

Sample Question Paper 2022-23

CLASS XII BIOLOGY (044)

Maximum Marks: 70

Time: 3 hours

General Instructions:

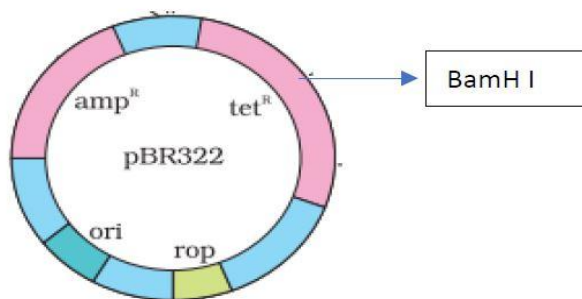
- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions. All questions are compulsory.
- (iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
- (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																						
Q.N o.	Question	Marks																				
1.	An infertile couple was advised to undergo In vitro fertilization by the doctor. Out of the options given below, select the correct stage for transfer to the fallopian tube for successful results? (a) Zygote only (b) Zygote or early embryo upto 8 blastomeres (c) Embryos with more than 8 blastomeres (d) Blastocyst Stage	1																				
2.	Given below are four contraceptive methods and their modes of action. Select the correct match: <table><tr><th>S. No.</th><th>Method</th><th>S. No</th><th>Mode of action</th></tr><tr><td>a)</td><td>Condom</td><td>(i)</td><td>Ovum not able to reach Fallopian tube</td></tr><tr><td>b)</td><td>Vasectomy</td><td>(ii)</td><td>Prevents ovulation</td></tr><tr><td>c)</td><td>Pill</td><td>(iii)</td><td>Prevents sperm reaching the cervix</td></tr><tr><td>d)</td><td>Tubectomy</td><td>(iv)</td><td>Semen contains no sperms</td></tr></table> (a) a)–(i) b)–(ii) c)– (iii) d)–(iv) (b) a)–(ii) b)–(iii) c)–(iii) d) – (i) (c) a)–(iii) b)–(iv) c)–(ii) d)–(i) (d) a)–(iv) b)–(i) c)– (iii) d)–(ii)	S. No.	Method	S. No	Mode of action	a)	Condom	(i)	Ovum not able to reach Fallopian tube	b)	Vasectomy	(ii)	Prevents ovulation	c)	Pill	(iii)	Prevents sperm reaching the cervix	d)	Tubectomy	(iv)	Semen contains no sperms	1
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3	Which of the following amino acid residues will constitute the histone core? (a) Lysine and Arginine (b) Asparagine and Arginine (c) Glutamine and Lysine (d) Asparagine and Glutamine	1															
4	Evolutionary convergence is development of a (a) common set of functions in groups of different ancestry. (b) dissimilar set of functions in closely related groups. (c) common set of structures in closely related groups. (d) dissimilar set of functions in unrelated groups.	1															
5.	<i>Apis mellifera</i> are killer bees possessing toxic bee venom. Identify the treatment and the type of immunity developed from the given table to treat a person against the venom of this bee. <table> <tr> <th></th><th><i>Remedy</i></th><th><i>Immunity</i></th></tr> <tr> <td>(a)</td><td>Inactivated proteins</td><td>Active</td></tr> <tr> <td>(b)</td><td>Proteins of the venom</td><td>Passive</td></tr> <tr> <td>(c)</td><td>Preformed antibodies</td><td>Passive</td></tr> <tr> <td>(d)</td><td>Dead micro-organisms</td><td>Active</td></tr> </table>		<i>Remedy</i>	<i>Immunity</i>	(a)	Inactivated proteins	Active	(b)	Proteins of the venom	Passive	(c)	Preformed antibodies	Passive	(d)	Dead micro-organisms	Active	1
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6.	Interferons are most effective in making non-infected cells resistant against the spread of which of the following diseases in humans? (a) ascariasis (b) ringworm (c) amoebiasis (d) AIDS	1															
7.	Which of the following water samples in the table given below, will have a higher concentration of organic matter? <table> <tr> <th><i>Water Sample</i></th><th><i>Level of pollution</i></th><th><i>Value of BOD</i></th></tr> <tr> <td>(a)</td><td>High</td><td>High</td></tr> <tr> <td>(b)</td><td>Low</td><td>Low</td></tr> <tr> <td>(c)</td><td>Low</td><td>High</td></tr> <tr> <td>(d)</td><td>High</td><td>Low</td></tr> </table>	<i>Water Sample</i>	<i>Level of pollution</i>	<i>Value of BOD</i>	(a)	High	High	(b)	Low	Low	(c)	Low	High	(d)	High	Low	1
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(a)	High	High															
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(c)	Low	High															
(d)	High	Low															

8. The figure below shows the structure of a plasmid.

1



A foreign DNA was ligated at BamH1. The transformants were then grown in a medium containing antibiotics tetracycline and ampicillin. Choose the correct observation for the growth of bacterial colonies from the given table

	<i>Medium with Tetracycline</i>	<i>Medium with Ampicillin</i>
(a)	Growth	No growth
(b)	No growth	Growth
(c)	No growth	No Growth
(d)	Growth	Growth

9. Swathi was growing a bacterial colony in a culture flask under ideal laboratory conditions where the resources are replenished. Which of the following equations will represent the growth in this case?

