice sheets where the temperature is around  $-40^{\circ}\text{C}$ .

Is she correct and why ?

- (a) Yes, because  $-40^{\circ}\text{C}$  is enough to keep pollen grains viable
  - (b) No, because the pollen grains will get wet and won't function
  - (c) Yes, because pollen grains are viable at any temperature for several years
  - (d) No, because pollen grains need to be stored at much lower temperatures to be viable
4. If  $B = 0.66$ ,  $D = 0.50$  and  $N = 1000$ , then  $dN/dt =$
- (a) 55000
  - (b) 1600
  - (c) 160
  - (d) 260
5. A biologist inoculated bacteria A, fungus B and both bacteria A and fungus B on three different sterile petridishes 1, 2 and 3 respectively. After 24 hours, he observed growth in all three. These are his observations.

Plates	Organisms	Observations
1	Bacteria A	46 small round colonies
2	Fungus B	9 medium round colonies
3	Bacteria A + fungus B	4 small round colonies + 10 medium round colonies

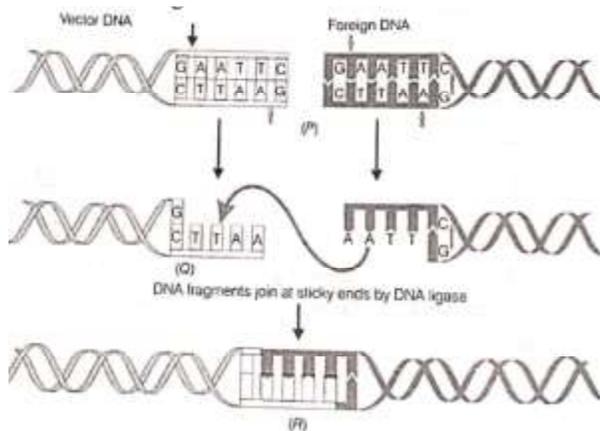
Which can the biologist conclude from this ?

Y. The fungus inhibits the growth of the bacteria.

Z. The bacterium causes the fungus to grow better.

- (a) Only Y
  - (b) Only Z
  - (c) Both Y and Z
  - (d) Neither Y nor Z
6. 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.
- 3'-AUCAGGUUUGUGAUGGUACGA-5'
- (a) Phenylalanine, Methionine
  - (b) Cystein, Glycine
  - (c) Alanine, Proline
  - (d) Serine, Valine

7. Recognise the figure and find out the correct matching.



- (a) P-Hind II, Q-Blunt end, R-Non-recombinant DNA
- (b) P-BamHI, Q-Sticky end, R-Recombinant DNA
- (c) P-EcoRI, Q-Blunt end, R-Non-recombinant DNA
- (d) P-EcoRI, Q-Sticky end, R-recombinant DNA

8. Match the following columns.

Column I	Column II
P. Rivet popper hypothesis	1 Paul Ehrlich
Q. Communities with more species	2 Edward Wilson
R. Communities with less species	3 Less stable
S. Term biodiversity	4 More stable

Codes

	P	Q	R	S
(a)	2	4	3	1
(b)	1	4	3	2
(c)	1	3	4	2
(d)	1	4	2	3

9. Transgenic mice are being developed to replace the use of monkeys for laboratory testing of vaccines or drugs meant for humans.

Which of the following is/are possible reason for this move ?

P. Mice and humans have similar physiology.

Q. The reproduction rate is faster in mice.

- (a) Only P
- (b) Only Q
- (c) Both P and Q
- (d) Neither P nor Q

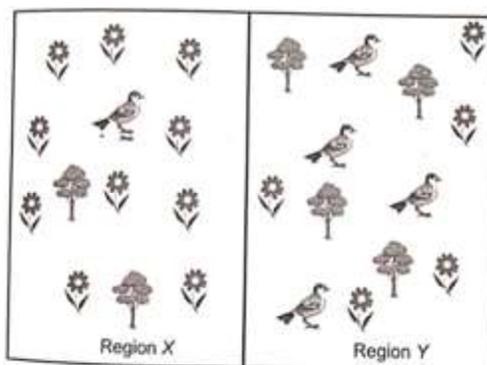
10. Which is medicine free contraceptive method ?

