West Bengal – 2015
Class 12
Biological Science

Total Time – 3 Hours **Total Marks – 70**

Group A

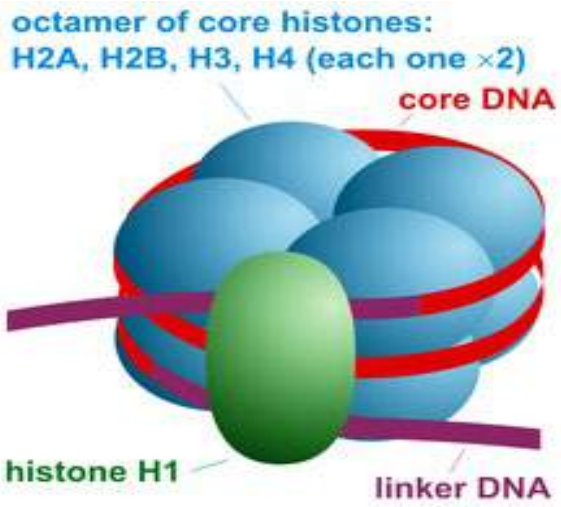
1. Answer the following questions (Alternative are to be noted): $(2 \times 5 = 10)$

(a) Distinguish between isogamy and oogamy.

Answer:- In isogamy, the male and female gametes are identical in structure and in oogamy, the male gamete is motile and smaller than the female gamete which is larger and non motile.

(b) What is nucleosome?

Answer:- The nucleosome is the fundamental subunit of chromatin, around which 147 base pairs of DNA is wrapped. It a set of eight proteins called histones, which are known as a histone octamer. Each histone octamer is composed of two copies each of the histone proteins H2A, H2B, H3, and H4. The chain of nucleosomes is then compacted further and forms a highly organized complex of DNA and protein called a chromosome.



OR

Mention any two symptoms of Turner's or Klinefelter's syndrome.

Answer:- Symptoms of Turner's syndrome :

A short neck with a webbed appearance, low hairline at the back of the neck, low-set ears, hands and feet that are swollen or puffy at birth, and soft nails that turn upward.

Symptoms of Klinefelter's syndrome:

Larger breasts than normal, longer arms and legs, wider hips, and a shorter torso than other boys their age, Small penis and small, firm testicles.

(c) Give scientific names of two exotic carps.

Answer:- Scientific names of two exotic carps are :

Aristichthys nobilis (Bighead carp)

Hypophthalmichthys molitrix (Silver carp)

(d) Give two examples of bio-piracy.

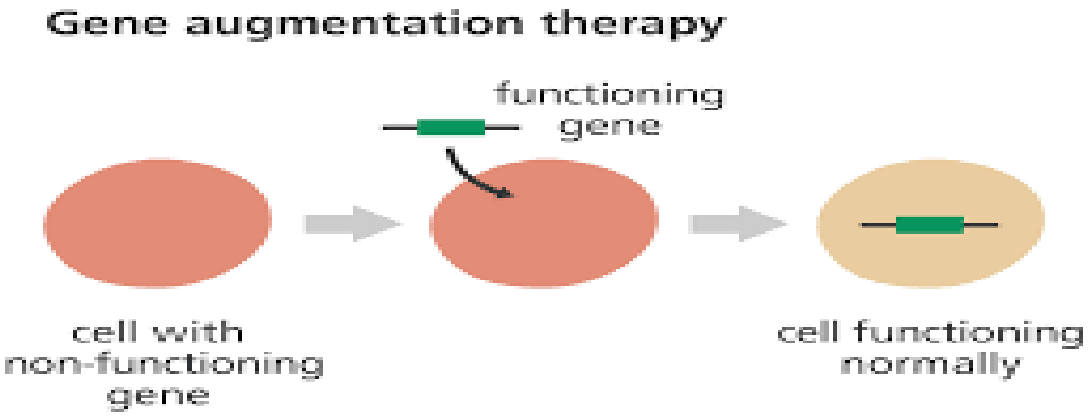
Answer:- Two examples of bio-piracy are :

Patenting of basmati and patenting of neem are examples of biopiracy. Both basmati and neem are indigenous to India are were biopiraced by USDA and USPTO respectively in the USA.

OR

What is gene therapy? Give an example

Answer:- Gene therapy is the insertion of genes into an individual's cells and tissues to treat a disease, and hereditary diseases in which a defective mutant allele is replaced with a functional one.



Example: The first human to receive gene therapy treatment was a 4 year old girl with severe immune-deficiency disease. This disease is caused by a faulty gene that fails to produce a vital

enzyme. In the therapy procedure, they extracted some of the girl's white blood cells. Then, they exposed them to a genetically engineered virus that had lost its virulence but still carried normal versions of the gene that was not functioning correctly in the girl. The virus invaded the white blood cells, and then these cells were transfused back into the girl. Once back inside the girl's bloodstream, the cells began producing the proper enzyme. Although the girl still needs follow-up treatments, she now leads a relatively normal life following the gene therapy. This is one of the success stories of gene therapy.

