

Solved Question Paper
2017
Class – XII
Subject – Biology
All India

Time allowed: 3 hours

Maximum Marks: 70

General Instructions:

- (i) There are a total of 26 questions and five sections in the question paper. All questions are compulsory.
- (ii) Section A contains questions number 1 to 5, very short-answer type questions of 1 mark each.
- (iii) Section B contains questions number 6 to 10, short-answer type I questions of 2 marks each.
- (iv) Section C contains questions number 11 to 22, short-answer type II questions of 3 marks each.
- (v) Section D contains question number 23, value based question of 4 marks.
- (vi) Section E contains questions number 24 to 26, long-answer type questions of 5 marks each.
- (vii) There is no overall choice in the question paper, however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.

Section A

Question 1:

Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers.

Solution 1:

Test Cross.

Question 2:

State two postulates of Oparin and Haldane with reference to origin of life.

Solution 2:

The two postulates are:

- (i) First form of life could have come from pre-existing non-living organic molecules / RNA & Protein.
- (ii) Formation of life was preceded by chemical evolution / formation of diverse organic molecules from inorganic constituents.

Question 3:

A herd of cattle is showing reduced fertility and productivity. Provide one reason and one suggestion to overcome this problem.

Solution 3:

Reason:

The cattle's productivity is hampered due to inbreeding depression.

Suggestion:

Suggestion: Cattle should be mated with unrelated superior cattle of the same breed.

Question 4:

What are Cry genes? In which organism are they present?

Solution 4:

Cry genes codes a toxin which is poisonous to some insects thus giving resistant to the plants. They are present in bacterium *Bacillus thuringiensis*.

Question 5:

An electrostatic precipitator in a thermal power plant is not able to generate high voltage of several thousands. Write the ecological implication because of it.

Solution 5:

As the electrostatic precipitator in a thermal power plant is not able to generate a high voltage of several thousand, so, it will not be able to remove particulate matter present in the exhaust of thermal power plants. Due to which, dust particles will be released into the air and will cause air pollution.

Section B**Question 6:**

A pollen grain in angiosperm at the time of dehiscence from an anther could be 2-celled or 3-celled. Explain, How are the cells placed within the pollen grain when shed at a 2-celled stage?

Solution 6:

In 2-celled stage the mature pollen grain contains a generative and vegetative cell, whereas in 3-celled stage one vegetative cell and two male gametes are present. The generative cell floats in the cytoplasm of vegetative cell.

Question 7:

Differentiate between the genetic codes given below:

- (a) Unambiguous and Universal
- (b) Degenerate and Initiator

Solution 7:

(a)

Unambiguous	Universal
One codon codes for only one amino acid. The code is specific.	The code is same in all organisms.

(b)

Degenerate:	Initiator:
More than one codon coding for the same amino acid. When an amino acid is coded by more than one codon, it is said to be degenerate.	AUG is an initiator codon i.e. it initiates the translation process & also codes for methionine.

Question 8:

Mention one application for each of the following:

- (a) Passive immunization
- (b) Antihistamine
- (c) Colostrum
- (d) Cytokinin-barrier

Solution 8:

(a) **Passive immunization** : Provide preformed antibodies / anti-toxins for quick response in case of infection by deadly microbes (tetanus) or snake bite.

(b) **Antihistamine**: It reduces symptoms of allergy. These chemicals are given against allergic reactions.

(c) **Colostrum** is the yellow fluid produced during the initial days of lactation. It is rich in antibodies and is necessary to develop resistance in a newly born baby.

(d) **Cytokinin-Barrier** is Interferon. These are the glycoproteins which provide protection of non-infected cells from further viral infection.

Question 9:

Name the microbes that help production of the following products commercially:

- (a) Statin
- (b) Citric acid
- (c) Penicillin
- (d) Butyric acid

Solution 9:

- (a) *Monascus purpureus*
- (b) *Aspergillus niger*
- (c) *Penicillium notatum*
- (d) *Clostridium butylicum*

Question 10:

List four benefits to human life by eliminating the use of CFCs.

OR

Suggest two practices giving one example of each that help, protect rare or threatened species.

