

Class: XII
SESSION : 2022-2023
SUBJECT: BIOLOGY (044)
SAMPLE QUESTION PAPER - 3
with SOLUTION

Maximum Marks: 70

Time: 3 hours

General Instructions:

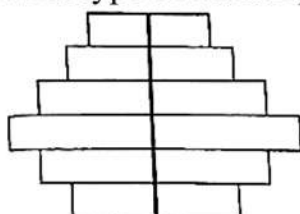
- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions. All questions are compulsory.
- (iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions 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

1. The main source of bio-fertilizers are: [1]

- | | |
|---------------------------------------|-----------------------|
| a) Bacteria, fungi, and cyanobacteria | b) Only cyanobacteria |
| c) Only fungi | d) Only bacteria |

2. What type of human population is represented by the following pyramid? [1]



- | | |
|-------------------------|-------------------------|
| a) Expanding population | b) Stable population |
| c) Declining population | d) Vanishing population |
3. Select the correct group of biocontrol agents. [1]

- | | |
|-----------------------------------------------------------------|--------------------------------------------------------------------|
| a) <i>Bacillus thuringiensis</i> , Tobacco mosaic virus, Aphids | b) <i>Trichoderma</i> , Baculovirus, <i>Bacillus thuringiensis</i> |
| c) <i>Oscillatoria</i> , <i>Rhizobium</i> , <i>Trichoderma</i> | d) <i>Nostoc</i> , <i>Azospirillum</i> , Nucleopolyhedrovirus |

4. Flowers which have single ovule in the ovary and are packed into inflorescence are usually pollinated by: [1]

- | | |
|----------|---------|
| a) Water | b) Bee |
| c) Bat | d) Wind |

5. Pollen grains can be stored for several years in liquid nitrogen having a temperature of: [1]
a) -196°C b) -120°C
c) -160°C d) -80°C
6. A heterogamous tall plant produces tall and dwarf plants after selfing. This conforms the Mendel's law called as: [1]
a) Law of dominance b) Law of purity of gametes
c) Law of segregation d) Law of independent assortment
7. Signals for parturition originate from: [1]
a) Fully developed foetus only b) Placenta only
c) Both placenta as well as fully developed foetus d) Oxytocin released from maternal pituitary
8. The entomophilous flower is pollinated by _____. [1]
a) Birds b) Wind
c) Bats d) Insects
9. Rice is important food grains grown in India for thousands of years. Estimated varieties of rice present in India are: [1]
a) 500,000 b) 100,000
c) 200,000 d) 300,000
10. The super helix relaxing protein has been also called as: [1]
a) Both SSB and ω b) ω
c) None of these d) SSB
11. The successive nucleotides of RNA are covalently linked through: [1]
a) None of these b) Hydrogen bonds
c) Glycosidic bonds d) Phosphodiester bonds
12. **Assertion (A):** A father may be a haemophilic only if his mother is a carrier. [1]
Reason (R): The father cannot pass on a sex-linked gene to his son.
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. A patient brought to a hospital with myocardial infection is normally immediately [1]

given:

a) Penicillin

b) Cyclosporine-A

c) Streptokinase

d) Statins

14. **Assertion (A):** Core enzyme catalyses chain elongation of RNA. [1]

Reason (R): The presence of sigma factor is required for initiation of transcription.

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.

15. **Assertion (A):** Artificial selection is based on the desire of human. [1]

Reason (R): The improvement of domesticated plants and animals is possible through artificial selection.

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.

16. **Assertion (A):** Mucous membrane immobilises the micro-organisms in the body. [1]

Reason (R): Microorganisms and dust particles entering the respiratory tract are trapped in the mucus.

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.

Section B

17. Name any two new programmes which are essential to provide efficient care and assistance to people/child. [2]

18. A plasmid DNA and a linear DNA (both are of the same size) have one site for a restriction endonuclease. When cut and separated on agarose gel electrophoresis, plasmid shows one DNA band while linear DNA shows two fragments. Explain. [2]

19. What is the function of Leydig cells? [2]

20. How is Cuscuta adapted to be a parasitic plant? [2]

OR

Draw a growth curve where resources are not limiting to growth of a population.

