

Biology

Academic Year: 2016-2017

Marks: 70

Date & Time: 10th March 2017, 11:00 am

Duration: 3h

Question 1: Select and write the most appropriate answer from the given alternatives (along with its alphabets) for each sub-question [7]

Question 1.1:

The genotype of human blood group B is [1]

- (a) $I^A i$
- (b) $I^B i$
- (c) $I^A I^A$
- (d) ii

Solution: $I^B i$

Question 1.2: Breakdown of detritus into smaller particles is called _____ [1]

Fragmentation

Leaching

Catabolism

Humification

Solution: Breakdown of detritus into smaller particles is called **Fragmentation**.

The process of decomposition involves the breakdown of the complex compounds into the simpler nutrients which enrich the soil with the minerals. There are many steps involved in decomposition like fragmentation, catabolism, leaching, leaching, humification and mineralisation. The process of fragmentation includes the breaking down of the detritus matter into smaller particles.

Question 1.3: In Brassica (rapeseed, mustard)..... variety is resistant to Aphids. [1]

- (a) Pusa A-4
- (b) Pusa Gaurav
- (c) Pusa Sawani
- (d) . Pusa Shubra

Solution: (B) Pusa Gaurav

Question 1.4: The antibiotic chloromycetin is obtained from [1]

- (a) *Sclerotinia libertina*

- (b) *Aspergillus niger*
- (c) *Streptomyces griseus*
- (d) *Streptomyces venezuelae*

Solution: (D) *Streptomyces venezuelae*

Question 1.5: The _____enzyme is used to cut DNA at specific point [1]

- (a) DNA polymerase
- (b) Alkaline phosphatase
- (c) restriction endonuclease
- (d) DNA ligase

Solution: (c) restriction endonuclease

Question 1.6: R. Q. for proteins is about [1]

- (a) 0.7
- (b) 0.8
- (c) 0.9
- (d) 1.0

Solution: (C) 0.9

Question 1.7: Ozone depletion is occurring widely in the stratosphere, it leads to ozone hole caused mainly due to [1]

- (a) ethylene
- (b) methane
- (c) CFCs
- (d) CO₂

Solution: (C) CFCs

Question 2.1 | Answer each question in 'one' sentence only [6]

Question 2.1.1: Give an example of the source of thermostable enzyme DNA polymerase. [1]

Solution: Taq polymerase is an enzyme obtained from *Thermus aquaticus* which is a bacterium that normally lives in hot water springs. It is used in amplifying small quantity of short segments of DNA by polymerase chain reaction.

Question 2.1.2: Give an example of the non-edible or poisonous mushroom, studied by you. [1]

Solution: Toad stools are non-edible or poisonous mushrooms.

Question 2.1.3: Name the secondary metabolites in catharanthus roseus. [1]

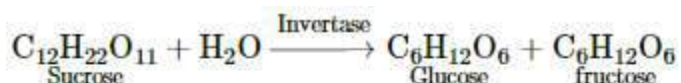
Solution: Vincristin and vinblastin are the secondary metabolites in Catharanthus roseus.

Question 2.1.4: What is ecological succession? [1]

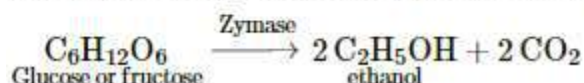
Solution: The gradual (and predictable) change in the species composition of a given area is called ecological succession.

Question 2.1.5: Name the organism and enzyme which bring about alcoholic fermentation of sucrose. [1]

Solution: Saccharomyces cerevisiae is the yeast species which produces the enzyme invertase and zymase responsible for alcoholic fermentation of sucrose. The sugarcane molasses containing sucrose are generally used as the fermentation medium. The yeast cells are grown in this medium to perform anaerobic respiration which produces ethanol and carbon dioxide.



This mixture is converted to ethanol by enzyme zymase.



Question 2.1.6: Enlist any 'two' floral adaptations in salvia. [1]

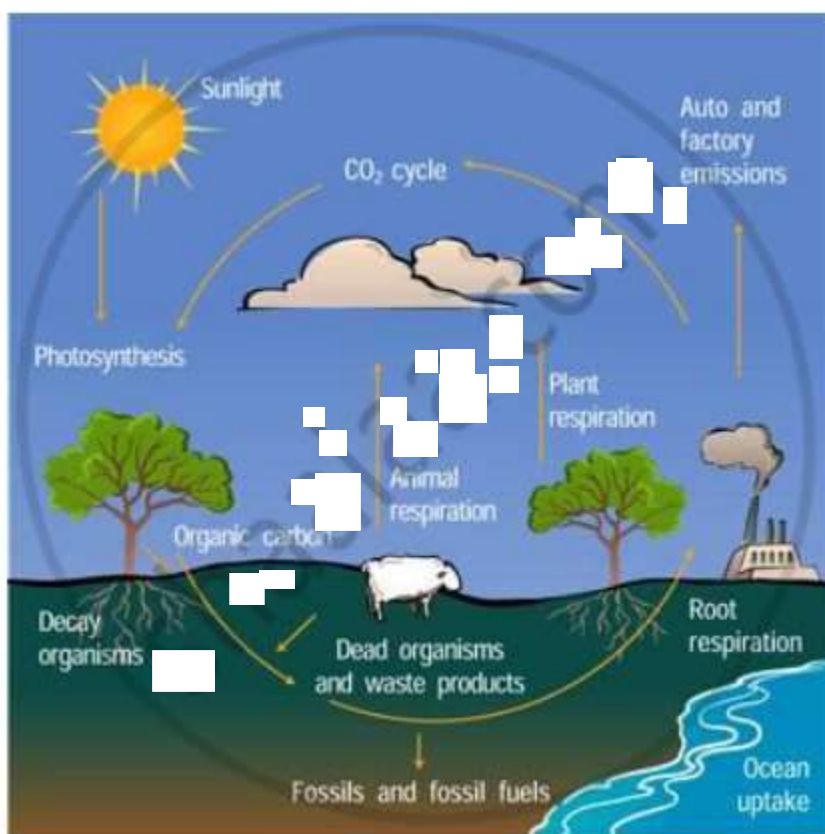
Solution: Floral adaptations in Salvia are as follows : (Lever Mechanism)

- (1) Pollination in Salvia is entomophilous.
- (2) The flower in Salvia is bisexual & protandrous.
- (3) There are two stamens in the flower having long bifurcated connective.
- (4) The upper branch of the connective bears a fertile anther lobe while the lower branch of the connective bears a sterile anther lobe.
- (5) When an insect enters the Salvia flower, it pushes the lower sterile lobe owing to which the upper fertile lobe bends & strikes the back of the insect & dust its pollen grains.
- (6) When the same insect visits another flower, the pollen grains are picked up by the receptive stigma & the pollination is effected.