(e) Define ecological diversity.

Answer:- It defines the diversity observed among the ecosystems in a particular region. Different ecosystems like mangroves, rainforests, deserts, etc., show a great variety of life forms residing in them. Ecological diversity is a type of biodiversity. It is the variation in the ecosystems found in a region or the variation in ecosystems over the whole planet.

OR

What is ex-situ conservation? Give an example.

Answer:- Ex: situ conservation literally means, "off-site conservation". It is the process of protecting an endangered species, variety or breed, of plant or animal outside its natural habitat. It includes both captive propagation of species and their eventual release into natural or restored ecosystem. Examples of

Ex situ Conservation are Captive Breeding, Gene Banks, Seed Banks, Zoos, Aquaria, In vitro fertilization, Cryopreservation, Tissue Culture.

2. Answer the following questions (Alternative are to be noted): $(3 \times 9 = 27)$

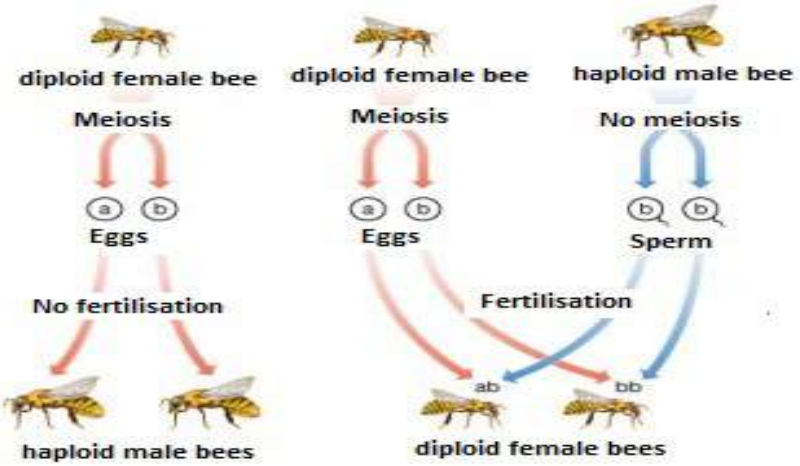
(a) What is amniocentesis? What is this significance? **(1+2=3)**

Answer:- Amniocentesis is a diagnostic procedure undergone during pregnancy. It a process in which amniotic fluid is sampled using a hollow needle inserted into the uterus, to screen for abnormalities in the developing fetus. The significance of Amniocentesis is to check If the karyotype of the baby is (are) normal , If there is evidence of a neural tube defect , If there is evidence that the baby might have had an infection and If the lungs of the baby are ready to breathe.

(b) What is sex chromosome? Give the method of sex determination in honeybee. **(1+2=3)**

Answer:- A sex chromosome is a type of chromosome that participates in sex determination. Humans and most other mammals have two sex chromosomes, the X and the Y. Females have two X chromosomes in their cells, while males have both X and a Y chromosomes in their cells. Egg cells all contain an X chromosome, while sperm cells contain an X or Y chromosome.

This arrangement means that it is the male that determines the sex of the offspring when fertilization occurs. Honeybees show haplodiploid method of sex determination. Haplodiploidy is a sex determination mechanism in which males develop from unfertilised eggs and are haploid, and females develop from fertilised eggs and are diploid. This mode of sex determination was first discovered by Johann Dzierzon, a Catholic priest, in 1845. In honeybees, sex is normally determined by the fertilisation or non-fertilisation of the eggs, rather than the presence or absence of sex chromosomes. In honeybees, the male progeny normally develops from unfertilised eggs, which are haploid and have just one set of chromosomes. The fertilised honeybee eggs, which are diploid and have two sets of chromosomes, differentiate into queens and worker bees.



Sex determination in honeybees

OR

Give the significance of principles of Hardy-Weinberg equilibrium. **(3)**

Answer:- The Hardy-Weinberg equilibrium is important primarily because it describes the situation in which there is no evolution, and thus it provides a theoretical baseline for measuring evolutionary change. The equilibrium tendency

serves to conserve gains which have been made in the past and also to avoid too rapid changes; in other words, giving a genetic stability to the population.

The Hardy-Weinberg equation describes conditions that are not found in natural population. The function of the Hardy-Weinberg principle, and its equation, is as an experimental control— a prediction of what the allelic and genotypic frequencies should be if nothing acts to alter the gene pool

(c) What is biofertilizer? Write how microbes are used as biofertilizer. **(1+2=3)**

Answer:- Biofertilizers are the substance that contains microorganism's living or latent cells. They increase the nutrients of host plants when applied to their seeds, plant surface or soil by colonizing the rhizosphere of the plant. They refer to the use of microbes instead of chemicals to enhance the nutrition of the soil. As a result, it is also less harmful and does not cause pollution. This is what makes them so important

to organic farming because they are completely environment - friendly.