Solution 10:

Four benefits to human life by eliminating the use of CFCs are:

- (i) It prevents depletion of Ozone layer.
- (ii) It reduces greenhouse effect.
- (iii) It reduces odd climatic changes or El Nino effect
- (iv) It will also prevent snow blindness and inflammation of cornea

OR

(i) Ex situ Conservation – In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care.

By using cryopreservation (preservation at -196°C) technique, sperms, eggs, tissues, and embryo can be stored for long period in gene banks, seed banks etc.

(ii) In situ conservation – When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected - we save the entire forest to save the tiger. This approach is called in situ (on site) conservation.

In India, ecologically unique and biodiversity-rich regions are legally protected as biosphere reserves, national parks and sanctuaries.

Section C

Question 11:

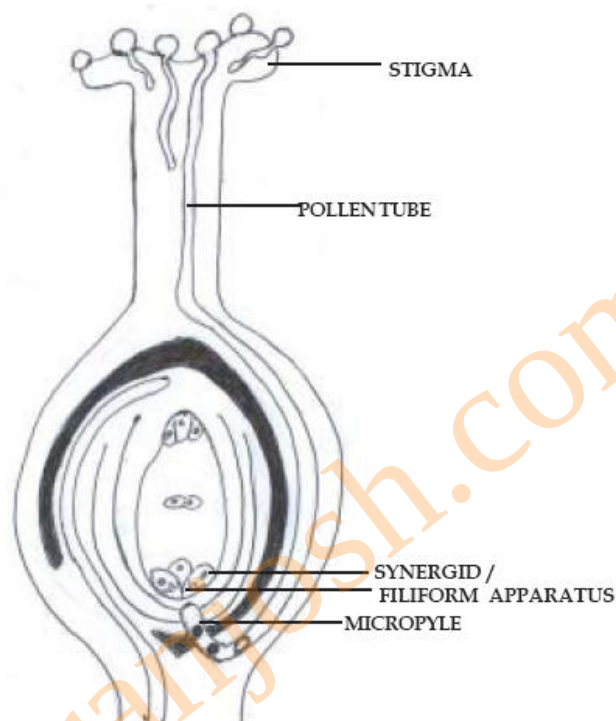
(a) Can a plant flowering in Mumbai be pollinated by pollen grains of the same species growing in New Delhi? Provide explanations to your answer.

(b) Draw the diagram of a pistil where pollination has successfully occurred. Label the parts involved in reaching the male gametes to its desired destination.

Solution 11:

(a) Yes, by artificial means or Artificial Hybridisation where pollen grain of one flower is introduced artificially on the stigma of another flower. But there should not be self-incompatibility.

(b) The diagram is shown below:

**Question 12:**

Both Haemophilia and Thalassemia are blood related disorders in humans. Write their causes and the difference between the two. Name the category of genetic disorder they both come under.

Solution 12:

Haemophilia	Thalassemia
Single protein involved in the clotting of blood is affected	Defects in the synthesis of globin leading to formation of abnormal haemeoglobin
Sex linked recessive disorder	Autosomal recessive disorder
Blood does not clot	Results in anaemia

Both come under Mendelian disorder.

Question 13:

(a) List the two methodologies which were involved in human genome project. Mention how they were used.

(b) Expand 'YAC' and mention what it was used for.

Solution 13:

(a)

Expressed Sequence Tags: This method focuses on identifying all the genes that are expressed as RNA.

Sequence Annotation: It is an approach of sequencing the whole set of genome coding or non coding sequences and later assigning different region with functions.

(b) Yeast Artificial Chromosome(YAC), it is used as cloning vectors for cloning DNA fragments in suitable host so that DNA sequencing can be done.

Question 14:

Write the characteristics of Ramapithecus, Dryopithecus and Neanderthal man.

Solution 14:

Characteristics of Ramapithecus:

- Walked like gorillas and chimpanzees
- Dental structure was more man like.

Characteristics of Dryopithecus:

- Hairy arms and legs of same length,
- Walked like gorillas and chimpanzees, more ape- like.