21. Kavita's parents suffer from high blood pressure and are obese. Kavita is also worried about her health. Do you think kavita can inherit these characteristic from parent. Suggest two measures kavita can adopt to avoid high blood pressure and obesity. [2]

Section C

22. Draw the different stages of the development of Graafian follicle diagrammatically. [3]
23. Describe critically the main ideas behind the biological control of pests and diseases. [3]
24. A man with blood group A married a woman with blood group B. They have a son with AB blood group and a daughter with blood group O. Work out the cross and show the possibility of such inheritance. [3]
25. Write the mode of pollination in Vallisneria and water lily. Explain the mechanism of pollination in Vallisneria. [3]

OR

In a developing embryo, analyse the consequences if cell divisions are not followed by cell differentiation.



26. Explain rivet popper hypothesis. Name the ecologist who proposed it. [3]
27. In a food chain, a trophic level represents a functional level, not a species. Explain. [3]
28. Name and explain the surgical method advised to human males and females as a mean of birth control. Mention its one advantage and one disadvantage. [3]

Section D

29. Read the text carefully and answer the questions: [4]

GM is a technology that involves inserting DNA into the genome of an organism. To produce a GM plant, new DNA is transferred into plant cells. Usually, the cells are then grown in tissue culture where they develop into plants. The seeds produced by these plants will inherit the new DNA.

Given below is a table depicting the different genetically engineered plants and the organism used.

Genetically engineered plants	Organism used
	(a) _____
	(b) _____

- (i) Name the organisms used in (a) and (b).
- (ii) Write the name of plants (a) and (b).

(iii) Which organisms infect the plants?

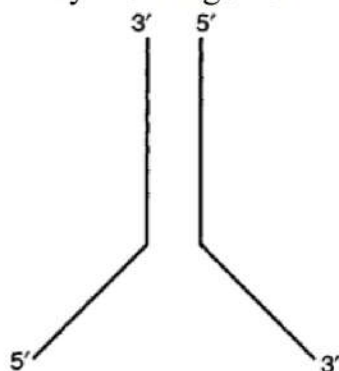
OR

How do these plants are genetically engineered?

30. **Read the text carefully and answer the questions:**

[4]

Study the image below:



- (i) Identify the structure shown above.
- (ii) Redraw the structure as a replicating fork and label the parts.
- (iii) Write the source of energy for this replication and list the enzymes involved in this process.

OR

Mention the difference in the synthesis based on the polarity of the two template strands.

Section E

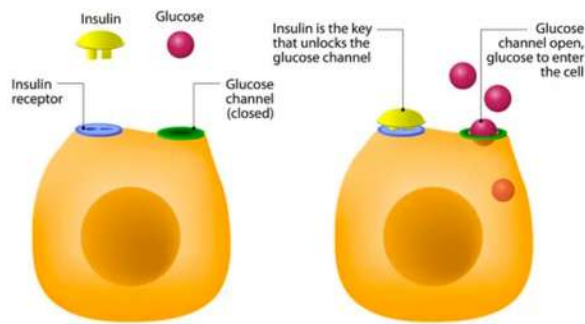
31. Pesticidal crystal proteins (Cry) are endotoxins produced by *Bacillus thuringiensis*, and form crystal structures (thus the name "cry" proteins, short for crystal). Cry toxins have specific activities against insect species of the orders Lepidoptera (moths and butterflies), Diptera (flies and mosquitoes), Coleoptera (beetles), Hymenoptera (wasps, bees, ants and sawflies) and nematodes. When insects ingest toxin crystals, the alkaline pH of their digestive tract denatures the insoluble crystals, making them soluble and thus amenable to being cut with proteases found in the insect gut, which liberate the cry toxin from the crystal. The Cry toxin is then inserted into the insect gut cell membrane, paralyzing the digestive tract and forming a pore. The insect stops eating and starves to death; live Bt bacteria may also colonize the insect which can contribute to death. **[5]**

- i. Give the scientific name of the soil bacterium which produces crystal (Cry) proteins.
- ii. How are these proteins useful in agriculture?
- iii. What do the different written terms **Cry** and **cry** represent respectively?