1

(Where population size is N , birth rate is b , death rate is d , unit time period is t , and carrying capacity is K).

- (a) $dN/dt = KN$
- (b) $dN/dt = r N$
- (c) $dN/dt = r N(K-N/K)$
- (d) $dN/dt = r N(K+N/K)$

10. Sea Anemone gets attached to the surface of the hermit crab. The kind of population interaction exhibited in this case is

1

- (a) amensalism.
- (b) commensalism.
- (c) mutualism.
- (d) parasitism.

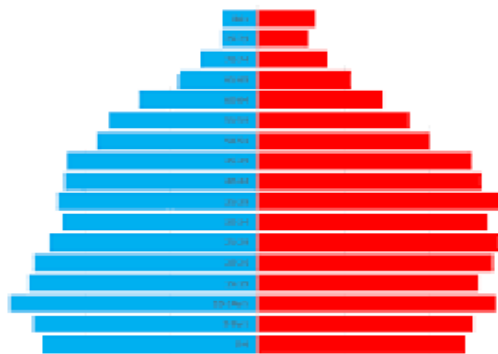
11.	Which of the following food chains is the major conduit for energy flow in terrestrial and aquatic ecosystems respectively? <table><thead><tr><th></th><th><i>Terrestrial Ecosystem</i></th><th><i>Aquatic Ecosystem</i></th></tr></thead><tbody><tr><td>(a)</td><td>Grazing</td><td>Grazing</td></tr><tr><td>(b)</td><td>Detritus</td><td>Detritus</td></tr><tr><td>(c)</td><td>Detritus</td><td>Grazing</td></tr><tr><td>(d)</td><td>Grazing</td><td>Detritus</td></tr></tbody></table>		<i>Terrestrial Ecosystem</i>	<i>Aquatic Ecosystem</i>	(a)	Grazing	Grazing	(b)	Detritus	Detritus	(c)	Detritus	Grazing	(d)	Grazing	Detritus	1
	<i>Terrestrial Ecosystem</i>	<i>Aquatic Ecosystem</i>															
(a)	Grazing	Grazing															
(b)	Detritus	Detritus															
(c)	Detritus	Grazing															
(d)	Grazing	Detritus															
12	Which of the following is an example of ex situ conservation? (a) Sacred Groves (b) National Park (c) Biosphere Reserve (d) Seed Bank	1															

Question No. 13 to 16 consist 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 and 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: Apomictic embryos are genetically identical to the parent plant. Reason: Apomixis is the production of seeds without fertilization.	1
14.	Assertion: When white eyed, yellow bodied <i>Drosophila</i> females were hybridized with red eyed, brown-bodied males; and F1 progeny was intercrossed, F2 ratio deviated from 9 : 3 : 3 : 1. Reason: When two genes in a dihybrid are on the same chromosome, the proportion of parental gene combinations is much higher than the non-parental type.	1
15.	Assertion: Functional ADA cDNA genes must be inserted in the lymphocytes at the early embryonic stage. Reason: Cells in the embryonic stage are mortal, differentiated and easy to manipulate.	1
16.	Given below is the Age Pyramid of population in one of the states in India as per 2011 census. It depicts the male population on the left hand side, female population on the right hand side, newborns towards the base and gradually increasing age groups as we move from base to the top, with the oldest population at the top. Study	1

this pyramid and comment upon the appropriateness of the Assertion and the Reason.



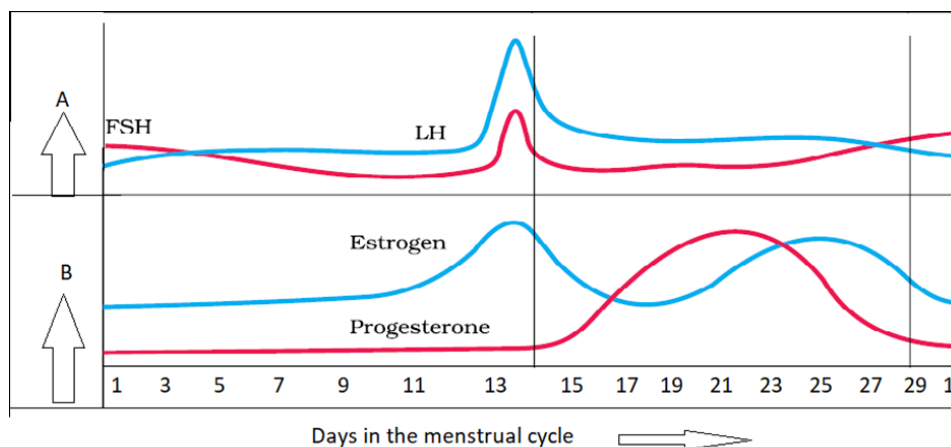
Assertion: It is a stable population.