Characteristics of Neanderthal man:

- Brain size is 1400cc,
- Used hides to protect their body / buried their dead

Question 15:

Name a human disease, its causal organism, symptoms (any three) and vector, spread by intake of water and food contaminated by human faecal matter.

OR

(a) Why is there a fear amongst the guardians that their adolescent wards may get trapped in drug/alcohol abuse?

(b) Explain 'addiction' and 'dependence' in respect of drug/alcohol abuse in youth.

Solution 14:

Amoebic dysentery [Amoebiasis]

Causal Organism: Entamoeba histolytica, a protozoa.

Symptoms: Abdominal pain, Constipation, Cramps.

Vector: Housefly.

OR

(a) Reasons for alcohol abuse in adolescents: -

(i) Peer pressure

(ii) Curiosity and need for adventure, excitement and experiment.

(iii) To escape from stress, frustration and depression.

(iv) To overcome hardships of life.

(v) Unstable or unsupportive family structure

(b) Addiction -Psychological attachment to certain effects such as Euphoria / temporary feeling of well-being.

Dependence: Tendency of the body to show withdrawal syndrome / symptoms if regular doses of drug / alcohol is abruptly discontinued.

Question 16:

(a) Write the desirable characters a farmer looks for in his sugarcane crop.

(b) How did plant breeding techniques help north Indian farmers to develop cane with desired characters?

Solution 16:

(a)

Desirable characters a farmer looks for in his sugarcane crop are:

- High yield
- Thick stem
- High sugar content
- Ability to grow in their areas

(b) By crossing the two varieties of sugarcane i.e. *Saccharum barberi* [sugarcane of North India] and *Saccharum officinarum* [sugarcane of South India] were crossed to obtain sugarcane varieties having desirable qualities. With this method, a good quality sugarcane variety could be grown in North India.

Question 17:

Secondary treatment of the sewage is also called Biological treatment. Justify this statement and explain the process.

Solution 17:

Secondary treatment of the sewage is also called Biological treatment because it involves biological organism such as aerobic and anerobic microbes / bacteria and fungi to digest / consume organic waste.

In this process, primary effluent is passed into aeration tank where vigorous growth of aerobic microbes (flocs) take place, BOD reduced (microbes consume major part of organic matter), effluent is passed to settling tank where flocs sediment to produce activated sludge, sludge is pumped to anerobic sludge digester to digest bacteria and fungi.

In the digesters, heterotrophic microbes anaerobically digest bacteria and fungi in sludge producing mixture of gases such as CH_4 , H_2S , CO_2 which forms the biogas.

Question 18:

(a) Explain the significance of 'palindromic nucleotide sequence' in the formation of recombinant DNA.

(b) Write the use of restriction endonuclease in the above process.

Solution 18:

(a) Palindromic nucleotide sequence is the recognition (specific) sequence present both on the vector and on a desired / alien DNA for the action of the same (specific) restriction endonuclease to act upon = 1

(b) Same restriction endonuclease binds to both the vector and the foreign DNA, cut each of the two strands of the double helix at specific points in their sugar phosphate backbone of recognition sequence for restriction endonucleases / palindromic sequence of vector and foreign DNA, to cut strand a little away from the centre of the palindrome sites, creates overhanging stretches / sticky ends.

Question 19:

Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR.

Solution 19:**Heat:**

Heat helps in denaturation process in PCR. The ds DNA is heated in this process at very high temperature (95°C) so, that DNA separate into two strands

Primer:

Enzyme DNA Polymerase extend the primers using the nucleotides provided in the reaction and the genomic DNA as template.

***Thermus aquaticus*:**

From this bacterium, a thermostable Taq DNA polymerase is isolated which can tolerate high temperatures and forms new strand.

Question 20:

Explain the various steps involved in the production of artificial insulin.

Solution 20:

Insulin contains two short polypeptide chains: chain A and chain B linked together by disulphide bridges.

In mammals insulin is synthesised as a pro-hormone. It contains an extra stretch called C-peptide.

C-peptide is absent in the mature insulin and is removed during maturation into insulin.

Two DNA sequences corresponding to A and B polypeptide chains of human insulin were prepared, these were introduced into *E.coli* to produce A and B chains separately, these chains were extracted and combined by creating disulphide bonds.