OR

Insulin is a hormone created by your pancreas that controls the amount of glucose in your bloodstream at any given moment. It also helps store glucose in your liver, fat, and muscles. Finally, it regulates your body's metabolism of carbohydrates, fats, and proteins. Sound important? That's because it is.

HOW DOES INSULIN WORK?



- i. Name the source from which insulin was extracted earlier. Why is this insulin no more in use by diabetic people?
- ii. Explain the process of synthesis of insulin by Eli Lilly company. Name the technique used by the company.
- iii. How is the insulin produced by human body different from the insulin produced by the above-mentioned company?

32. In the 1950s, there were hardly any mosquitoes in Delhi. The use of pesticide DDT on standing water killed their larvae. It is believed that now there are mosquitoes because they evolved DDT resistance through the interaction of mutation and Natural selection. Point wise, state in a sequence how that could have happened. [5]

OR

How does industrial melanism support Darwin's theory of natural selection explain?

33. a. Differentiate between active and passive immunity. [5]
b. Comment on the role of vaccination and immunization in keeping the human population healthy.

OR

What are vaccines? Describe the different types of vaccines.

SOLUTION

Section A

1. (a) Bacteria, fungi, and cyanobacteria

Explanation: Biofertilizers are organisms that enrich the nutrient quality of the soil. The main sources of biofertilizers are bacteria, fungi, and cyanobacteria (blue-green algae). The most striking relationship that these have with plants is symbiosis, in which the partners derive benefits from each other.

2. (c) Declining population

Explanation: Declining population

3. (b) Trichoderma, Baculovirus, Bacillus thuringiensis

Explanation: Fungus Trichoderma, Baculoviruses(NPV), and Bacillus thuringiensis are used as biocontrol agents. Rhizobium, Nostoc, Azospirillum, and Oscillatoria are used as biofertilizers, whereas TMV is a pathogen and aphids are pests that harm crop plants.

4. (d) Wind

Explanation: Wind pollinated flowers often have a single ovule in each ovary and numerous flowers packed into an inflorescence.

5. (a) -196°C

Explanation: -196°C

6. (c) Law of segregation

Explanation: Law of segregation

7. (c) Both placenta as well as fully developed foetus

Explanation: The signals for parturition originate from the fully developed fetus and the placenta which induce mild uterine contractions called foetal ejection reflex.

8. (d) Insects

Explanation: The transfer of pollen grain from the anther to stigma is called pollination. Pollination is caused by winds, insects, water, and some other means. Insect pollinated flowers are called Entomophilous flowers.

9. (c) 200,000

Explanation: Rice is an important food grain, the presence of which goes back thousands of years in Asia's agricultural history. There are an estimated 200,000 varieties of rice in India alone.

The diversity of rice in India is one of the richest in the world. Basmati rice is distinct for its unique aroma and flavour and 27 documented varieties of Basmati are grown in India. There is a reference to Basmati in ancient texts, folklore, and poetry, as it has been grown for centuries.

10. (c) None of these

Explanation: None of these

11. (d) Phosphodiester bonds

Explanation: Phosphodiester bonds

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

Explanation: Haemophilia is a sex-linked recessive disorder. The heterozygous female (carrier) for haemophilia may transmit the disease to sons. The possibility of a female becoming haemophilic is extremely rare because the mother of such a female has to be at least carrier and the father should be haemophilic (unviable in the later stage of life). As a father cannot pass an X-chromosome to his son, he cannot transmit the disease to his son.

13. (c) Streptokinase

Explanation: Streptokinase

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

Explanation: The core enzyme which catalyses covalent chain extension, consists of two α - polypeptides (each of molecular weight about 41,000), one β - polypeptide (molecular weight about 155,000) one β' -polypeptide (molecular weight about 165,000) and one ω - polypeptide (molecular weight about 12,000). The “holoenzyme” contains in addition, α - polypeptide (molecular weight about 95,000). The presence of the sigma factor is required for initiation at the proper transcription initiation (or promoter) sites. After each RNA chain-initiation event, sigma is released and the core enzyme catalyses chain elongation.