Question 2.2: Explain the carbon cycle with the help of a simplified model. [2]

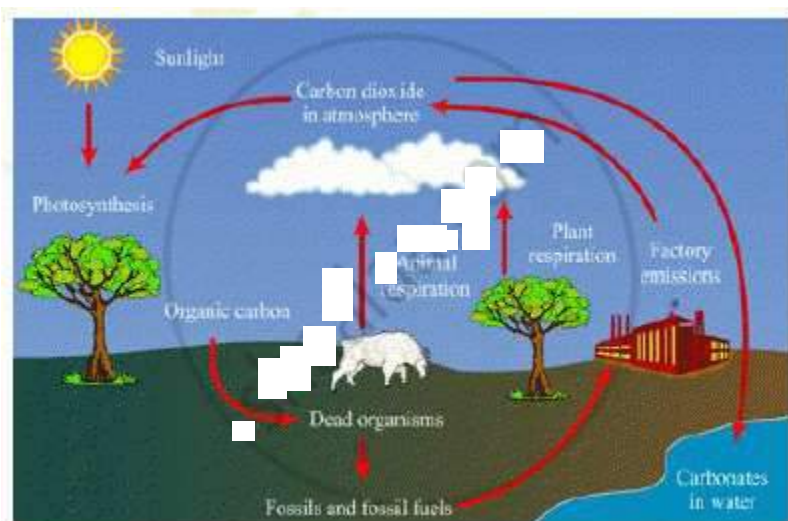
Solution 1: Carbon cycle in nature:

- (i) The main source of carbon in this Universe is CO_2 which is dissolved in water and present in air (0.03–0.04%).
- (ii) Plants take up carbon dioxide from the atmosphere and form organic compounds during photosynthesis. These organic compounds are transferred to animals as food.
- (iii) The carbon dioxide returns to the atmosphere during respiration, decay and combustion of plants and animals.
- (iv) The organic compounds of plants and animals are buried in the deep soil where they are acted upon by decomposers to change them to petroleum, coal, oil and carbonate rocks. These substances on their combustion release carbon dioxide in the atmosphere.
- (v) Some carbon dioxide is found in the dissolved state in water. This gets converted to calcium carbonate in limestone. The weathering and combustion of carbonate-containing rocks or treatment of their minerals give CO_2 .
- (vi) The hot springs and volcanic eruptions also give out CO_2 in the atmosphere.



Solution 2:

Key process involved in carbon cycle is photosynthesis and respiration.



1. In photosynthesis, carbon-dioxide and water produce carbohydrate and oxygen while respiration oxidizes food to give carbon-dioxide and water.
2. In oceans, carbon-dioxide dissolves readily in water. In rock it gets stored as calcium carbonate.
3. Carbon can either be liberated to atmosphere through respiration or can be passed to animal when being eaten or remain in plant even after death.
4. After death of plant or animal, decomposition takes place and carbon dioxide gets released into the atmosphere. They can also be buried inside the earth and converted to coal or natural gas. Natural gas and coal are fuels and on combustion they release carbon dioxide back into the atmosphere.
5. Excess of carbon-dioxide can cause global warming.

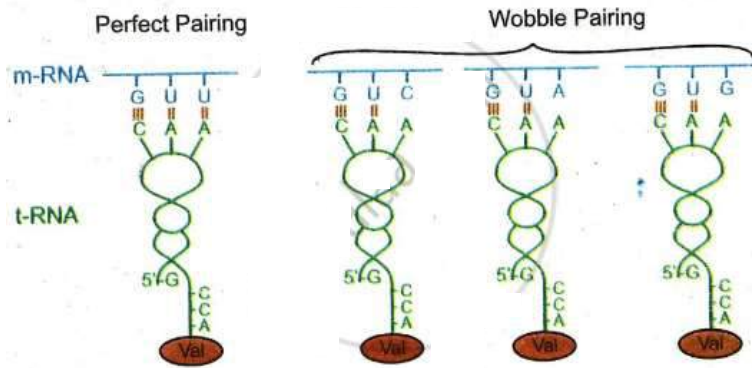
Question 2.3.1: What is test cross? [2]

Solution: The cross between F₁ hybrid and the recessive parent is called test cross. The crossing of an F₁ progeny with a double (homozygous) recessive parental progeny is done in order to determine whether the progeny is homozygous or heterozygous for a character under consideration. This is called as test cross.

Question 2.3.2: Explain 'Wobble hypothesis' with the help of a suitable diagram. [2]

Solution: Wobble Hypothesis:

- (1) This hypothesis suggests that, in codon-anticodon pairing, the third base may not be complementary. The third base of the codon is called wobble base and this position is called wobble position.
- (2) The actual base pairing occurs at first two positions only.



c. In the above example though the codon & anticodon do not match perfectly then also the required amino acid is brought perfectly. This enables the economy of tRNA.
 GUU, GUC, GUA & GUG – codons.
 CCA – anticodon for all 4 codons.

Question 2.3.3: What is a 'biopatent'? Explain it with a suitable example. [2]

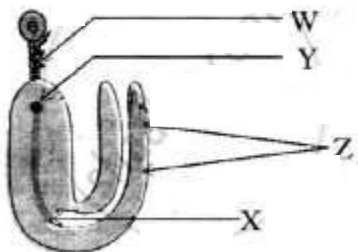
Solution 1: Biopatent - A biopatent is a patent granted by the government to the inventor for biological entities, processes and products.