Question 21:

(a) “Organisms may be conformers or regulators.” Explain this statement and give one example of each.

(b) Why are there more conformers than regulators in the animal world?

Solution 21:

(a) Conformers- organisms which cannot maintain a constant internal environment under varying external environmental conditions. They can change body temperature and osmotic concentration with change in external environment e.g., all plants, fishes etc.

Regulators - organisms which can maintain homeostasis (by physiological means or behavioural means). They maintain constant body temperature and osmotic concentration eg. birds, mammals etc.

(b) It is because they lack the capability to maintain a constant internal environment or homeostasis. Thermoregulation is energetically expensive for animals.

Question 22:

Describe the inter-relationship between productivity, gross primary productivity and net productivity.

Solution 22:

Productivity is the rate of biomass production per unit area over a period of time.

Gross primary productivity is the rate of production of organic matter during photosynthesis in an ecosystem,

Net productivity is the gross primary productivity minus respiration losses (R).

SECTION D**Question 23:**

It is commonly observed that parents feel embarrassed to discuss freely with their adolescent children about sexuality and reproduction. The result of this parental inhibition is that the children go astray sometimes.

- (a) Explain the reasons that you feel are behind such embarrassment amongst some parents to freely discuss such issues with their growing children.
- (b) By taking one example of a local plant and animal, how would you help these parents to overcome such inhibitions about reproduction and sexuality?

Solution 23:

- (a) The main reasons are illiteracy, conservative attitude, misconceptions, social myths etc.
- (b) Let's take an example of male honey bee and orchid ophrys flower, it is evident that sexual attraction is a natural phenomenon, the honey bee is attracted to a ophrys flower and assumes its one petal as its female partner & pseudo copulates with it. Therefore, it is a natural phenomenon & parents should talk regarding this matter to their children.

SECTION E**Question 24:**

- (a) When a seed of an orange is squeezed, many embryos, instead of one are observed. Explain how it is possible.
- (b) Are these embryos genetically similar or different? Comment.

OR

- (a) Explain the following phases in the menstrual cycle of a human female:

- (i) Menstrual phase
- (ii) Follicular phase
- (iii) Luteal phase

- (b) A proper understanding of menstrual cycle can help immensely in family planning. Do you agree with the statement? Provide reasons for your answer.

Solution 24:

(a) It is due to polyembryony.

Occurrence of more than one embryos in a seed is called as POLYEMBRYONY. In orange, the nucellar cells, synergid or integument cells develop into a number of embryos of different sizes.
e.g., - Citrus.

Sometimes formation of more than one egg in an embryo sac can lead to polyembryony.

(b) These embryos are genetically similar, as produced from nucellar cells by mitotic division / formed without fertilisation (but different from the embryo formed by fertilization)

OR

(a)

(i) Menstrual phase - first 3-5 days of the cycle where menstrual flow occurs due to break down of endometrial lining of uterus, if the released ovum is not fertilised

(ii) Follicular phase - from 5th to 14th day of the cycle where the primary follicles grow to become a fully mature Graafian follicle, endometrium of uterus regenerates, Graafian follicle ruptures to release ova (ovulation on 14th day)

(iii) Luteal Phase - During 15th to 28th day remaining parts of graafian follicle transform into corpus luteum, secretion of progesterone (essential for maintenance of endometrium)

All these phases are under the influence of varying concentrations of pituitary and ovarian hormone

(b) Yes, can take appropriate precautions between 10th to 17th day of the menstrual cycle when the chances of fertilisation are high.

Question 25:

(a) Compare, giving reasons, the J-shaped and S-shaped models of population growth of a species.

(b) Explain “fitness of a species” as mentioned by Darwin.

OR

(a) What is an ecological pyramid? Compare the pyramids of energy, biomass and numbers.

(b) Write any two limitations of ecological pyramids.

Solution 25:

J shaped - growth curve	S shaped- growth curve
Resources are unlimited	Resources are limited
Growth is exponential	Logistic Growth
As resources are unlimited all individuals survive and reproduce	Fittest individual will survive and reproduce
Growth Equation $dN/dt = R_n$ (If explained)	Growth Equation $dN/dt = rN (k - N/K)$ (If explained)

(b) “Fitness of a species” according to Darwin means reproductive fitness. When resources are limited, Competition occurs between individuals, fittest will survive, who reproduce to leave more progeny.