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

Explanation: Man selects the individuals with desired characters and separates them from those which do not have such characters. The selected individuals are interbred. This process is termed as artificial selection. Thus this process of selection is done through the agency of man or it is man made. By artificial selection animal breeders are able to produce improved varieties of different kinds of domestic animals from their wild ancestors. Similarly, the plant breeders have obtained improved varieties of useful plants such as wheat, rice, sugarcane, cotton, pulses, vegetables, fruits etc.

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

Explanation: Innate immunity is a non-specific type of defense, that is accomplished by providing different types of barriers to the entry of foreign agents into our bodies. Mucus coating of the epithelium lining in the respiratory, gastrointestinal, and urogenital tracts traps microbes and prevents their entry into our body.

Section B

17. i. Statutory ban on amniocentesis techniques.

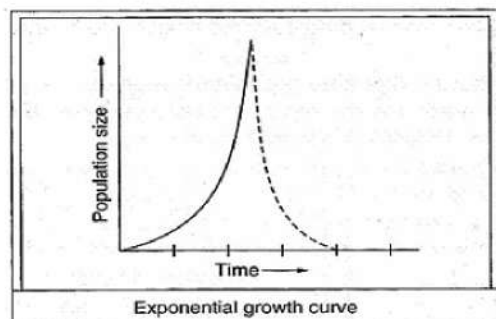
ii. Massive child immunisation.

18. A circular DNA opens up to resemble a single linear DNA. A Linear DNA is divided into two fragments after cleavage. Hence, circular DNA shows one band, while linear DNA shows two bands.

19. Leydig cells are interstitial cells located adjacent to the seminiferous tubules in the testes. The best-established function of Leydig cells is to produce the androgen, testosterone, under the pulsatile control of pituitary luteinizing hormone (LH).

20. Cuscuta produces haustoria to derive nutrition from the host plant. Cuscuta has haustorial or sucking roots which penetrate into the xylem and phloem vessels of the host plant and thus it can derive it's nutrition.

OR



21. 1) No, these are life style related diseases

2) Any two measures- changing in food habits, exercises, leading active life, meditation.

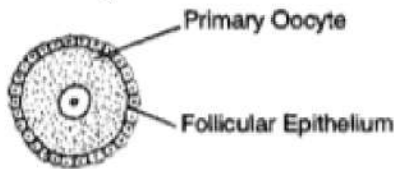
Values

- Awareness about health.
- Understanding.