Basmati rice known for its unique aroma and flavour has been grown in India for centuries.

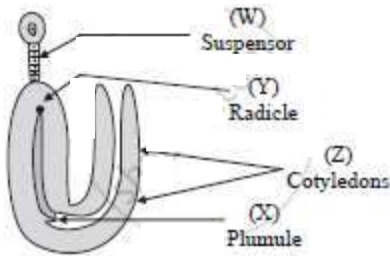
Solution 2: Biopatent: A biopatent is a right granted by a government to an inventor to prevent others from commercial use of his invention. A patent is granted for

- (a) An invention (including product)
- (b) An improvement in an earlier invention
- (c) The process of generating products
- (d) A concept or design

Question 2.3.4: Name the parts W, X, Y and Z from the following figure: [2]



Solution:

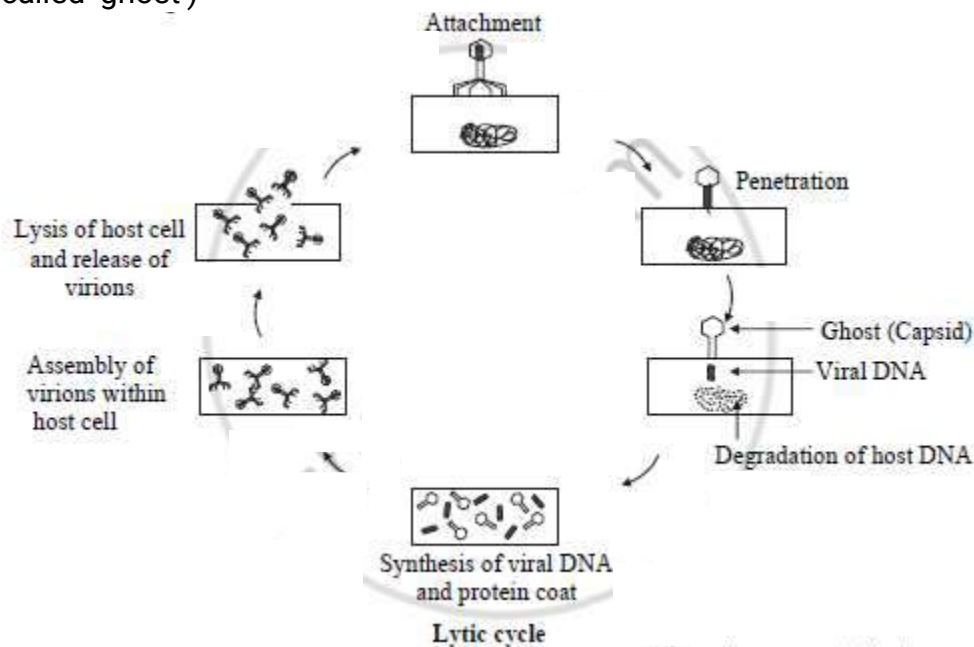


Question 3.1 | Attempt any Two of the following [6]

Question 3.1.1: Explain replication of bacteriophage with the help of a suitable diagram. [3]

Solution: the following steps:

1. Attachment: Bacteriophages attach to specific receptors on the surface of bacteria. As phages do not move independently, they rely on random encounters with the right receptors.
2. Penetration: After attachment, the tail fibres bring the base plate closer to the surface of the cell. Once attached completely, the tail contracts, injecting genetic material (DNA) through the bacterial membrane. (Capsid – protein coat remains outside and is called 'ghost')



3. Degradation of host DNA: Once the viral DNA enters the host cell, the degradation of host DNA starts.
4. Synthesis of proteins and nucleic acid: The host's normal synthesis of proteins and nucleic acids is disrupted, and it is forced to manufacture viral DNA and proteins

instead. These products are the parts of new virions within the cell or proteins involved in cell lysis.

5. Virion assembly: The base plates are assembled with the tails first. The head (capsids) are constructed separately and then are joined with the tails. The DNA is packed efficiently within the head. The whole process takes about 15 minutes.
6. Release of virions: Phages are released via. lysis of cell. It is achieved by an enzyme called endolysin, which breaks down the cell wall. Released virions are capable of infecting a new bacterium.

Question 3.1.2: What are 'biofertilizers'? Explain them with suitable examples. [3]

Solution: Biofertilizers : The biofertilizers are nitrogen fixing microbes or fungi which enrich the soil with nutrients.

There are 3 major types of biofertilizers i.e. bacterial biofertilizers, cyanobacterial biofertilizers and fungal biofertilizers.

Examples of biofertilizers:

1. Nitrogen fixing symbiotic bacterial biofertilizer - Rhizobium in root nodule of leguminous plants.
2. Nitrogen fixing symbiotic cyanobacterial biofertilizers - Anabaena azollae in Azolla.
3. Nitrogen fixing non - symbiotic cyanobacterial biofertilizers - Nostoc, Anabaena.
4. Mycorrhiza - Fungal biofertilizer - Ectotrophic mycorrhiza and Endotrophic mycorrhiza - VAM.

Question 3.1.3: Differentiate between anemophily and entomophily. [3]

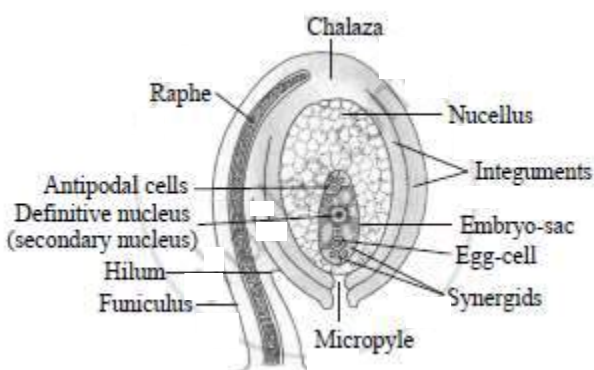
Solution:

No	Anemophily	Entomophily
1	Wind pollinated flowers	Insect pollinated flowers
2	Size of flowers is small.	Size of flowers is large or present in groups to show conspicuous appearance.
3	Not brightly coloured.	Brightly coloured.
4	Odourless.	Usually odour/fragrance present.
5	Nectar is not produced.	Nectar or edible pollen usually present.
6	Number of pollen grains produced in large quantity.	Number of pollen grains are less.