Reason: The pre-reproductive and reproductive individuals are almost in equal numbers and the post-reproductive individuals are relatively fewer.

SECTION - B

17. In the figure given below, parts A and B show the level of hormones which influence the menstrual cycle. Study the figure and answer the questions that follow:

2



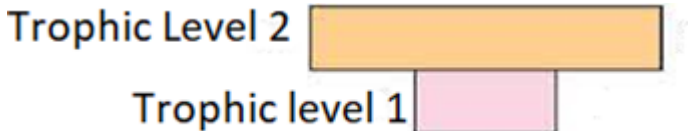
- (a) Name the organs which secrete the hormones represented in parts A and B.
 (b) State the impact of the hormones in part B on the uterus of the human female during 6 to 15 days of menstrual cycle?

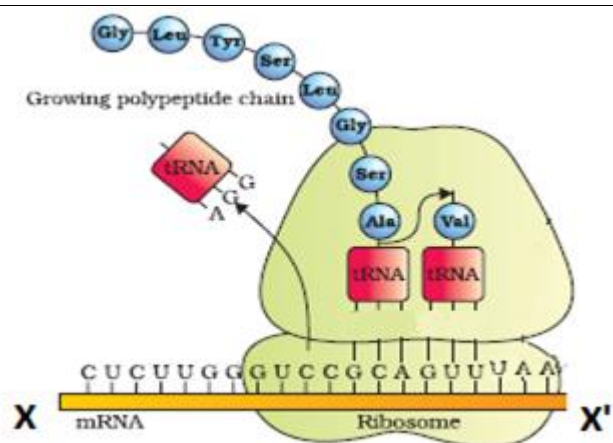
18. A true breeding pea plant, homozygous dominant for inflated green pods is crossed with another pea plant with constricted yellow pods (ffgg). With the help of Punnett square show the above cross and mention the results obtained phenotypically and genotypically in F₁ generation?

2

19. During a field trip, one of your friend in the group suddenly became unwell, she started sneezing and had trouble in breathing.
 Name and explain the term associated with such sudden responses. What would the doctor recommend for relief?

2

20	CTTAAG GAATTC (a) What are such sequences called? Name the enzyme used that recognizes such nucleotide sequences. (b) What is their significance in biotechnology?	2
21	(a) Given below is a pyramid of biomass in an ecosystem where each bar represents the standing crop available in the trophic level. With the help of an example explain the conditions where this kind of pyramid is possible in nature?  (b) Will the pyramid of energy be also of the same shape in this situation? Give reason for your response. OR (a) Draw a pyramid of numbers where a large number of insects are feeding on the leaves of a tree. What is the shape of this pyramid? (b) Will the pyramid of energy be also of the same shape in this situation? Give reason for your response.	2
SECTION - C		
22	Explain the functions of the following structures in the human male reproductive system. (a) Scrotum (b) Leydig cells (c) Male accessory glands	3
23	State the agent(s) which helps in pollinating in the following plants. Explain the adaptations in these plants to ensure pollination: (a) Corn (b) Water hyacinth (c) Vallisneria	3
24	(a) Identify the polarity of x to x' in the diagram below and mention how many more amino acids are expected to be added to this polypeptide chain.	3



- (b) Mention the codon and anticodon for alanine.
- (c) Why are some untranslated sequences of bases seen in mRNA coding for a polypeptide? Where exactly are they present on mRNA?

- 25 (a) How is Hardy-Weinberg's expression " $(p^2 + 2pq + q^2) = 1$ " derived?
(b) List any two factors that can disturb the genetic equilibrium.

3

- 26 Highlight the structural importance of an antibody molecule with a diagram. Name the four types of antibodies found to give a humoral immune response, mentioning the functions of two of them you have studied.

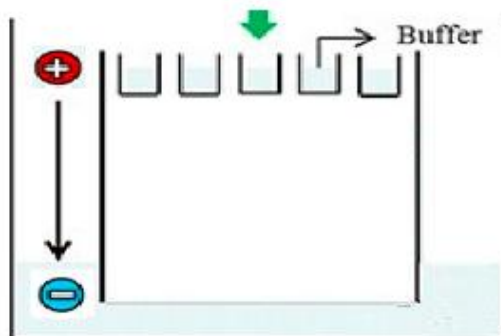
3

OR

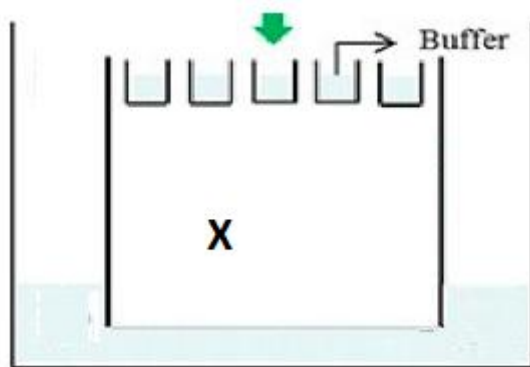
- (a) Explain the Life cycle of *Plasmodium* starting from its entry in the body of female *Anopheles* till the completion of its life cycle in humans.
- (b) Explain the cause of periodic recurrence of chill and high fever during malarial attack in humans.