- (a) LNG-20
- (b) Progestasert
- (c) CuT
- (d) Lippe's loop

11. Select the incorrect match from the following:-

- (a) Saccharomyces cerevisiae- Commercial production of ethanol
- (b) Acetobacter aceti- Production of preservative agent
- (c) Propionibacterium shermani- Ripening of roquefort cheese
- (d) Trichoderma polysporum- Production of immunosuppressive agent

12. Given below is the species distribution across two different regions X and Y. The area used to count species was the same.



Which of the following is true about the biodiversity in these regions ?

- (a) Region X is more diverse than Region Y even though both regions have the same species richness.
- (b) Region X is less diverse than Region Y even though both regions have the same species richness.
- (c) Region X and Region Y have the same species richness and so the same diversity.
- (d) Region X is more diverse as it has greater species richness than Region Y.

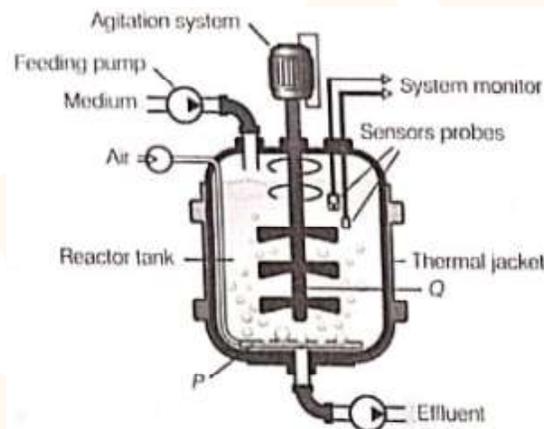
**For Questions number (13-16) , two statements are given - one labelled as Assertion (A) and the other labelled as Reason (R) . Select the correct answer to these questions from the codes (a), (b), (c) , and (d) as given below.**

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).**
- (b) Both Assertion (A) and Reason (R) are true, but Reason(R) is not the correct explanation of the Assertion(A).**
- (c) Assertion (A) is true, but Reason (R) is false.**
- (d) Assertion (A) is false, but Reason (R) is true.**

13. Assertion : Menstrual phase is analogous to shedding tears over the lost ovum.  
Reason : During the menstrual phase, the Endometrial lining shed because of reduced hormonal support.
14. Assertion : A single stranded DNA probe tagged with a radioactive molecule does not appear in autoradiogram.  
Reason : Complementarity with DNA obtained form the basis of probing using tagged DNA molecules in Autoradiography.
15. Assertion : Each antibody is represented as  $H_2L_2$   
Reason : Each antibody molecule has 4 nucleotide chains two small called light chains & 2 longer called heavy chains.
16. Assertion : Embryo's of fish, salamander, tortoise, chick & a man of same age resemble each other closely.  
Reason : This verifies that ontogeny recapitulates phylogeny.



25. Sex determination in cockroaches is the same as that seen in some other insects like grasshoppers.
- (a) Illustrate a cross between a female (XX) cockroach and a male (XO) cockroach.
- (b) What will be the chromosome number of the off springs formed, if the number of autosomes is 22?
26. (i) What is a detritus food chain made up of ? How do they meet their energy and nutritional requirements ?
- (ii) Is it possible that a species may occupy more than one trophic level in the same ecosystem at the same time? Explain with the help of one example.
27. Give a reason why
- (i) The absence of RNA polymerase III can interfere with the translation of nuclear genes.
- (ii) Defining a gene present in DNA is complicated, particularly in eukaryotes.
- (iii) In bacteria, translation & transcription happen almost simultaneously ?
28. Given below is a diagram of a bioreactor with some of its parts labelled P & Q.

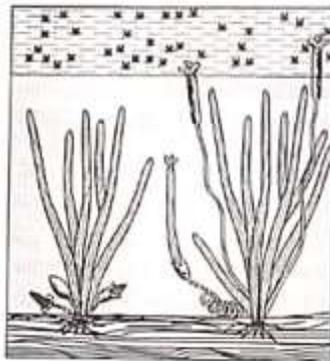


- (i) Which type of organism can most likely be used if part P is not a major part of the bioreactor ? Why
- (ii) Identify the name & purpose of Q and P.
- (iii) How does the thermal Jacket help in the process ?