7	Stigma is branched or hairy.	Stigma is usually unbranched and sticky.
8	Pollination is non-directional.	Pollination is directional and highly specific.
9	Pollen grains are light and smooth.	Pollen grains are heavier and sticky.
10	e.g. grass, maize, etc.	e.g. jasmine, rose, etc.

Question 3.2: Sketch and label V. S. of mature anatropous ovule. [3]

Solution: V. S. of mature anatropous ovule :



Question 4 | Attempt any one of the following [7]

Question 4.1: What is 'photophosphorylation'? [7]

Solution:

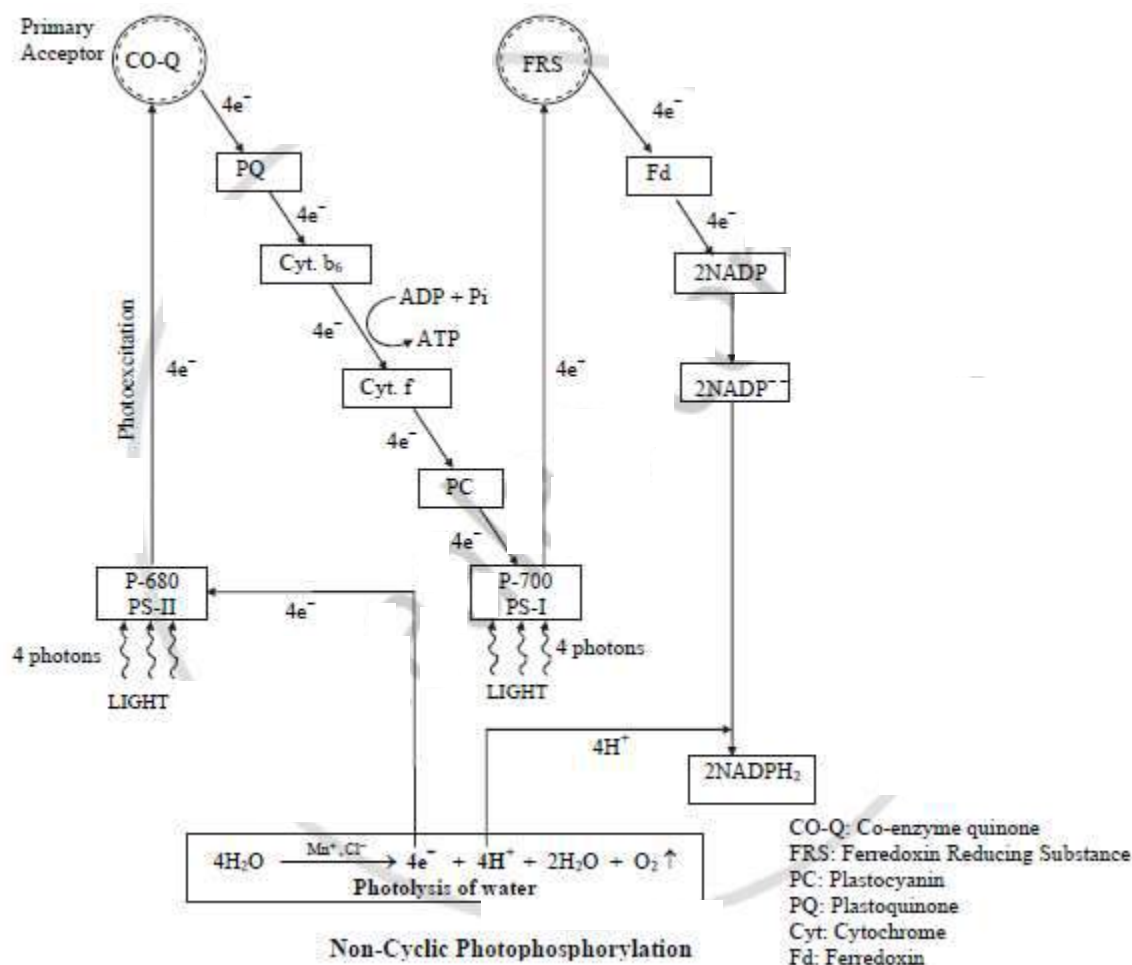
The process in which energy rich ATP molecules are synthesized using solar energy is called photophosphorylation.

Question 4.1: Describe non-cyclic photophosphorylation with schematic representation. Give its significance.

Solution: Non-cyclic photophosphorylation involves the following steps:

1. **Photoexcitation of PS-II:** PS-II absorbs light and gets excited, which results in ionisation of chlorophyll-a and a high energy electron is expelled from PS-II.
2. **Electron Acceptors:** The expelled energy rich electron is first accepted by CO-Q (co-enzyme quinone). Electron from CO-Q moves down through various electron carriers and releases energy. From CO-Q, electrons are transferred to plastoquinone (PQ) (it is an iron containing protein). From PQ, electrons are transferred to cytochrome complex (cytochrome-b and cytochrome-f). From cytochrome complex, the electrons are transferred to plastocyanin (PC) (it is a copper containing protein). From PC, the electrons are finally accepted by ionized chlorophyll of PS-I.

3. **Synthesis of ATP:** One ATP is synthesized when electron passes from cytochrome b6 to cytochrome f.
4. **Photoexcitation of PS-I:** The light energy absorbed by PS-I is transferred to reaction centre P700. It gets excited and expels energy rich electrons. The electrons are first accepted by unknown electron acceptor called FRS (Ferredoxin Reducing Substance). Electron from FRS moves down through various electron carriers and release energy. From FRS, electrons are transferred to ferredoxin (it is an iron containing protein). The reduced ferredoxin transfers electron to NADP to form $\text{NADP}^{\cdot-}$ in the presence of enzyme Fd-NADP-reductase.
5. **Photolysis of water:** Splitting of water into H^+ and $\text{OH}^{\cdot-}$ in presence of light and chlorophyll is called photolysis of water. Manganese, calcium and chloride ions present in PS-II play an important role in photolysis of water. Photolysis of water occurs in order to satisfy the electron need of PS-II and proton need of NADP.
6. **Assimilatory power:** ATP and NADPH_2 are together called as assimilating power by Calvin, as it is required for assimilation of CO_2 .