The following microorganisms are used as biofertilizers:

- Rhizobium: They form root nodules in leguminous plants and fix the atmospheric nitrogen into an organic form. Rhizobium also has no negative effect on soil quality and improves the quality, nutrient content, and growth of the plant.
- Azotobacter: These are free-living nitrogen fixers found in all types of upland crops. These not only fix nitrogen but also provide certain antibiotics and growth substances to the plant.
- Azospirillum: Unlike Azotobacter, these can be used in wetland areas. They are found inside the roots of the plant (non-free living) where they fix the atmospheric nitrogen.
- Blue-green algae: These are free-living nitrogen-fixing Cyanobacteria that are present only in wet and marshy lands. However, they do not survive in acidic soil.
- Mycorrhiza: It is a symbiotic association between the fungi and the roots of a plant. The mycorrhizal fungi play an important role in binding the soil together and improves the activity of the microbes. The fungi draw water and nutrients from the soil thereby increasing the plant productivity. It also helps the plant to survive under various environmental stresses.

OR

What is drug abuse? Give an example each of a stimulant and a tranquilizer drug. (1+1+1=3)

Answer: Drug abuse are a serious public health problem that affects almost every community and family in some way. It is the use of a drug in amounts or by methods which are harmful to the individual or others. Drugs most often associated with this term include:
alcohol, amphetamines, barbiturates, benzodiazepines, cannabis cocaine, hallucinogens, methaqualone, and opioids.

Example of a stimulant drug is dextroamphetamine and example of a tranquilizer drug is Valium.

(d) Name one bacterial disease of poultry birds. Mention its main symptom and control. **(1+1+1=3)**

Answer:- Bacterial disease of poultry birds is Pullorum. It is generally a disease of young chicks and poults. Symptoms are anorexia, depression, diarrhea, decreased egg production, high fever, increased mortality etc. To control this disease, obtain your birds or hatching eggs from a hatchery participating in the National Poultry Improvement Plan (NPIP). Do not mix NPIP-certified flocks with noncertified birds. Maintain a rigorous biosecurity program.

(e) What is hybridization? Mention the ways by which emasculation is done. (1+2=3)

Answer:- Hybridization is the process of combining different varieties of organisms to create a hybrid. A hybrid, or crossbreed, is the result of combining the qualities of 2 organisms of different breeds, varieties, species or genera through sexual reproduction. Emasculation is the process of removal of the male reproductive organs from an organism. In plants, it is done by removing the stamens of a flower before they achieve reproductive maturity. This is usually done in bisexual flowers to prevent self pollination. Emasculation is followed by bagging the flower and then the desired pollen grains are introduced on the stigma for hybridization.

(f) Define genetic engineering. Name one genetically modified organism. (1+2=3)

Answer:- Genetic engineering is the process of modifying an organism of a genetic level- for example, inserting or modifying a gene into an organism is genetic engineering. It is defined as the direct manipulation of an organism's genes including heritable and nonheritable recombinant DNA constructs. Herbert Boyer and Stanley Cohen made the first genetically modified organism in 1973, a bacteria resistant to the antibiotic kanamycin. The first genetically modified animal, a mouse, was created in 1974 by Rudolf Jaenisch, and the first plant was produced in 1983.

(g) What is transgenic cell? Mention two ways in which vector with recombinant DNA is introduced into a cell. (1+2=3)

Answer:- A transgene is a gene that has been transferred naturally, or by any of a number of genetic engineering techniques from one organism to another. The introduction of a transgene has the potential to change the phenotype of an organism transgene describes a segment of DNA containing a gene sequence that has been isolated from one organism and is introduced into a different organism. This non-native segment of DNA may either retain the ability to produce RNA or protein in the transgenic organism or alter the normal function of the transgenic organism's genetic code. The ways by which vector with recombinant DNA is introduced into a cell are Transduction, Transformation or Transfection.

OR

Mention three aspects of Bio-safety issues. **(3)**

Answer:- Biosafety issues refer to the procedures, policies, and principles to be adopted to safeguard the environment and the human population. It refers to the containment principles, strategies, and practices that are adopted to prevent exposure to pathogens and toxins. Its main objective is to keep a check on harmful biological agents, toxins, chemicals, and radiation. With the advent of genetic engineering, biosafety measures have gained importance to ensure public and environmental safety.

Three aspects of bio-safety issues are:

1. Laboratory safety, Biological waste disposal

2. Bloodborne pathogens (BBP), Recombinant DNA (rDNA)

3. Biohazards used in animal models etc.

(h) Mention types of RNA and their functions. **(3)**

Answer:- Types of RNA and their functions are :

tRNA – Transfer RNA

The transfer RNA is held responsible for choosing the correct protein or the amino acids required by the body in-turn helping the ribosomes. It is located at the endpoints of each amino acid. This is also called as soluble RNA and it forms a link between the messenger RNA and the amino acid.