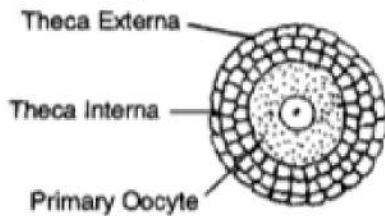
Section C

22. Different stages of development of Graffian follicle are as follows:

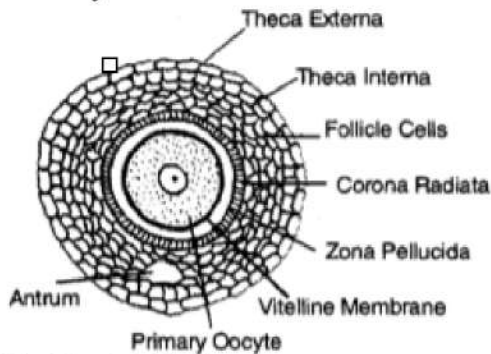
a. Primary Follicle



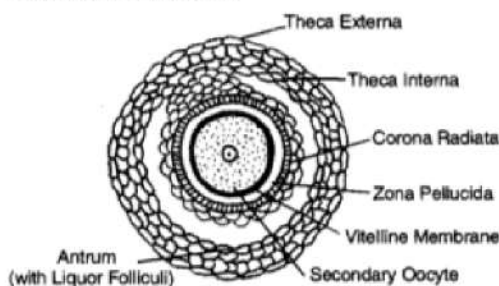
b. Secondary Follicle



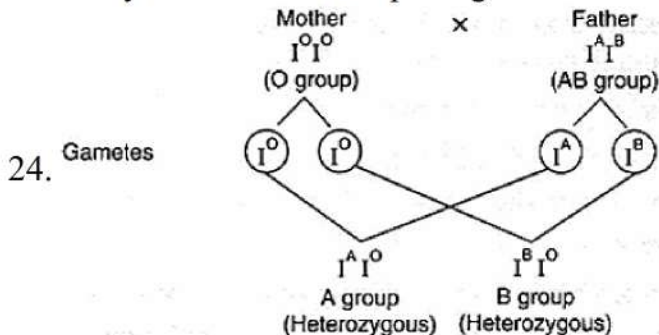
c. Tertiary Follicle



d. Graffan Follicle



23. Biological control means life against life. It is a natural and eco-friendly concept. It employs the natural organisms to control the population of pathogens and pests in an ecosystem. Classical examples are Trichoderma which is antagonist against many soil-borne Plant Pathogens. Similarly, Penicillium inhibits the growth of Staphylococcus and, therefore, has been successfully used in the production of Penicillin antibiotic to control many human bacterial pathogens.



25. Mode of pollination in

a. Vallisneria - hydrophily

b. Water lily - Entomophily

In Vallisneria, a dioecious plant, male flowers abscise from the submerged spadix and rise to the surface of the water. The female flowers are brought to the surface of the water by

uncoiling of their long stalks. They have large sticky trifid stigmas. The male flowers come in contact with the stigma of female flowers. The anther bursts and pollination is brought about. After getting pollinated, the female flowers are pulled back inside water by coiling of the stalk.

OR

Cell divisions increase the number of cells in the developing embryo, while cell differentiation helps a group of cells to undergo certain modifications to form specialised tissues and organs to form an organism.

At many stages of embryogenesis, if cell differentiation does not occur, the embryo cannot develop into a new organism. It will only remain like a mass of cells.

26. Rivet Popper Hypothesis

- i. The hypothesis was proposed by Paul Ehrlich.
 - ii. In an airplane (ecosystem), all parts are joined together using thousands of rivets (species).
 - iii. If every passenger travelling in it, starts popping a rivet to take home (causing a species to become extinct), it may not affect the flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak after some time.
 - iv. Further, which rivet is removed may also be critical loss of rivets on the wings. (Key species that drive major ecosystem function) is obviously a more serious threat to flight safety than the loss of a few rivets on the seats or windows inside the plane.
27. Trophic level- It is a specific position of an organism in the food chain. All organisms occupy a particular place in their natural surrounding or in a community according to their feeding relationship with other organisms.

This specific position is based on the organism's feeding relationship with other organisms the source of their nutrition or food.

Producers occupy the first trophic level, primary consumers (herbivores) occupy the second and the secondary consumers (carnivores) occupy the third level.

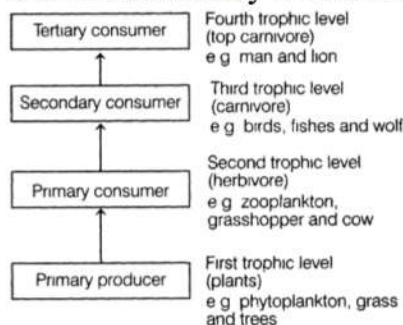


Figure: Diagrammatic view of a typical food chain.

28. The surgical or sterilisation methods advised to human males and females as effective means of birth control are-

- i. **Vasectomy** (In males) - A sterilisation method in which a small portion of vas deferens is removed or tied up through a cut or incision on the scrotum, thus blocking the transport of sperms.
- ii. **Tubectomy** (In females) - A sterilisation method in which small part of Fallopian tube is removed or tied up through incision in the abdomen or through vagina. It blocks the passage of ova.

The **advantages** of these two sterilisation methods in both human males and females are that it is a very effective method for preventing conception as it blocks the transport of gametes.