OR

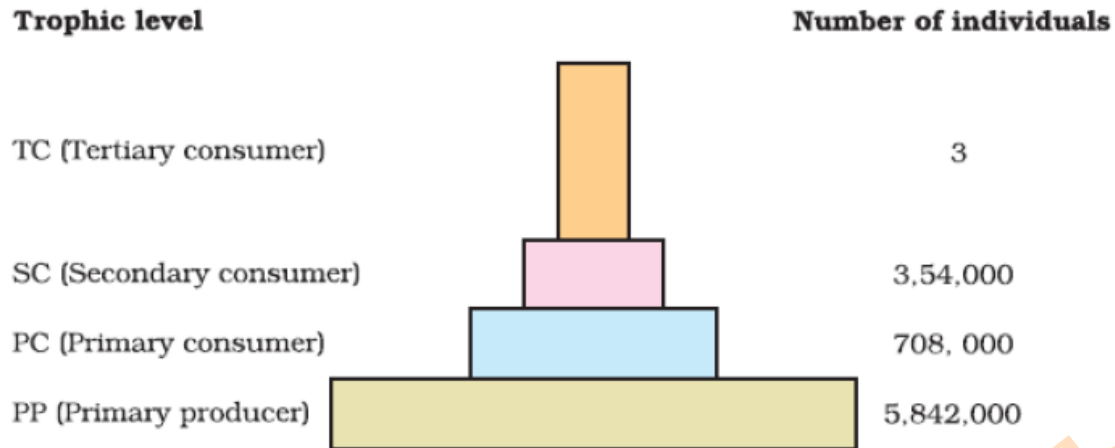
(a)

Ecological pyramid:

It is the relation between producers and consumers in an ecosystem can be graphically represented in the form of a pyramid called ecological pyramid.

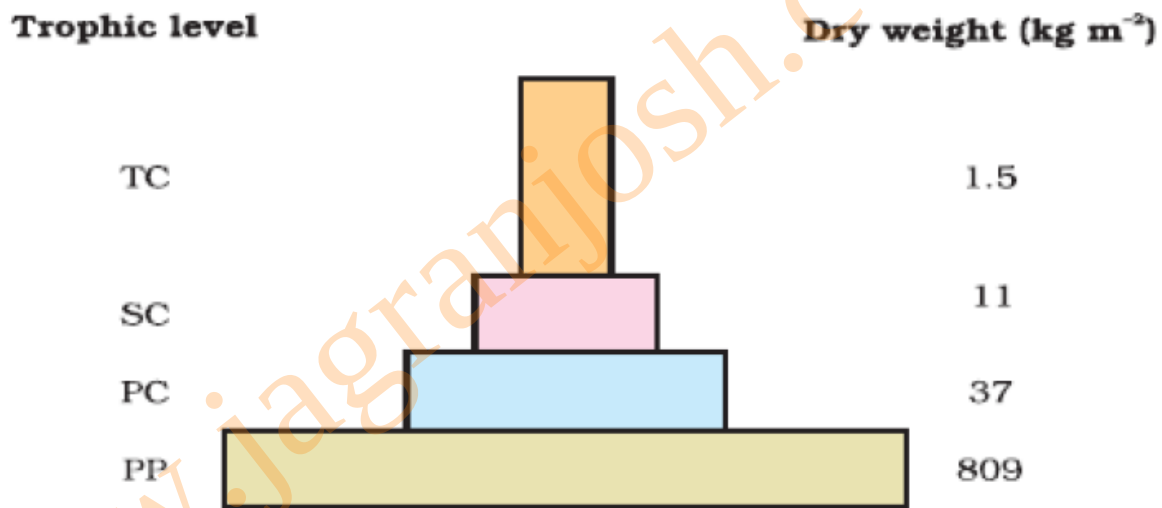
Pyramid of number:

The relationship between producers and consumers in an ecosystem can be represented in the form of a pyramid in terms of number is called pyramid of number.