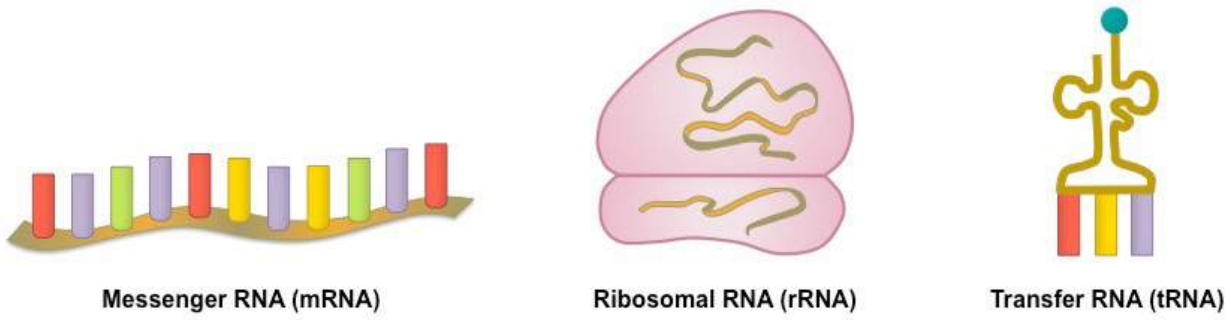
rRNA- Ribosomal RNA

The rRNA is the component of the ribosome and are located within the in the cytoplasm of a cell, where ribosomes are found. The Ribosomal RNA is primarily involved in the synthesis and translation of mRNA into proteins in all living organisms. The rRNA is mainly composed of cellular RNA and are the most predominant RNA within the cells of all living organisms.

mRNA – Messenger RNA.

As the name itself tells, this RNA is responsible for carrying the genetic material to the ribosomes and insists as to what kind of proteins is required by the body. Hence it is called messenger

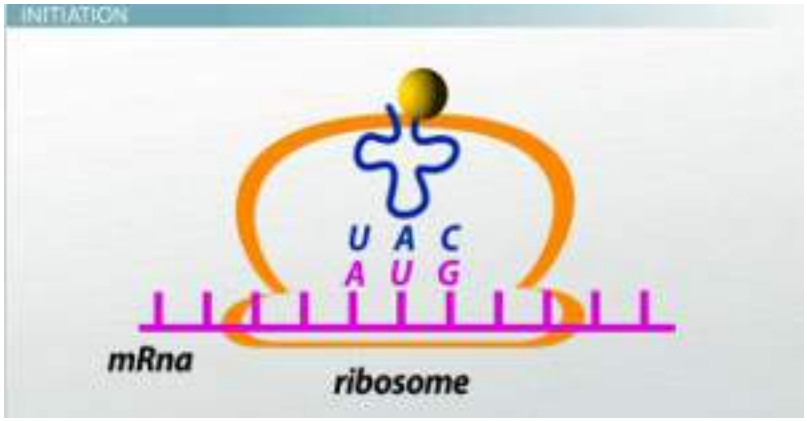
RNA. Usually, this m-RNA is involved in the process of transcription or during the protein synthesis process.



OR

Describe the initiation phase of translation process. **(3)**

Answer: During initiation, the mRNA, the tRNA, and the first amino acid all come together within the ribosome. The mRNA strand remains continuous, but the true initiation point is the start codon, AUG. The start codon is the set of three nucleotides that begins the coded sequence of a gene. The start codon specifies the amino acid methionine. So, methionine is the name of the amino acid that is brought into the ribosome first. Methionine get itself to the ribosome by attaching to the tRNA that contains the right anticodon. The anticodon for AUG is UAC. The tRNA with the anticodon UAC will automatically match to the codon AUG, bringing the methionine along. So now mRNA is attached to tRNA, and tRNA is attached to methionine. This is the initiation phase of translation process.



(i) What do you mean by productivity and decomposition? What is microclimate? **(1+2=3)**

Answer:- Productivity is the process of synthesis of organic compounds/biomass from inorganic matter using sunlight by producers (plants). It traps energy and builds up biomass from inorganic nutrients.

Decomposition is the process of breaking down of a substance/waste biomass into its constituent parts by decomposers (bacteria, fungi). It releases energy and inorganic nutrients from the biomass.

Microclimate is the suite of climatic conditions measured in localized areas near the earth's surface. These environmental variables—which include temperature, light, wind speed, and moisture—provide meaningful indicators for habitat selection and other ecological activities.

OR

Mention the ways in which water becomes polluted. **(3)**

Answer:- Ways in which water becomes polluted are :

Sewage And Waste Water: Sewage, garbage and liquid waste of households, agricultural lands and factories are discharged into lakes and rivers. These wastes contain harmful chemicals and toxins which make the water poisonous for aquatic animals and plants.

Dumping: Dumping of solid wastes and litters in water bodies causes huge problems. Litters include glass, plastic, aluminum, styrofoam etc. Different things take different amount of time to degrade in water. They affect aquatic plants and animals.

Industrial Waste: Industrial waste contains pollutants like asbestos, lead, mercury and petrochemicals which are extremely harmful to both people and environment. Industrial waste is discharged into lakes and rivers by using fresh water making the water contaminated.