Significance of non-cyclic photophosphorylation:

- i. ATP molecules as well as NADPH₂ are produced.
- ii. Photolysis of water takes place to release O₂.

Question 4.2: What is 'RNA'? [7]

Solution:

RNA (Ribose Nucleic Acid) is a type of nucleic acid found in the nucleus as well as in the cytoplasm.

Question 4.2: Explain different types of non-genetic RNA with diagrams and functions.

Solution: Types of RNA: There are two main types of RNA:

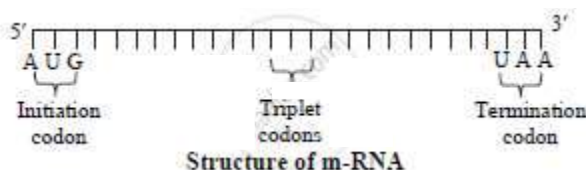
1. Genetic RNA: It acts as genetic material in some viruses.
2. Non-genetic RNA: It is mainly involved in protein synthesis. There are three different types

of non-genetic RNA:

a. Messenger RNA (m-RNA) b. Ribosomal RNA (r-RNA) c. Transfer RNA (t-RNA) or Soluble RNA (s-RNA)

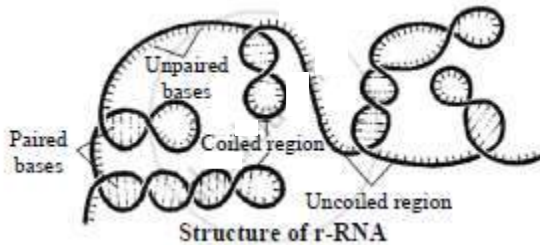
a. Messenger RNA (m-RNA) or Informational RNA:

1. It is called messenger RNA because it carries the message for protein synthesis from DNA to the ribosomes (site for protein synthesis) in the form of codons
2. It is produced on the DNA strand inside nucleus by a process called transcription and then transferred to the cytoplasm.
3. It constitutes about 3-5% of the total RNA content of the cell.
4. It is long RNA and the molecular weight of an average sized m-RNA is about 5,00,000.
5. It is always single stranded, linear and straight (unfolded).
6. It has two ends – 5' end and 3' end.
7. A triplet of nucleotides on m-RNA is called codon.
8. Each codon on m-RNA specifies one amino acid. This is called m-RNA language or genetic code or cryptogram.
9. The codon present at 5' end of mRNA is called initiation codon or start codon. The common initiation codon is AUG or in some cases GUG. AUG and GUG specify amino acids methionine and valine respectively.
10. The codon present at 3' end is called termination codon or stop codon or nonsense codon (as they do not specify any amino acid). The termination codon may be UAA (Ochre) or UAG (Amber) or UGA (Opal).
11. m-RNA is short lived and is degraded soon after protein synthesis.



Functions of m-RNA:

1. It carries genetic information from DNA to ribosomes during protein synthesis.
2. The genetic code of m-RNA gets translated into the sequences of amino acids to form proteins.



b. Ribosomal RNA (r-RNA):

1. It is present in ribosomes, hence the name ribosomal RNA.
2. It consists of a single strand. The single strand is folded upon itself in certain regions.
3. In folded regions, complementary base pairing occurs, while in unfolded regions, it is absent. Hence, r-RNA does not show purine-pyrimidine equality.
4. It constitutes about 80% of the total RNA content of the cell.
5. The molecular weight ranges from 40,000 to 100,000.

Functions of r-RNA:

1. It provides proper binding site for m-RNA on the ribosome.
2. It orients m-RNA molecule in such a way that all the codons are properly read.
3. It releases t-RNA molecule after transfer of activated amino acid to polypeptide chain.
4. It also protects the protein molecule under construction.
5. It also protects m-RNA from Rnase enzyme.

c. Transfer RNA (t-RNA) or Soluble RNA (s-RNA) or Supernatant RNA or adapter RNA.

1. It is the smallest of the three types of non-genetic RNA.
2. It transfers activated amino acids to the site of protein synthesis. Hence, it is called transfer RNA.
3. It is also called soluble RNA as these molecules cannot be separated from cytoplasm even by ultra centrifugation technique.
4. The t-RNA molecule consists of a single strand folded upon itself.
5. It constitutes about 10-20% of the total RNA content of the cell.
6. It is made up of 73-93 nucleotides with molecular weight of about 23,000-30,000.
7. There are more than 20 different types of t-RNA.
8. Structure of t-RNA can be explained by two models as:

1. Hairpin model:

The t-RNA molecule is folded in such a manner that there is formation of one loop having a triplet of unpaired bases called anticodon.

The 5' end has G-nucleotide, while at 3' end, there is a sequence of CCA nucleotides.

2. Clover leaf model (trifoliate leaf model):

- i. The clover leaf model of t-RNA shows presence of three arms, namely – DHU

arm, middle arm and T ψ C arm.

ii. These arms have loops at their ends such as amino acyl binding loop, anticodon loop and ribosomal binding loop respectively.

iii. The anticodon loop has anticodon which is a triplet of unpaired nucleotides.

iv. The anticodons present on t-RNA are complementary to codons present on the m-RNA (anticodons are also referred to as nodoc).

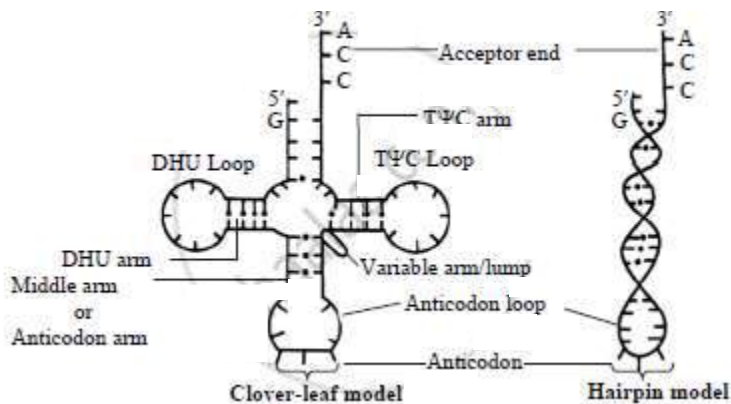
v. In addition, it also shows a small lump called variable arm or variable lump.

vi. Like the hair-pin model of t-RNA, it has G nucleotide at 5' end and CCA nucleotides at 3' end.