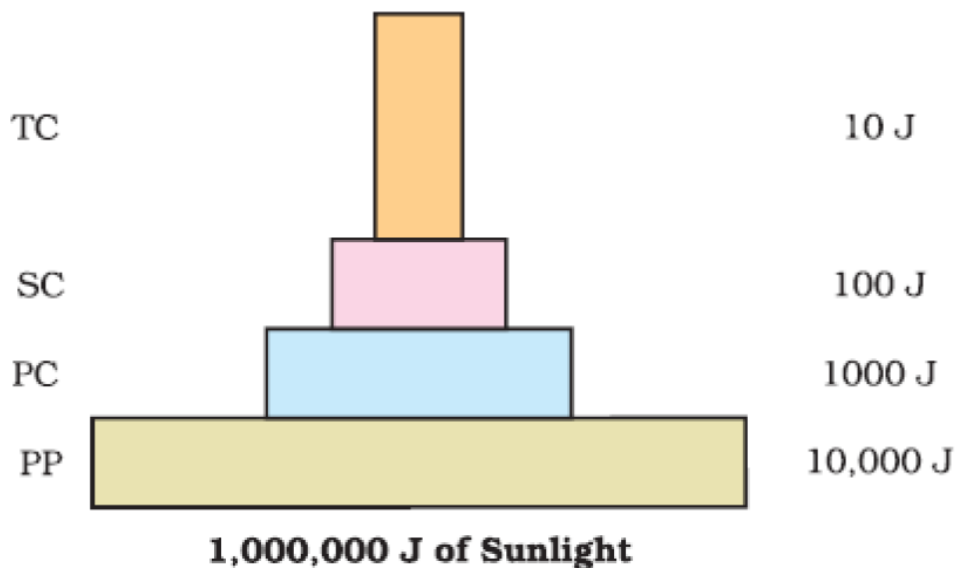


Pyramid of Biomass:

The relationship between producers and consumers in an ecosystem can be represented in the form of a pyramid in terms of biomass is called pyramid of biomass. It can be upright or inverted.



Pyramid of energy: The relationship between producers and consumers in an ecosystem can be represented in the form of pyramid in terms of flow of energy called pyramid of energy. Always upright as energy is lost as heat at each step.



Pyramid of Energy	Pyramid of Bio Mass	Pyramid of Numbers
Shows transfer of Energy from one tropic level to other	Shows transfer of amount of food/ biomass from one tropic level to other	Pyramid of Numbers shows numbers of organism at each tropic level.
Always upright	Mostly upright but can be inverted	Mostly upright can be inverted

(b) It does not accommodate the food web / does not take into account the same species belonging to two or more tropic levels, Saprophytes are not given any place.

Question 26:

(a) Describe the structure and function of a t-RNA molecule. Why is it referred to as an adapter molecule?