Oil Pollution: Sea water gets polluted due to oil spilled from ships and tankers while traveling. The spilled oil does not dissolve in water and forms a thick sludge polluting the water.

Acid Rain: Acid rain is pollution of water caused by air pollution. When the acidic particles caused by air pollution in the atmosphere mix with water vapor, it results in acid rain.

Global Warming: Due to global warming, there is an increase in water temperature. This increase in temperature results in death

of aquatic plants and animals. This also results in bleaching of coral reefs in water.

Eutrophication: Eutrophication is an increased level of nutrients in water bodies. This results in bloom of algae in water. It also depletes the oxygen in water, which negatively affects fish and other aquatic animal population

3. Answer the following questions (Alternative arc to be noted): $(5 \times 3 = 15)$

(a) What is menstrual cycle? Describe briefly the uterine changes during different phases of the menstrual cycle. (1+4=5)

Answer:- Menstrual cycle is the monthly menstrual bleeding or period that women have from their early teens until menopause which comes around the age of 50. This cycle has four phases :

1. Follicular phase –

High levels of follicle stimulating hormone (FSH) are secreted which stimulates the follicle in the ovaries. One follicle matures and brings an egg to maturity from 1-14 days. These follicles secrete estrogen and its increased levels causes endometrial proliferation.

2. Ovulation phase –

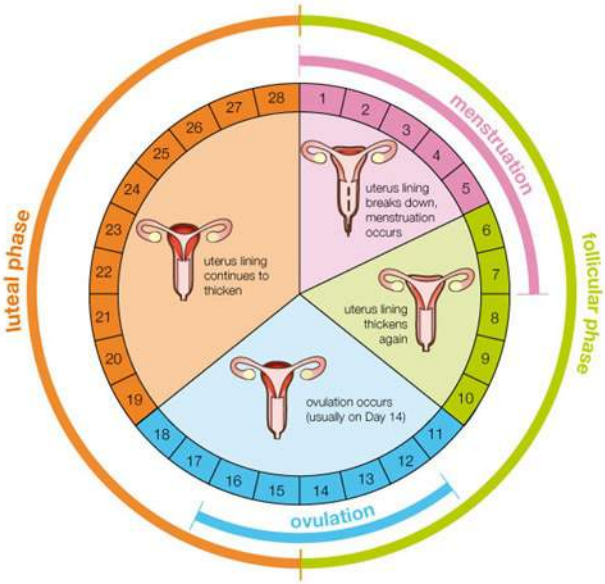
Follicle ruptures and release the mature egg on the 14th day due to LH surge. Decreased level of estrogen is seen.

3. Luteal phase –

After releasing the egg by rupturing, the follicle turns into corpus luteum in approx. 15-28th day. This secretes progesterone to prepare endometrium for implantation. If there is no fertilization, then corpus luteum degenerates leading to decreased levels of progesterone and estrogen.

4. Menstruation –

Degeneration of corpus luteum causes endometrial degeneration which marks the beginning of a new cycle.

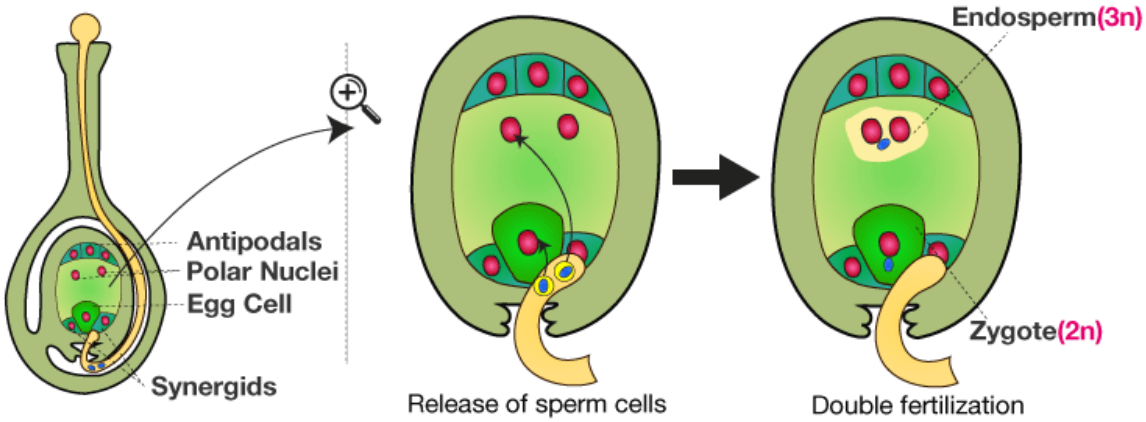


OR

Describe the fertilization process of a flowering plant mentioning the formation of endosperm and embryo. **(3+2=5)**

Answer:- Angiosperms are flower-bearing plants and are the most diverse group of terrestrial plants. The flowers form the reproductive part of angiosperms with separate male and

female reproductive organs. Each contains gametes – sperm and egg cells respectively. Pollination helps the pollen grains to reach stigma via style. The two sperm cells enter the ovule-synergid cell. This proceeds to fertilization which is the process of fusion of gametes. In angiosperms, fertilization results in two structures, namely, zygote and endosperm, hence named, double fertilization. It is a complex process where out of two sperm cells, one fuses with the egg cell and the other fuses with two polar nuclei which result in a diploid (2n) zygote and a triploid (3n) primary endosperm nucleus (PEN) respectively. Since endosperm is a product of the fusion of three haploid nuclei, it is called triple fusion. Eventually, the primary endosperm nucleus develops into the primary endosperm cell (PEC) and then into the endosperm. After fertilization, the zygote divides into the upper terminal cell and lower basal cell. The basal cell develops into suspensor which helps in the transport of nutrients to the growing embryo. The terminal cell develops into proembryo.