The **disadvantage** of this method is that this surgical procedure cannot be reversed, so it is



helpful for only those who already have children and do not want to extend their family further.

Section D

29. Read the text carefully and answer the questions:

GM is a technology that involves inserting DNA into the genome of an organism. To produce a GM plant, new DNA is transferred into plant cells. Usually, the cells are then grown in tissue culture where they develop into plants. The seeds produced by these plants will inherit the new DNA.

Given below is a table depicting the different genetically engineered plants and the organism used.

Genetically engineered plants	Organism used
	(a) _____
	(b) _____

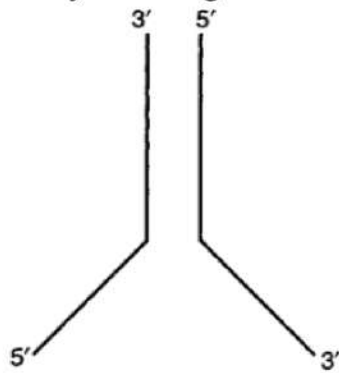
- (i) The organism used to develop (a) is *Bacillus thuringiensis* and (b) is *Agrobacterium*.
- (ii) The name of the plant which is genetically engineered by (a) is Cotton and (b) is Tobacco.
- (iii) To develop the resistant variety of Cotton plant against the infection of Bollworm, Bt-toxin gene has been cloned from the bacteria and been expressed in plants without the need for insecticides.

OR

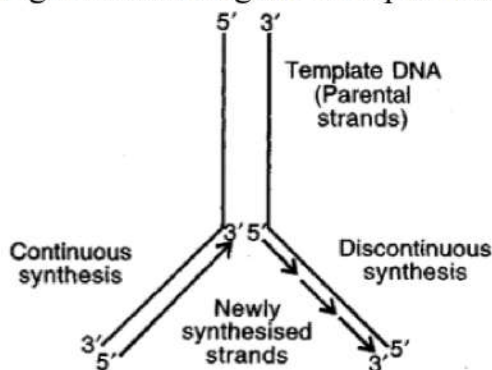
In the case of Tobacco plant, a nematode *Meloidogyne incognita* infects its roots which results in the reduction of yield. To develop a resistant variety, RNA interference (RNAi) technology is used. Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells. These two RNA's being complementary to each other formed a double-stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode.

30. Read the text carefully and answer the questions:

Study the image below:



- (i) The diagram shown is of the replication fork.
(ii) Fig: Labeled diagram of replication fork



- (iii) Activated deoxyribonucleotide triphosphate (dNTPs) act as substrate and also provides energy for polymerisation reaction, similar to ATP.

List of enzymes:

- i. **Helicases:** It unwinds the two strands of DNA.
- ii. **Single-stranded DNA binding proteins:** They bind to the single strands and stabilize them.
- iii. **Topoisomerases:** They release tension in the uncoiled part by nicking and then resealing the straightened DNA strands.
- iv. **RNA polymerase primase:** They are needed for primer synthesis to initiate the replication process.
- v. **DNA polymerase:** It adds the new nucleotides thus replicating the DNA.
(Prokaryotes have three major types of DNA polymerases III, II and I).
- vi. **DNA ligase:** The Okazaki fragments are joined by this enzyme at the end of replication.

OR

On the template strand with 3' → 5' polarity (leading strand), the synthesis of new strand is continuous while on the other template strand with 5' → 3' polarity (lagging strand), the synthesis of new strand is in discontinuous fashion forming **Okazaki fragments**.

Section E

31. i. Soil bacterium - *Bacillus thuringiensis* produces crystal (Cry) proteins.
- ii. This protein acts as a toxin for insects. If gene for 'Cry', protein is incorporated into crop plants they will develop resistant to the insects and pests.
- iii. 'Cry' is used for Cry protein and 'cry' is used to denote gene which encodes for 'Cry' protein.