Functions of t-RNA:

It carries specific type of amino acid at CCA end to the ribosomes during protein synthesis.

It places the required amino acid properly in the sequence. (This becomes possible because of complementary nature of codons and anticodons).



Structure of t-RNA

Question 5 | Select and write the most appropriate answer from the given alternatives (along with its alphabets) for each sub-question : [7]

Question 5.1: Which of the following has normal vision? [1]

- (a) Xc Xc
- (b) Xc Y
- (c) XC Xc
- (d) Xc Yc

Solution:

- (C) XC Xc

Question 5.2: In DNA fingerprinting technique, radioactive DNA probe is obtained from_____ of female banded krait snake. [1]

- (a) X chromosome
- (b) Y chromoson1e

- (c) X and Y chromosomes
- (d) autosome

Solution: (B) Y chromosome

Question 5.3: Abortion in the first trimester of pregnancy may occur due to lack of_____ [1]

- (a) aldosterone
- (b) testosterone
- (c) oestrogen
- (d) progesterone

Solution: (D) progesterone

Question 5.4: _____contribute about 60% of the total volume of the semen. [1]

- (a) Prostate glands
- (b) Cowper's glands
- (c) Seminal vesicles
- (d) Bartholin's glands

Solution: (C) Seminal vesicles

Question 5.5: Lowering of blood pressure is related with the production of_____ [1]

- (a) ADH
- (b) ANF
- (c) GH
- (d) LH

Solution: (b) ANF

Question 5.6: Humulin is used to treat_____ [1]

- (a) Diabetes mellitus
- (b) Diabetes insipidus
- (c) Hepatitis
- (d) Nephritis

Solution: (a) Diabetes mellitus

Question 5.7: The modification of original genetic make-up is focussed by_____ [1]

- (a) PCR
- (b) DNA fingerprinting
- (c) Electrophoresis
- (d) Gene therapy

Solution: (d) Gene therapy

Question 6.1 | Answer the .following questions only in 'one' sentence each [6]

Question 6.1.1: Which material is used for isolation of DNA in fingerprinting technique? [1]

Solution: Blood, semen, hair roots or other cells of the body are used for isolation of DNA in fingerprinting technique.

Question 6.1.2: Give significance of podocyte [1]

Solution: Podocytes produce foot like processes, which form intimate contact with glomerulus and the gaps between these processes are filtration slits which help in ultrafiltration.

Question 6.1.3: Define the following term and give one example for each: [1]

Commensalism

What is 'commensalism'?

Very short answer question

Define the following term

Commensalism

Solution 1: Commensalism: Commensalism is an interaction between two species in which one species gets benefited while the other remains unaffected. An orchid growing on the branches of a mango tree and barnacles attached to the body of whales are examples of commensalisms.

Solution 2: Commensalism: Commensalism is the interaction in which one species gets benefited and the other is neither harmed nor benefited.

Question 6.1.4: Name the functions – Acrosome [1]

Solution: Acrosome – It is a cap-like structure present in the anterior part of the head of the sperm. It contains hyaluronidase enzyme, which hydrolyses the outer membrane of the egg, thereby helping the sperm to penetrate the egg at the time of fertilization.

Question 6.1.5: Distinguish between X and Y chromosomes. (Mention any 'two' points.) [1]

Solution:

No	X Chromosome	Y chromosome
1	These chromosomes are metacentric, hence appear X shaped.	These chromosomes are acrocentric, hence appear Y shaped
2	They are longer than 'Y' chromosomes	They are shorter than 'X' chromosomes

3	It contains large amount of euchromatin and small amount of heterochromatin.	It contains large amount of heterochromatin and small amount of euchromatin.
4	Found in both male and females.	Found only in males.
5	Non-homologous part shows more genes than Y chromosome.	Non-homologous part contains few genes as compared to X chromosome.
6	X - linked genes are present on X chromosome.	Y- linked genes (Holandric genes) are present on Y chromosome.
7	Genes present on X chromosome show criss-cross inheritance.	Genes present on Y chromosome show straight inheritance

Question 6.1.6: Give any 'two' examples of endangered species [1]

Solution: Endangered species:

i. Plant species

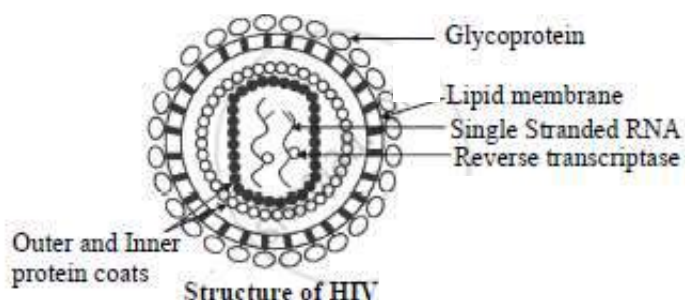
- a. Psilotum nudum
- b. Osmunda regalis

ii. Animal species

- a. Asiatic wild ass
- b. White-eyed duck
- c. Red Panda
- d. Crocodile

Question 6.2: Sketch and Label the 'Structure of HIV'. [2]

Solution:



Question 6.3 | Attempt any two of the following [4]

Question 6.3.1: Write a note on erythrocytes. [2]

Solution: RBC (Red Blood Corpuscles) or Erythrocytes:

- Erythrocytes are circular, biconcave and non-nucleated cells.
- Their diameter is 7μ and are 2.5μ thick.