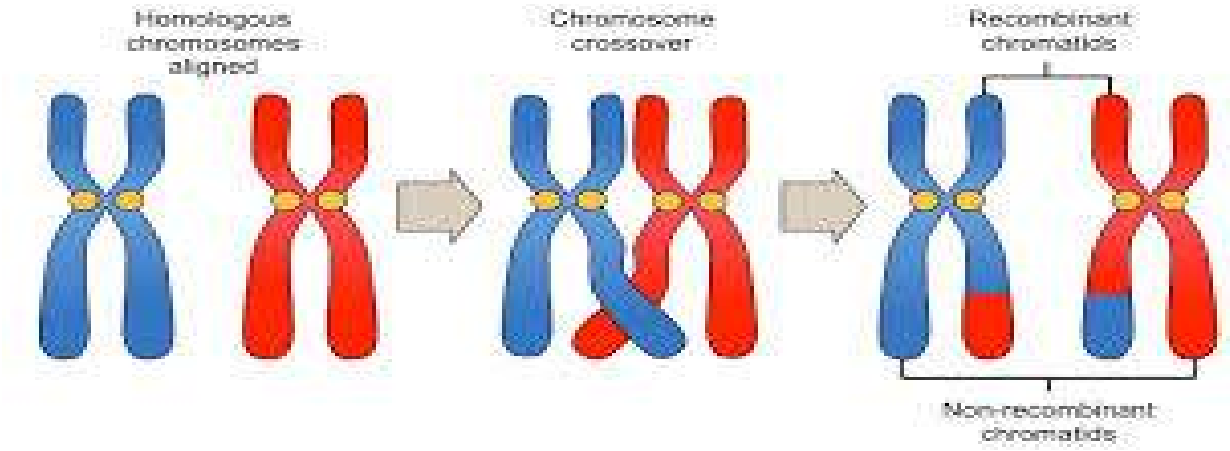


(b) Give evidences in favor of chromosomal theory of inheritance. What is crossing over? **(3+2=5)**

Answer:- Boveri and Sutton's chromosome theory of inheritance states that genes are found at specific locations on chromosomes, and that the behavior of chromosomes during meiosis can explain Mendel’s laws of inheritance. Thomas Hunt Morgan, who studied fruit flies, provided the first strong confirmation of the chromosome theory. Morgan discovered a mutation that affected fly eye color. He observed that the mutation was inherited differently by male and female flies. Based on the inheritance pattern, Morgan concluded that the eye color gene must be located on the X chromosome. He concluded that the gene must lie on, or be very tightly associated with, the X chromosome 7,9. A strong confirmation of this conclusion came later, from Morgan's student Calvin Bridges. Bridges showed that rare male or female flies with unexpected eye colors were produced through nondisjunction of sex chromosomes during meiosis—basically, the exception that proved the rule 10,11. Morgan also found mutations in other genes that were not inherited in a sex-specific pattern. So, we now know that genes are borne on both sex and non-sex chromosomes, in species from fruit flies to humans.

Crossing over is process by which the two chromosomes of a homologous pair exchange equal segments with each other. Crossing over occurs in the first division of meiosis. At that stage each chromosome has replicated into two strands called