- 27 Carefully observe the given picture. A mixture of DNA with fragments ranging from 200 base pairs to 2500 base pairs was electrophoresed on agarose gel with the following arrangement.

3



- (a) What result will be obtained on staining with ethidium bromide? Explain with reason.
- (b) The above set-up was modified and a band with 250 base pairs was obtained at X.



What change(s) were made to the previous design to obtain a band at X? Why did the band appear at the position X?

- 28 (a) There was loss of biodiversity in an ecosystem due to a new construction project in that area. What would be its impact on the ecosystem? State any three.
- (b) List any three major causes of loss of biodiversity?

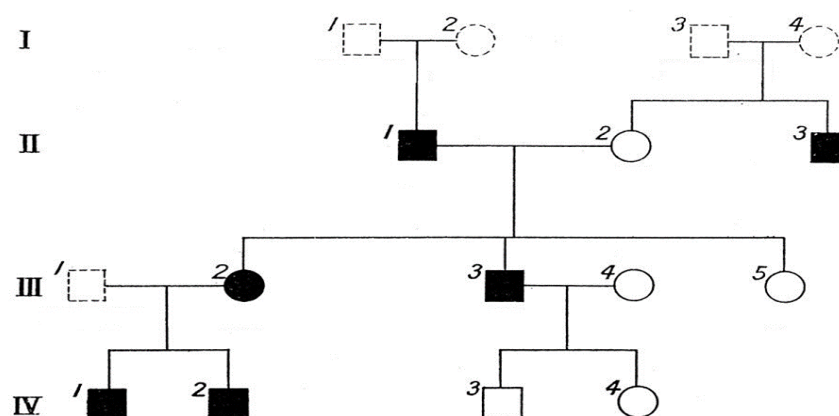
3

SECTION - D

Q.no 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.

- 29 Study the Pedigree chart given below and answer the questions that follow:

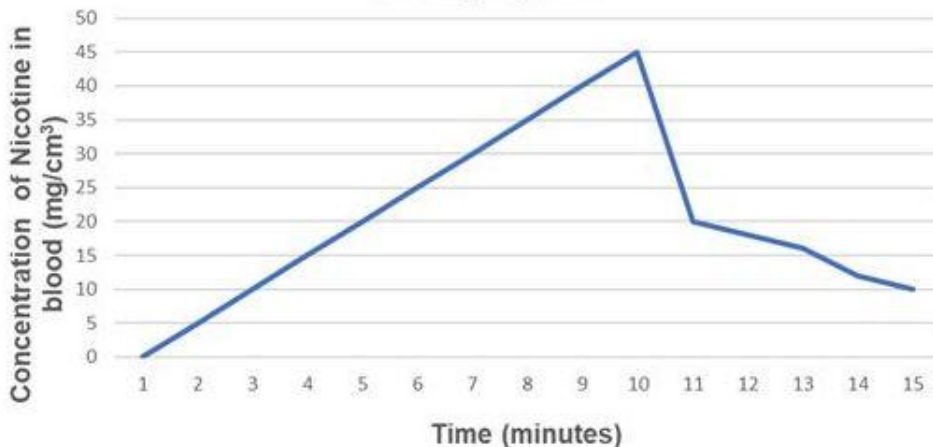
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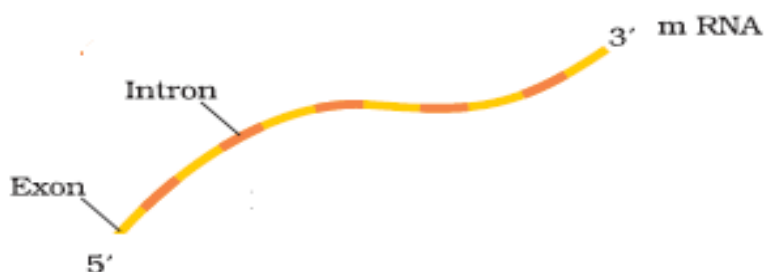


Symbols used in the given Pedigree Chart are as follows:

Carrier male,
 - Affected male,
 - Normal male
 - Carrier female,
 - Affected Female,
 - Normal female

- (a) On the basis of the inheritance pattern exhibited in this pedigree chart, what conclusion can you draw about the pattern of inheritance?
- (b) If the female is homozygous for the affected trait in this pedigree chart, then what percentage of her sons will be affected ?