- In adult male, RBC count is 5.1 to 5.8 million per cubic millimeter, while in female, it is 4.3 to 5.2 million per cubic millimeter.
- Normal life span of a single RBC is about 120 days.
- Formation of RBCs is called erythropoiesis.
- Erythropoiesis in foetus, takes place in yolk sac, kidney, spleen and liver while in adults, it takes place in red bone marrow.
- Stroma of RBC contains haemoglobin which helps in carrying respiratory gases. Old and worn out RBCs are destroyed in spleen and liver



Question 6.3.2: What are the uses of vaccine? [2]

Solution: a. Vaccine is an antigenic preparation used to stimulate the production of antibodies.

b. Vaccines induce immunity against several diseases.

c. Vaccines stimulate immune system to act against genuine toxins.

d. Vaccines or vaccination programme is used to eradicate a particular disease.

e.g. Now, the disease smallpox is totally eradicated by vaccination programme.

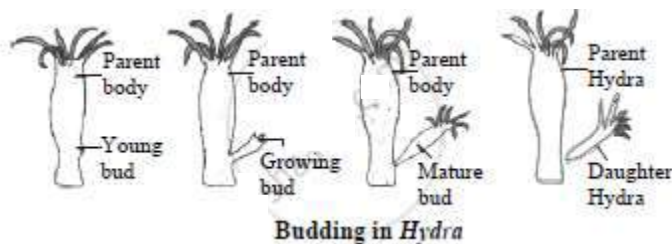
Question 6.3.3: Describe the process of budding in hydra. [2]

Solution: a. Budding is a type of asexual reproduction seen in Coelenterates (e.g. Hydra) and Ascidians.

b. These multicellular animals form a small bud which grows gradually.

c. The bud grows slowly into a young animal and then detaches itself from the parent body.

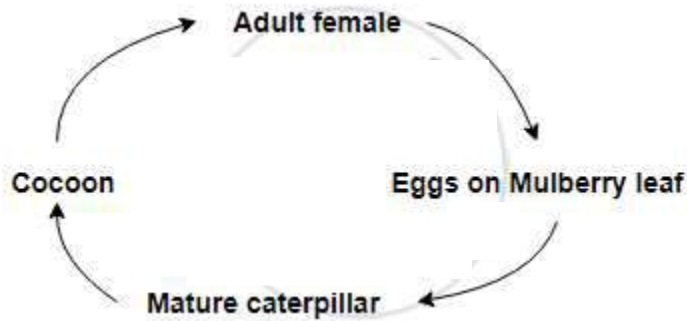
d. This bud then grows into an independent new organism



Question 6.3.4: Name the species used in sericulture. Name the stages in the life cycle of a silk moth in cyclic form. [4]

Solution: Species used in sericulture is *Bombyx Mori* - it produces mulberry silk.

Various stages in life cycle of silk moth in cyclic form are



Question 7.1 | Attempt any TWO of the following [6]

Question 7.1.1: Explain ABO blood group system in human being with a suitable chart.
[3]

Solution: On the surface of plasma membrane of RBC's, certain glycoprotein molecules called antigens are present. These antigens differ in different persons and give blood grouping properties to them.

- i. ABO blood group system
- ii. Rh-blood group system

a. **ABO blood group system** was discovered by Karl Landsteiner.

b. In ABO system, blood groups are determined by the presence or absence of antigen A and antigen B.

c. **Antigen** : Blood groups are based on two antigens present on the membranes of RBC's, namely antigen A and antigen B. Person may have neither of them or one of them or both of them.

d. **Antibody** : It is γ -globulin protein present in blood plasma, so is called plasma factor. There are two types of antibodies a and b. A person may have neither of them, one of them or both of them.

e. Antigen A and antibody a and antigen B and antibody b are incompatible to each other and causes self-clumping. On the basis of this, four blood groups are recognized.

Blood Group	Antigen	Antibody	Can give blood to	can receive blood from	Genotype
A	A	b	A, AB	A, O	$I^A I^A$ or $I^A i$
B	B	a	B, Ab	B, O	$I^B I^B$ or $I^B i$
AB	A, B (both)	none	AB	All (Universal recipient)	$I^A I^B$
O	none	a, b (both)	All(universal Donor)	O	ii

Person with blood group O is called universal donor as it has no antigen and can donate blood to any person.

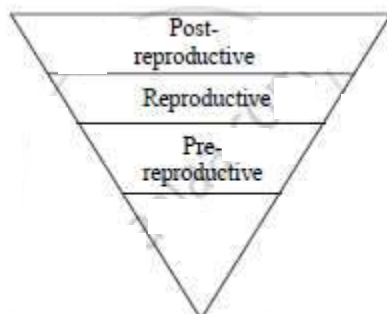
Person with blood group AB is called universal recipient as it has no antibody in their plasma so can receive blood from any blood group.

Question 7.1.2: Describe diagrammatic representation of age structure showing declining population. [3]

Solution: a. The relative proportion of individuals of various age groups in the population is called age structure of the population.

b. Age structure of a population is the percentage of individuals of different age groups such as young (0-14 years), adults (15-59 years) and old (60 years and above).

c. The distribution of these age groups determine the trend of population.



Age structure showing declining population

d. In declining population, number of post reproductive age group is large whereas the number of pre reproductive age group is small.

e. Thus, the age structure shows declining population.

Question 7.1.3: With the help of a neat and labelled diagram, describe reflex arc. [3]

Solution: Reflex arc: The pathway of nerve fibres along which the reflex impulse travels is known as reflex arc.

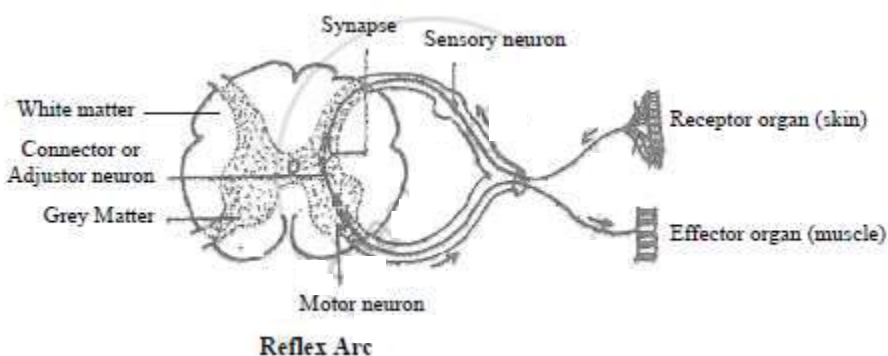
It is always unidirectional from receptor organs to the effector organ, via. CNS. Reflex arc is the structural and functional unit of reflex action.