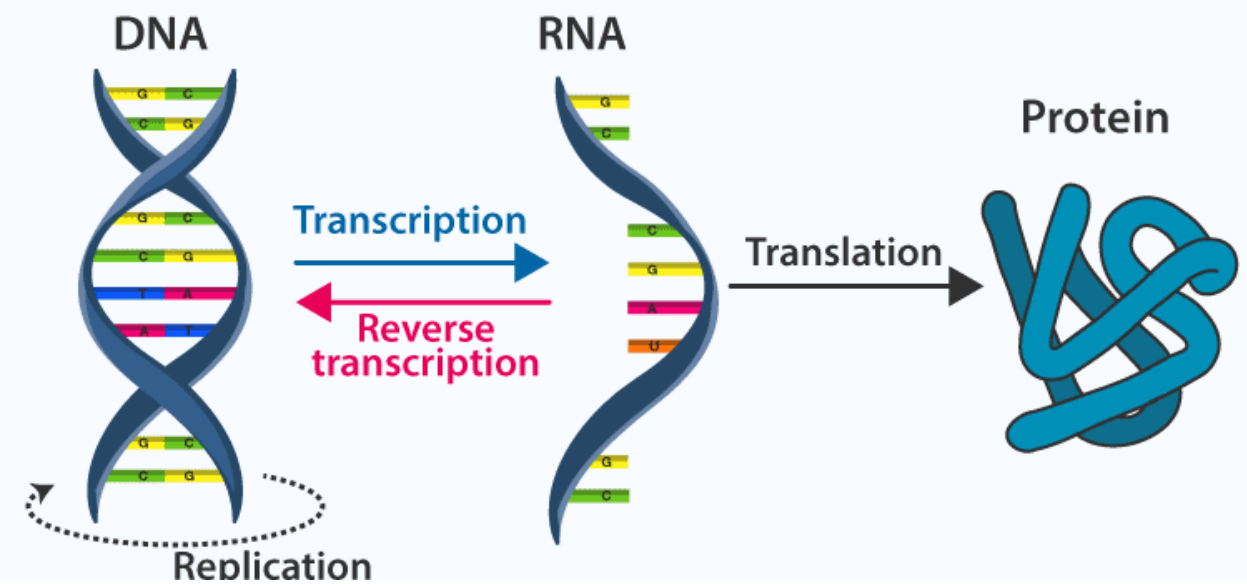
sister chromatids. The two homologous chromosomes of a pair synapse, or come together. While the chromosomes are synapsed, breaks occur at corresponding points in two of the non-sister chromatids, i.e., in one chromatid of each chromosome. Since the chromosomes are homologous, breaks at corresponding points mean that the segments that are broken off contain corresponding genes, i.e., alleles. The broken sections are then exchanged between the chromosomes to form completely new units, and each new recombined chromosome of the pair can go to a different daughter sex cell. Crossing over results in recombination of genes found on the same chromosome, called linked genes, that would otherwise always be transmitted together. Because the frequency of crossing over between any two linked genes is proportional to the chromosomal distance between them, crossing over frequencies are used to construct genetic, or linkage, maps of genes on chromosomes.



OR

What is central dogma of molecular biology? Describe the main features of transcription process. **(1+4=5)**

Answer:- The central dogma was discovered by Francis' Crick in the year 1958. It is the conversion of DNA instructions into proteins. According to central dogma, the genetic information flows from DNA to RNA to form a functional product, protein. The DNA gets converted into RNA by the process of transcription. This RNA forms proteins by the process of translation.



Main features of transcription process are:

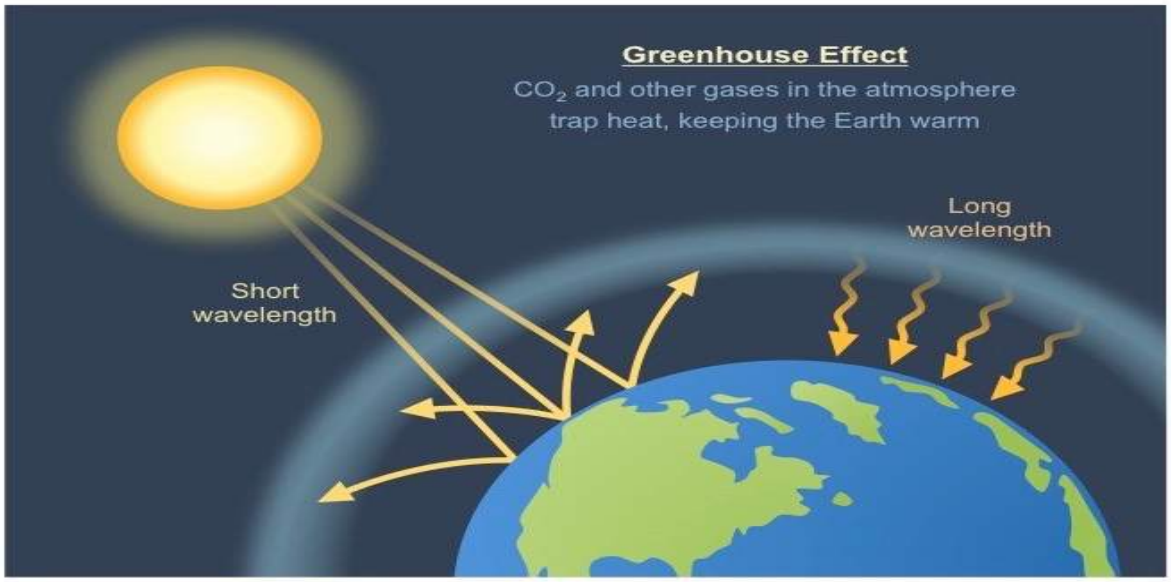
Initiation: RNA polymerase binds to a sequence of DNA called the promoter, found near the beginning of a gene. Each gene (or group of co-transcribed genes, in bacteria) has its own promoter. Once bound, RNA polymerase separates the DNA strands, providing the single-stranded template needed for transcription.