	(c) Give the genotype of offsprings 1,2,3 and 4 in III generation. OR (c) In this type of inheritance pattern, out of male and female children which one has less probability of receiving the trait from the parents. Give a reason.	
30.	The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/ minute. Smoking Cigarette  Time (minutes) (a) With reference to the above graph explain the concentration of nicotine in blood at 10 minutes. (b) How will this affect the concentration of carbon monoxide and haemoglobin oxygen at 10 minutes? (c) How does cigarette smoking result in high blood pressure and increase in heart rate? OR (c) How does cigarette smoking result in lung cancer and emphysema?	4
SECTION - E		
31	Trace the events from copulation to zygote formation in a human female. OR Trace the development of a megaspore mother cell to the formation of mature embryo sac in a flowering plant.	5
32.	Observe the segment of mRNA given below.	5



- Explain and illustrate the steps involved to make fully processed hnRNA?
- Gene encoding RNA Polymerase I and III have been affected by mutation in a cell. Explain its impact on the synthesis of polypeptide, stating reasons.

OR

Study the schematic representation of the genes involved in the lac operon given below and answer the questions that follow:



- The active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, how will it affect the lac operon?
- The protein produced by the *i* gene has become abnormal due to unknown reasons. Explain its impact on lactose metabolism stating the reason.
- If the nutrient medium for the bacteria contains only galactose; will operon be expressed? Justify your answer.

33. Oil spill is a major environmental issue. It has been found that different strains of *Pseudomonas* bacteria have genes to break down the four major groups of hydrocarbons in oil. Trials are underway to use different biotechnological tools to incorporate these genes and create a genetically engineered strain of *Pseudomonas* - a 'super-bug', to break down the four major groups of hydrocarbons in oil. Such bacteria might be sprayed onto surfaces polluted with oil to clean thin films of oil.

5

- List two advantages of using bacteria for such biotechnological studies?
- For amplification of the gene of interest PCR was carried out. The PCR was run with the help of polymerase which was functional only at a very low temperature. How will this impact the efficiency of the PCR? Justify.
- If such bacteria are sprayed on water bodies with oil spills, how will this have a positive or negative effect on the environment? Discuss.

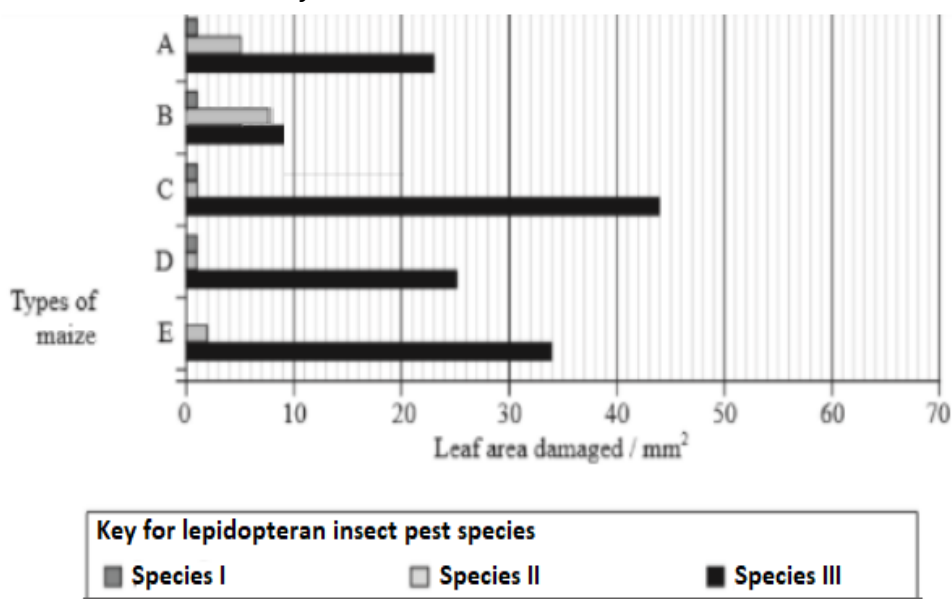
OR

Insects in the Lepidopteran group lay eggs on maize crops. The larvae on hatching feed on maize leaf and tender cob. In order to arrest the spread of three such Lepidopteran pests, Bt maize crops were introduced in an experimental field. A study was carried out to see which of the three species of lepidopteran pests was

most susceptible to Bt genes and its product.

The lepidopteran pests were allowed to feed on the same Bt-maize crops grown on 5 fields (A-E).

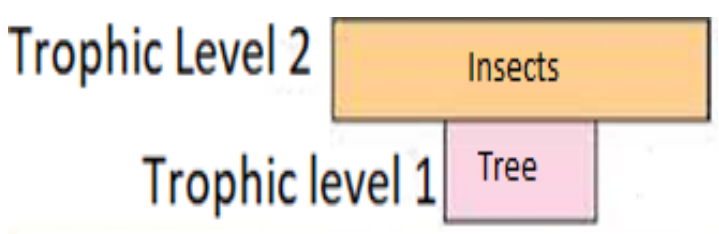
The graph below shows the leaf area damaged by these three pests after feeding on maize leaves for five days.