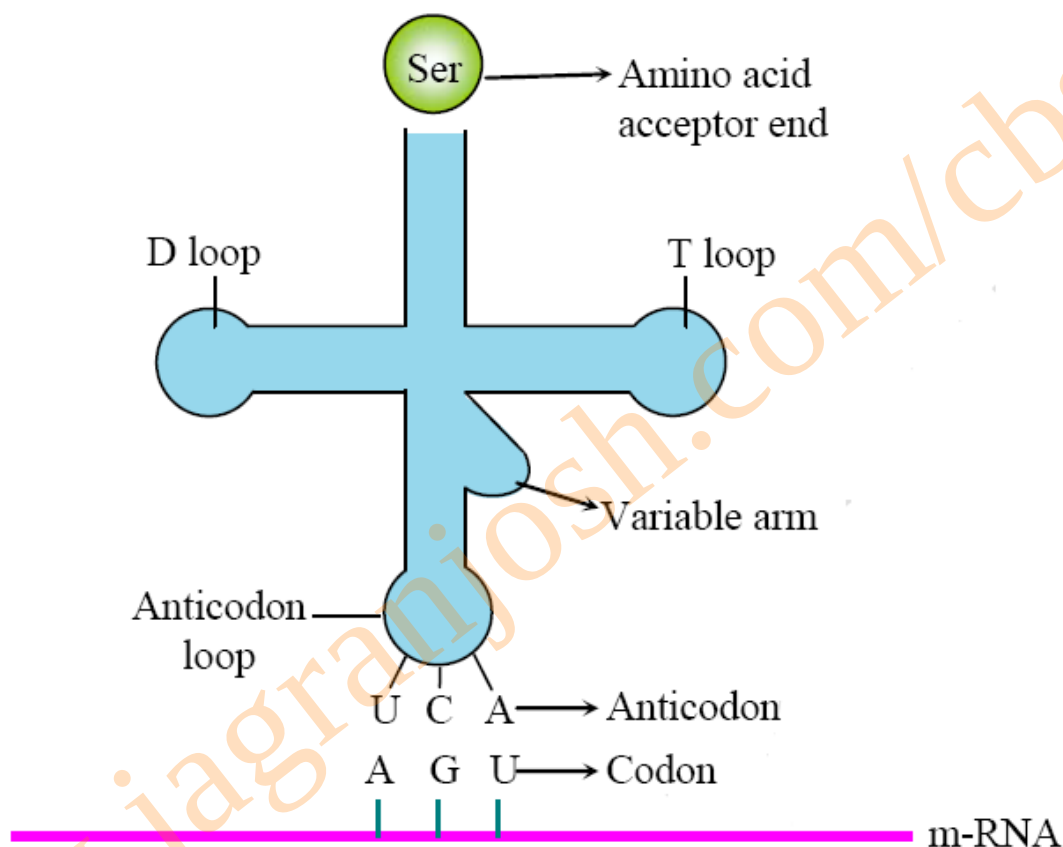
(b) Explain the process of splicing of hn-RNA in a eukaryotic cell.

OR

Write the different components of a lac-operon in *E. coli*. Explain its expression while in an 'open' state.

Solution 26:

(a) t-RNA (transfer RNA) reads the genetic code on one hand & transfers amino acids on the other hand, so it is called as adapter molecule by Francis Crick. It is also called as soluble RNA (SRNA).

Structure of t-RNA:

Secondary structure of t-RNA is clover leaf like but the 3-D structure is inverted L-shaped.

t-RNA has five arms or loops

- (i) Anticodon loop has bases complementary to the code.
- (ii) Amino acid has an acceptor end to which amino acid binds.
- (iii) T-loop help in binding to ribosome.
- (iv) D-loop help in binding amino acyl synthetase.
- (v) Variable loop has no known function.

The function of tRNA is to align the required amino acids according to the nucleotide sequence of mRNA.

tRNA is also called the adapter molecule because on one hand it can read the code and on the other hand it can bind to specific amino acid. It acts as intermediate molecule between triplet code of mRNA and amino acid sequence of polypeptide chain.

(b) The primary transcript formed in eukaryotes are non-functional, containing both the coding region, exon and non-coding region, intron in RNA and are called *heterogeneous RNA* or *hn-RNA*. The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.

OR

An operon is a unit of prokaryotic gene expression, which includes sequentially regulated (structural) genes and control elements recognised by the regulatory gene product. In other words, when many genes are regulated by a single promoter then this arrangement of genes is known as operon.

The various components of lac operon in *E. coli* are:

(i) Structural genes: Fragments of DNA, which transcribe mRNA for polypeptide synthesis. The lac operon consists of three structural genes.

- *z* – for beta-galactosidase (β -gal) that catalyses the hydrolysis of lactose into galactose and glucose.
- *y* – for permease, increases the permeability of cell.
- *α* – for transacetylase.

(ii) Promoter gene:

Sequence of DNA, where RNA polymerase binds and initiates transcription.