OR

- i. Insulin was extracted earlier from the pancreas of slaughtered pigs and cattle animals. Insulin obtained from these sources caused some allergy or some other reactions to the foreign protein.
- ii. Steps involved in insulin production by the Eli Lilly company are as follows:
 - a. DNA sequences corresponding to the two polypeptide, A and B-chains of insulin were synthesized in vitro.
 - b. They were introduced into plasmid DNA of E. coli.
 - c. This bacterium was cloned under suitable conditions.
 - d. The transgene was expressed in the form of polypeptides A and B, secreted into the medium.
 - e. They were extracted and combined by creating disulphide bridge to form human insulin.
- iii. Differences between insulin produced by rDNA and insulin produced by pancreas are as follows:

Insulin produced by rDNA	Insulin produced by the pancreas
It has A and B polypeptides.	It has three polypeptides. A, B and C-chains before maturing called the prohormone.
It directly synthesizes the mature hormone.	It undergoes processing to form mature and functional hormone.

32. - When DDT was first used, most of the mosquitoes were sensitive to it and were therefore killed.
- In the original population of mosquitoes, some individuals were resistant to DDT.
 - They did not have any advantage over the DDT sensitive mosquitoes, in the absence of DDT.
 - They survived in the presence of DDT and reproduced the offspring were also mostly DDT resistant.
 - As a result, over a period of time almost the entire population came to consist of the resistant type.

OR

Industrial Melanism is an adaptation, where the moths living in the industrial area developed melanin pigments to match their body to the tree trunk that were covered with black soot. Before industrialization, in Great Britain, it was observed that there were more white winged moths. However, after industrialization the white coloured lichen covered the tree trunks. In that background the white winged moths survived but the dark coloured moths were eaten by predators. During the post industrialization periods the tree trunks became dark due to industrial smoke and soots. Under such conditions, the white winged moths did not survive due to predators and dark winged moths survived. In areas where industrialization did not occur, the count of moths were low. Thus, industrial melanism supports evolution by natural selection.

33. a.

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

- b. Vaccination and immunization keep the human population healthy as it helps in neutralizing the effect of pathogenic agents by producing a massive response against the particular pathogen. They do so because-
- Vaccines 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.

OR

The vaccine is a preparation/suspension or extract of dead/attenuated (weakened) germs of a disease which on inoculation produce antibodies that provide temporary/permanent active/passive immunity to a healthy person.

Types of Vaccines: Vaccines are of following types:

- i. Live Vaccines or Attenuated Vaccines: Live vaccines are prepared from live (generally attenuated-the pathogen is made weakened to make it nonvirulent) organisms. Examples: OPV, (Oral Polio Vaccine), BCG, (Bacillus Calmette Guerin), smallpox, yellow fever vaccine, Influenza vaccine. These vaccines provide active lifelong immunity.
- ii. Killed Vaccines or Inactivated Vaccines: These vaccines are prepared by killing the pathogenic organisms by heat/ultraviolet rays/alcohol/formalin/phenol. Examples: Typhoid vaccine, Salk Polio Vaccine, Typhus Vaccine, Cholera Vaccine, Rabies Vaccine, Plague Vaccine, TAB Vaccine.
- iii. Toxoids: Certain organisms such as Diphtheria and Tetanus bacilli produce toxins. The toxins produced by these organisms are detoxicated and used in the preparation of vaccines. Examples: Diphtheria toxoid and Tetanus Toxoid. These vaccines provide passive immunity for a short period.
- iv. Cellular Fractions: Vaccines in certain instances are prepared from extracted cellular fraction. Examples: Meningococcal vaccine from the polysaccharide antigen of the cell wall, the pneumococcal vaccine from the polysaccharide contained in the capsule of the organism and hepatitis-B polypeptide vaccines.
- v. Combinations: If more than one kind of immunizing agent is included in the vaccine, it is called a mixed or combined vaccine. The following are some of the well known combinations : DPT (Diphtheria + pertussis + tetanus), DT (Diphtheria + tetanus), DP (Diphtheria + pertussis), Tetanus + Influenza, DPT and typhoid Vaccine, MMR (Measles + mumps + rubella), Measles + rubella.