Insect gut pH was recorded as 10, 8 and 6 respectively for Species I, II and III respectively.

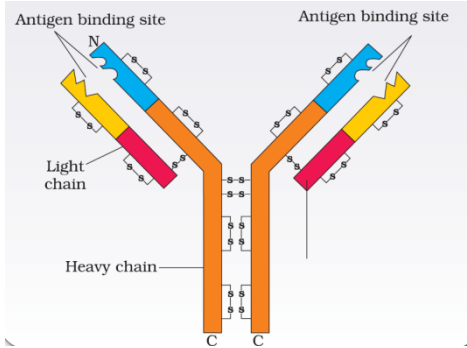
- Evaluate the efficacy of the Bt crop on the feeding habits of the three species of stem borer and suggest which species is least susceptible to Bt toxin.
- Which species is most susceptible to Bt-maize, explain why?
- Using the given information, suggest why similar effect was not seen in the three insect species?

	MARKING SCHEME (2022-23) CLASS XII BIOLOGY (044)	
Q.No.	Question	Marks
SECTION - A		
1	(b) Zygote or early embryo upto 8 blastomeres	1
2	(c) a) - iii, b) - iv, c) - ii, d) - i	1
3	(a) Lysine and Arginine	1
4	(a) common set of characters in groups of different ancestry	1
5	(c) Preformed Antibodies, Passive	1
6	(d) AIDS	1
7	(a) High , High	1
8	(b) No growth, growth	1
9	(b) $dN/dt = r N$	1
10	(b) commensalism	1
11	(c) Detritus; Grazing food chain respectively	1
12	(d) Seed Bank	1
	Question No. 13 to 16 consist 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 and 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	(a) Both A and R are true and R is the correct explanation of A	1
14	(a) Both A and R are true and R is the correct explanation of A	1
15	(c) A is true but R is false	1
16	(a) Both A and R are true and R is the correct explanation of A	1
SECTION – B		
17	(a) A –Pituitary gland; B: Ovary($\frac{1}{2} \times 2 = 1$ Mark) (b) Endometrium of the uterus regenerates through proliferation. (1 Mark)	2

18	Parents (Inflated, green pods) × (Constricted, yellow pods) Genotypes FFGG ffgg Gametes FG fg F₁ generation FfGg (All Inflated green pods) Making the correct punnett square (1 mark) Phenotype - All Inflated green pods (½ mark) Genotype –FfGg (½ mark)	2
19	(a) Allergy, the exaggerated response of the immune response to certain antigens present in the environment is called allergy. (1 Mark) (b) Doctors would administer drugs like antihistamines, adrenaline and steroids (any one) to reduce the symptoms. (1 Mark)	2
20	(a) Palindromic sequences (0.5), endonuclease enzyme (½ Mark) (b) Restriction enzymes can make complementary cut counterparts forming sticky ends for recombination DNA / RDNA technology/ to facilitate ligation of vector and foreign DNA.(1 Mark)	2
21	(a) Inverted pyramids of biomass are seen in aquatic conditions where a small standing crop of phytoplankton supports a large standing crop of zooplankton/fish/In terrestrial ecosystem where a large number of insects are feeding on the leaves of a tree. (1 Mark) (b) No, the Pyramid of energy is always upright, and can never be inverted because when energy flows from one trophic level to the next trophic level some amount of energy is always lost as heat at each step. (1 Mark) OR  (a) Inverted pyramid because a large number of insects feed on one tree. (b) No, the Pyramid of energy is always upright, and can never be inverted because when energy flows from one trophic level to the next trophic level some amount of energy is always lost as heat at each step. (1 x 2 = 2 marks)	2