(iii) Operator:

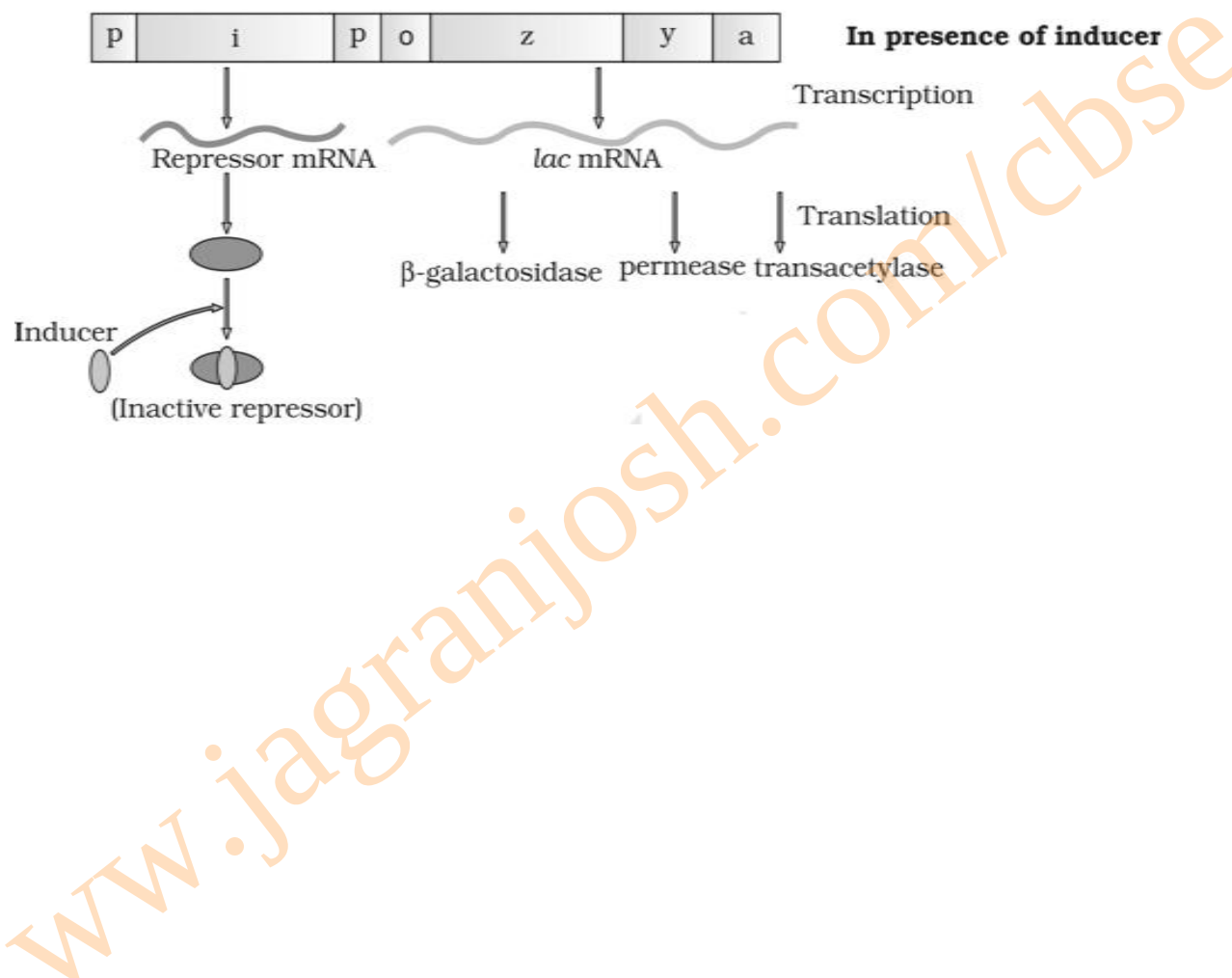
It is sequence of DNA adjacent to promoter, where specific repressor protein binds.

(iv) Regulator gene:

Codes for the repressor protein that binds to the operator and suppresses its activity, hence transcription does not occur. Also, represented as '*i*' gene. Lac operon consists of a regulator *i* gene.

(v) Inducer Prevents the repressor from binding to the operator. Due to this transcription is switched on. It may be a metabolite, hormone, etc. In lac operon lactose acts as an inducer.

Lac operon is said to be in open state, when transcription of structural genes is occurring. It occurs in the presence of an inducer. In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. So, now inactivated repressor cannot bind to on operator. This allows RNA polymerase to access to the promoter and transcription proceeds. It means all the genes are transcribed and all three enzymes are formed.



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