Components of simple reflex arc:

Simple reflex arc is formed of five components as given below:

i. Receptor organ:

It is a specialized part of body called sense organ that receives the stimulus and converts it into the impulse. e.g. skin, eye, tongue, nose and ears.



ii. Sensory or Afferent neuro

It carries sensory nerve impulse from receptor organ to CNS. Its cyton is located in dorsal root ganglion. Its dendron is long and connected to receptor, while the axon enters in the grey matter of spinal cord to form a synapse.

iii. Associated or Intermediate neuron:

It is present in the grey matter of spinal cord. It receives sensory impulse, interprets it and generates motor impulse.

iv. Motor or effector neuron:

Its cyton is present in the ventral horn of grey matter and axon travels through ventral root. It conducts motor impulse from spinal cord to effector organ.

v. Effector organ:

It is a specialized part of the body which is excited by receiving the motor impulse. It gives proper response to the stimulus. e.g. Muscles and glands.

Question 7.2: Describe the human male reproductive system. [3]

Solution: Human male reproductive system:-

The human male reproductive system comprises testes, epididymis, vas deferens, Cowper's glands, prostate gland and penis.

1. Testes

- Testes produce male gametes and sperms.
- To maintain the temperature 2–3°C lower than the body temperature, the scrotum is located outside the body cavity.

2. Epididymis

- The epididymis stores sperms temporarily.

3. Vas deferens

- Each epididymis continues further as a sperm duct or vas deferens.

4. Seminal vesicles

- The seminal vesicles produce a secretion which is responsible for the transport of sperms.

5. Prostate gland

- It is a bilobed structure which surrounds the urethra.
- It pours an alkaline secretion into the semen.

6. Cowper's glands

- These are two small ovoid glands.
- They open into the urethra.
- Its secretion serves as a lubricant.

7. Penis

- The urethra passes through the penis.
- It carries either urine or semen at a given time.

Question 8 | Attempt any one of the following [7]

Question 8.1: Define Endocrine gland [7]

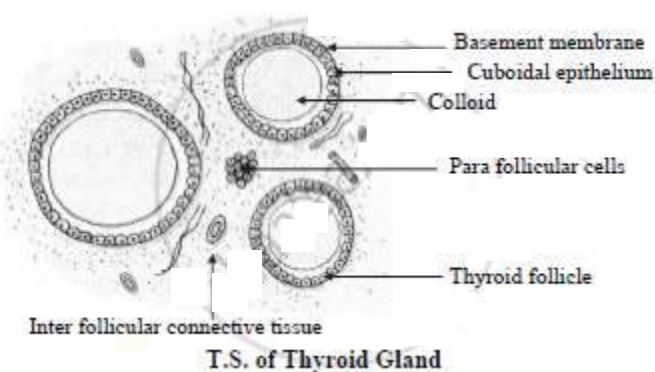
Solution 1: Endocrine glands: Glands that do not discharge their secretions into ducts

are known as endocrine glands. Instead, these glands discharge their secretions directly into the blood. Pituitary gland, thyroid gland, adrenal gland, etc. are examples of endocrine glands.

Solution 2: An organ that makes hormones that are released directly into the blood and travel to tissues and organs all over the body. Endocrine glands help control many body functions, including growth and development, metabolism, and fertility. Some examples of endocrine glands are the pituitary, thyroid, and adrenal glands.

Describe the T. S. of thyroid gland

Solution: Thyroid gland is externally covered by connective tissue sheath or capsule. From the capsule, number of septa called trabeculae arise, which divide the thyroid gland into several lobules. The lobules contain about 3 million thyroid follicles. Each thyroid follicle is oval in shape and varies in size. Larger follicles are present towards periphery, whereas smaller ones are present in the interior. The follicles are surrounded by a connective tissue called interfollicular tissue which contains blood vessels and nerve fibres. Each follicle is lined by a single layer of cuboidal glandular epithelium which rest on a very thin basement. The follicular cavity or acinus is filled by dense amorphous semisolid substance called colloid, which is thyroglobulin, a precursor of thyroid hormone, thyroxine. Other cells bigger than follicular cells are also present singly or in groups in the connective tissue. These are called parafollicular or 'C' cells. They secrete hormone thyrocalcitonin.



Question 8.2: Define organic evolution. [7]

Solution: Organic evolution is a slow, gradual, continuous and irreversible change through which the present-day complex forms have descended from their simple pre-existing forms of the past.

Give the principles of Darwin's theory of natural selection.

Solution: Principles of Darwinism:

Darwin's theory of organic evolution by natural selection is based on the following principles:

1. Over production or prodigality of production:
All organisms have a natural tendency to over produce.
If this tendency is not checked, then even a single species of a plant or animal will occupy the entire space available on the earth.
2. Struggle for existence: Organisms multiply in geometric ratio, but space and food remain constant leading to competition for survival. Increase in the number of species leads to a competition called struggle for existence
3. Variations and Heredity: The differences which occur between the closely related organisms are called variations. It is universal law of nature. Variations may be favourable or unfavourable.
4. Survival of the fittest or natural selection: According to Darwin, in the struggle for existence, the fittest individuals survive and reproduce, while the unfit individuals perish.
5. Origin of new species: According to Darwin, useful variations appear in every generation and are inherited from one generation to another.

Objection to Darwin's theory of natural selection

Solution: Objections to Darwin's natural selection theory:

- i. Natural selection theory explained "survival of the fittest" but not "arrival of the fittest".
- ii. Darwin did not take into account the hereditary principles.
- iii. He could not provide a satisfactory explanation for the cause, origin and inheritance of variations.
- iv. Certain useless characters are also inherited. He could not explain the inheritance of useless variations.
- v. He was unable to differentiate variations as hereditary and environmental variations.