SECTION – C

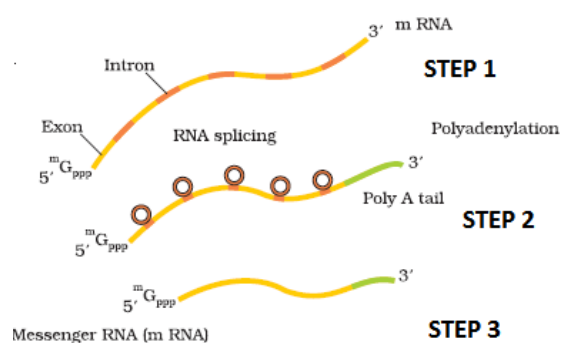
22	(a) Scrotum: The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2–2.5 degree celsius lower than the normal internal body temperature) necessary for spermatogenesis. (b) Leydig cells: The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Leydig cells synthesize and secrete testicular hormones called androgens. (c) Male accessory glands: The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of the penis. (1 x 3 = 3 marks)	3
23	(a) Corn: Wind. Numerous flowers are packed in an inflorescence; the tassels seen in the corn cob are the stigma and style which wave in the wind to trap pollen grains. (b) Water hyacinth: Insects or wind. In water hyacinth the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plants. (c) Vallisneria: Water, In Vallisneria - the female flower reaches the surface of water by the long stalk and the male flowers or pollen grains are released onto the surface of water. They are carried passively by water currents; some of them eventually reach the female flowers and the stigma. ($\frac{1}{2} \times 6 = 3$ Marks)	3
24	(a) x to x' is 5' ————— > 3' ($\frac{1}{2}$ Mark) No more amino acids will be added ($\frac{1}{2}$ Mark) (b) GCA ($\frac{1}{2}$ Mark) Anticodon is CGU ($\frac{1}{2}$ Mark) (c) The untranslated regions are required for an efficient translation process. ($\frac{1}{2}$ Mark) They are present before the initiation codon at the 5' – end and after the stop/termination codon, at the 3' – end ($\frac{1}{2}$ Mark)	3
25	(a) Sum Total of All the Allele Frequencies is 1: Let there be two alleles A and a in a population. The frequencies of alleles A and a are 'p' and 'q' respectively. ($\frac{1}{2}$ Mark) The frequency of AA individuals in a population is p^2 and it can be explained that the probability that an allele A with a frequency of p would appear on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e., p^2. Similarly, the frequency of aa is q^2 and that of Aa is $2pq$. ($\frac{1}{2}$ Mark)	3

	$p^2 + 2pq + q^2 = 1$, where p^2 represents the frequency of homozygous dominant genotype, $2pq$ represents the frequency of the heterozygous genotype and q^2 represents the frequency of the homozygous recessive. (1 Mark) (b) Factors that affect Hardy–Weinberg equilibrium: (i) Gene migration or gene flow (ii) Genetic drift (iii) Mutation (iv) Genetic recombination (v) Natural Selection (Any 2) ($\frac{1}{2} + \frac{1}{2} = 1$ mark)	
26	An antibody molecule consists of four polypeptide chains, two are long called heavy (H) chains while other two are short called light (L) chains. Both are arranged in the shape of Y. Hence, the antibody is represented as $H_2 L_2$.  (Diagram with Labels – Light chain ($\frac{1}{2}$ mark), Heavy Chain ($\frac{1}{2}$ Mark) Types of Antibody – IgA, IgM, IgE, IgG (1 mark awarded when all 4 types are stated) IgA – Lactating Mother to protect their infant ($\frac{1}{2}$ Mark) Ig E – To protect from allergen ($\frac{1}{2}$ Mark) OR (a) When a female <i>Anopheles</i> mosquito bites an infected person, the parasites enter the mosquito's body as gametocytes ($\frac{1}{2}$ mark). It leads to fertilization and development in the gut ($\frac{1}{2}$ Mark) of the mosquito and undergoes further development to form sporozoites that are stored in salivary glands ($\frac{1}{2}$ Mark) until their transfer to human body. In the human body – the sporozoites reach the liver and reproduce asexually ($\frac{1}{2}$ Mark), bursting the cells and releasing them into the RBCs as gametocytes ($\frac{1}{2}$ Mark). <i>(Labeled diagram explaining the mentioned stages can also be considered)</i>	3

	(b) The rupture of RBCs releases a toxic substance called haemozoin , (1/2 Mark) which is responsible for the chill and high fever.	
27	(a) No bands will be obtained as/All DNA will be seen in the well only; (½ Mark) DNA fragments being negatively charged will not move towards -ive end/ cathode. DNA being negatively charged will remain stationed at the positive end/ anodeend of the agar block; (1 Mark) (b) (a) Position of the positive terminal/ end/ anode and the negative terminal/ end/ cathode was inter-changed (½ Mark) (ii) The fragment with least base pairs will get separated faster and move faster to the anode end. (1 Mark)	3
28	Impacts of loss of biodiversity on the ecosystem: (a) (i) Decline in plant production (ii) Lowered resistance to environmental perturbations such as drought (iii) Increased variability in certain ecosystems – processes such as plant productivity, water use, pest and disease cycles. (½ x 3 = 1 ½ marks) (b) (i) Habitat loss and fragmentation (ii) Over-exploitation (iii) Alien invasive species (iv) Co-extinctions. (Any three - ½ x 3 = 1½)	3
SECTION –D		
29	(a) X- linked (½ Mark), Recessive trait (½ Mark) (b) 100% (1 Mark) (c) XY OR <u>XY</u>, 2. <u>XX</u>, 3. <u>XY</u>, 4. XX (½ x 4 =2 Marks) OR The possibility of the female getting the trait is less. (1 Mark) The female will get the trait only if the mother is at least a carrier and the father is affected. (1 Mark)	4
30	(a) Concentration of nicotine is maximum at 10 minutes/ conc. of nicotine increases steadily in the blood to reach 45mg/cm³ (1 Mark) (b) The Concentration of CO will increase resulting in reduced	4