### SECTION - D

**Q.no. 29 and 30 are case based questions. Each question has sub-parts with internal choice in one sub-part.**

29. Study the figure of a floating hydrophyte plant that grow in water bodies.



- (i) On the basis of your knowledge about pollination, identify the mechanism of pollination in this plant.
- (ii) This type of pollination mechanism is quite rare, limited to around 30 genera. The plants exhibiting this mechanism must have some special characteristics. Describe these characteristics.

(iii) If a plant has pollen grains which are small, light, dry, dusty and non-large, hairy and feathery, will they use a similar mechanism for exchanging gametes ?

OR

(iii) If a plant has to get pollinated by insect, what characteristics should it exhibit ?

30. A population at Hardy-Weinberg equilibrium has two alleles for fur colour, red and black. Assume black is dominant to red fur colour of the animal in the population, 16 percent of the animals have red fur.

Based on the following situation answer the questions that follows.

- (i) State the Hardy-Weinberg principle.
- (ii) What percentage of the alleles in the population code for black fur ?
- (iii) What are the factors affecting the Hardy-Weinberg equilibrium in a population ?

OR

(iii) How does all the factors of Hardy-Weinberg equilibrium actually contributes to the process of evolution.

### **SECTION - E**

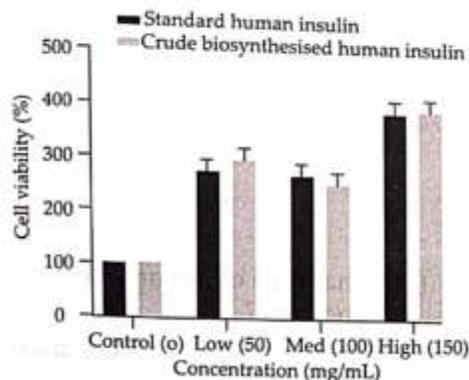
31. What did Messelson & Stahl observe when

- (i) They cultured E.coli in a medium containing  $^{15}\text{NH}_4\text{Cl}$  for a few generations & centrifuge the content.
- (ii) They transferred one such bacterium to the normal medium of  $\text{NH}_4\text{Cl}$  & cultured for two generations.
- (iii) What did Messelson & Stahl conclude from this experiment ? Explain with the help of diagrams.
- (iv) Write down the results obtained after 4<sup>th</sup> generation if the experiment is continued till 4<sup>th</sup> generation.

OR

The biological activity of insulin was tested using an assay in in vitro, using HepG2 cell under hyperglycemic conditions. In this assay, three concentrations were used for the standard insulin : low (50  $\mu\text{g}/\text{mL}$ ), medium (100  $\mu\text{g}/\text{mL}$ ) and high (150  $\mu\text{g}/\text{mL}$ ).

A graph illustrating the above conditions is given below.



- (i) By studying the above graph discuss the efficiency of crude biosynthesised human insulin at low concentration, i.e. 50  $\mu\text{g}/\text{mL}$ .
- (ii) At which concentration, both the insulin are equally efficient ?

(iii) Using the above information, suggest why we should always use control in assay ?

(iv) Describe the basic structure of the insulin molecule.

32. Almost any disease causing organisms such as bacteria, virus, fungi, prions, etc. or their toxins can be used as biological weapons.

Historical biological weapons programmes have included effects to produce aflatoxin, anthrax and many others. In the bioweapon industry, genetic engineering is used to create new pathogenic strains through increased survivability, infertility, virulence, etc.

(i) In their natural state, the organism or toxins do not have the efficiency to cause the large scale damage as compared to their bioweapon forms. Explain, how are these natural forms turned into bioweapons ?

(ii) Genetic modification to this extent can have unpredictable or unforeseen risks to the living forms and the environment. Comment.

OR

Mark the following statements as true or false and provide an explanation for each.

(a) The umbilical cord contains blood vessels that connect the foetus to the mother's heart.

(b) The mitotic differentiation of immature male and female germ cells begins at puberty.

(c) The meiotic divisions in oogenesis are unequal.

(d) Sexual intercourse between a healthy male and female might not always lead to fertilisation.

(e) The sex of the child depends on the sex chromosome contributed by the ovum.

33. (i) List the different attributes that a population has and not an individual organism.  
(ii) What is population density ? Explain any three different ways the population density can be measured with the help of an example of each.

OR

(a) Explain Dicot embryogenesis with well labelled diagram.

(b) Also explain the structure of grass embryo with the help of well labelled diagram.

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