Elongation: One strand of DNA, the template strand, acts as a template for RNA polymerase. As it "reads" this template one base at a time, the polymerase builds an RNA molecule out of complementary nucleotides, making a chain that grows from 5' to 3'. The RNA transcript carries the same information as the non-template strand of DNA, but it contains the base uracil (U) instead of thymine (T).

Termination: Sequences called terminators signal that the RNA transcript is complete. Once they are transcribed, they cause the transcript to be released from the RNA polymerase.

What do you mean by greenhouse effect? State the significance of global warming. **(2+3=5)**

Answer:- The greenhouse effect is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without this atmosphere. Radiatively active gases ie greenhouse gases in a planet's atmosphere radiate energy in all directions. The most common greenhouse gases are water vapor, carbon dioxide, and methane.



Global Warming is important since it helps determine future climate expectations. Through the use of latitude, one can determine the likelihood of snow and hail reaching the surface. You can also be able to identify the thermal energy from the sun that is accessible to a region. Global Warming is the scientific study of climates, which is defined as the mean weather conditions over a period of time. A branch of study within atmospheric sciences, it also takes into account the variables and averages of short-term and long-term weather conditions.

PART-B (Marks:18)

1. Find out the correct answer out of the options given against each question: $(1 \times 14 = 14)$

(i) Where do you find binary fission?

(a) Bacteria

(b) Starfish

(c) Tapeworm

(d) Riccia

Answer:- Bacteria

(ii) The chromosome number of a spore mother cell of a certain angiosperm is 24. What will be the chromosome number of its endosperm cell?

(a) 24

(b) 12

(c) 48

(d) 36

Answer:- 36

(iii) An essential component of a contraceptive pill is

(a) Thyroxine

(b) Oxytocin

(c) Progesterone

(d) Testosterone

Answer:- Progesterone

(iv) Where many phenotype traits are controlled by only one gene, this phenomenon is known as

(a) Multiple Allele

(b) Epistasis

(c) Pleiotropy

(d) Incomplete dominance

Answer:- Pleiotropy

(v) Coacervate is

(a) Lipoprotein

(b) Mixture of ammonia, carbohydrate and water

(c) Fatty acid

(d) Colloidal material

Answer:- Colloidal material

(vi) 'AUG' is the genetic code for which of the following amino acids?

(a) Methionine

(b) Tyrosine

(c) Valine

(d) Serine

Answer:- Methionine

(vii) Who proved for the first time that the origin of life is not spontaneous?

(a) Operin

(b) Pasteur

(c) Urey and Miller

(d) Haldane

Answer:- Pasteur

(viii) T-Iymphocytes are responsible for which kind of immunity?

(a) Inborn immunity

(b) Humoral immunity

(c) Cellular immunity

(d) None of these

Answer:- Cellular immunity

(ix) Process for obtaining large number or plantlets through tissue culture is known as

(a) Plantlet culture

(b) Macropropagation

(c) Organ culture

(d) Micropropagation

Answer:- Micropropagation

(x) Commercially, human insulin is produced from which transgenic organism?

(a) Rhizobium

(b) E. Coli.

(c) Bacillus

(d) Saccharomyces

Answer:- E. Coli.

(xi) Which one of the following is called 'molecular scissors' ?

(a) Taq polymerase

(b) Recombinant DNA

(c) Restriction endonuclease

(d) None of these

Answer:- Restriction endonuclease

(xii) ’Chipko Movement' is related to which one of the following?

(a) Salim Ali

(b) Amrita Devi

(c) S. Bahuguna

(d) J.L. Nehru

Answer:- S. Bahuguna

(xiii) Which of the following is responsible for ozone layer destruction?

(a) CFC

(b) Oxides of nitrogen

(c) CH4

(d) All of these

Answer:- All of these

(xiv) Growth curve of human population will be

(a) ’S' shaped

(b) ’J’ shaped

(c) 'Z' shaped

(d) None of these

Answer:- ‘S’ shaped

2. Answer the following questions (Alternatives are to be noted): $(1 \times 4 = 4)$

(i) Name the lactogenic hormone.

Answer:- Prolactin

OR

What is geitonogamy?

Answer:- Geitonogamy is a type of pollination in which pollen grains of one flower from the anther are transferred to the stigma of another flower of the same plant.

(ii) Give an example of co-dominance.

Answer:- An example of co-dominance is AB blood group type :

People with this blood type have A and B proteins at the same time. The ABO gene determine what blood type a person has, and everyone has two copies of this gene, one from each parent. There are several combinations of blood types that can result, but when a person has both an A and a B allele, it will lead to blood types visible in the blood, AB.

(iii) Name one fungal bio-control agent.

Answer:- Fungi used as bio-control agents are Trichoderma harzianum, Metarhizium anisopliae , Beauveria bassiana etc.

OR

Name the organism responsible for filariasis.

Answer:- Wuchereria bancrofti is responsible for filariasis.

(iv) What is biome?

Answer:- Biomes are areas of the world which are defined by climate as well as geography. The plants and animals that live in a specific biome are physically well adapted for that area. Examples of biomes include desserts, forests, grasslands, tundra and several types of aquatic environments.