	concentration of haemboundoxygen.(1 Mark) (c) Nicotine results in stimulating the adrenal gland which results in release of adrenaline / nor - adrenaline in the blood resulting in increase of blood pressure and heart rate. (2 Marks) OR (c) Chemical carcinogens present in tobacco smoke are the major cause of lung cancer.(1 Mark) The cigarette smoke irritates the air passages of the lungs causing them to produce mucus which causes cough resulting in enlarging air spaces/ reduce surface area/lose their elasticity (any point can be mentioned) thus difficulty in breathing causing emphysema. (1 Mark)	
SECTION –E		
31.	i) During copulation (coitus) semen is released by the penis into the vagina (insemination). ii) The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube. iii) The ovum released by the ovary is also transported to the ampullary region where fertilization takes place. iv) Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region. This is the reason why not all copulations lead to fertilisation and pregnancy. v) The process of fusion of a sperm with an ovum is called fertilisation. vi) During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum. vii) The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. viii) This induces the completion of the meiotic division of the secondary oocyte. ix) The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid). x) Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote. ($\frac{1}{2} \times 10 = 5$) OR	5

	Trace the development of a megaspore mother cell to the formation of mature embryo sac in a flowering plant. The process of formation of megaspores from the megaspore mother cell is called megasporogenesis. - Ovules generally differentiate a single megaspore mother cell (MMC) in the micropylar region of the nucellus. It is a large cell containing dense cytoplasm and a prominent nucleus. The MMC undergoes meiotic division to form megaspores. - In a majority of flowering plants, one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac). This method of embryo sac formation from a single megaspore is termed monosporic development. - The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. - Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. - These mitotic divisions are strictly free nuclear, that is, nuclear divisions are not followed immediately by cell wall formation. - After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. - Six of the eight nuclei are surrounded by cell walls and organised into cells; the remaining two nuclei, called polar nuclei are situated in the large central cell. - Three cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell. The synergids have special cellular thickenings at the micropylar tip called filiform apparatus. - Three cells are at the chalazal end and are called the antipodals. - The large central cell, as mentioned earlier, has two polar nuclei. Which come to lie below egg apparatus. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled. ($\frac{1}{2} \times 10 = 5$)	
32	(a) The hnRNA undergoes processes called capping and tailing followed by splicing. In capping, an unusual nucleotide is added to the 5'-end of hnRNA methyl guanosine triphosphate. In tailing, adenylate residues (about 200–300) are added at 3'-end in a template independent manner. Now the hnRNA undergoes a process where the introns are removed and exons are joined to form mRNA called splicing. ($\frac{1}{2} \times 6 = 3$ marks)	5



- (b) The process of translation will not happen, thus the polypeptide synthesis is stopped/ hampered. (1 Mark)
- The reason for the above is:
- RNA polymerase I transcribes rRNAs which is the cellular factory for protein synthesis. (½ Mark)
- RNA polymerase III helps in transcription of tRNA which is the adaptor molecule/ that transfers amino acids to the site of protein synthesis. (½ Mark)

OR

- (a) When the active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, the lactose is not transported into the cell (1 Mark). As lactose is the inducer, the lac operon will not be switched on. (1Mark)
- (b) Since the repressor protein synthesized by the i gene is abnormal, it will not bind to the operator region of the operon (1 Mark), resulting in a continuous state of transcription process (1 Mark)
- (c) No (½ Mark), because galactose is not an inducer/ it is a product of lactose metabolism (½ Mark)

33.

- (a) You can easily grow a large quantity of the bacteria/no ethical issues/have plasmids/ can easily transform (any 1)
- (b) PCR will not amplify the gene. (½ Mark)
- If the polymerase enzyme denatures at low temp, it will not be able to withstand **high temperature which is essential for separating/opening/unwinding/ denaturing DNA** strand to open. Thus subsequent step of **extending the primers using the nucleotides provided in the reaction and the genomic DNA as template will not occur.**(1½ Marks)
- (c) Positive effect: oil spills can be treated and the environment becomes better/ cleaner/ water becomes more potable/ safe for aquatic forms/ safe for water birds like sea gulls. (any one 1)

5

Negative effect: the bacteria can mutate/ can harm other organisms/ can conjugate with other non-virulent forms and make them super bugs with detrimental effect/ unpredictable/ for a longer duration it may reduce the dissolved oxygen and leading to mortality of aquatic organisms (any one 1)

OR

- (a) Species III is least susceptible (1 Mark)
- (b) Bt toxin **protoxins are converted into an active form in the gut** which solubilises the toxin crystals.
The **activated toxin binds to the surface of midgut epithelial cells** and **create pores** that **cause cell swelling and lysis** and eventually cause death of the insect (2 Marks)
- (c) Insect **species I and II have alkaline gut pH** which **solubilises the insecticidal protein crystals of protoxin and makes it active**.
Species **III has an acidic** and the **protoxin continues to remain in an inactive form** doing no harm to insect species III (2 Marks)