

Version No.			

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Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

BIOLOGY SSC–II (2nd Set Solution)

SECTION – A (Marks 12)

Time allowed: 15 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

- (1) In which of the following organism alcoholic fermentation takes place?
 A. *Saccharomyces cerevisiae* B. *Streptococcus species*
 C. *Lactobacillus species* D. *Homo sapiens*

- (2) Which one of the following row correctly describe the functions of the diaphragm, cilia and mucous in human gaseous exchange system?

	Diaphragm	Cilia	Mucous	
A	Contracts to cause breathing out	Trap bacteria from air	Absorb CO ₂ coming from alveoli	<input type="radio"/>
B	Contracts to cause breathing in	Carry mucous to the throat	Trap dust and bacteria from air	<input checked="" type="radio"/>
C	Relaxes to cause breathing in	Filter dust from air	help in sound production	<input type="radio"/>
D	Relaxes to cause breathing out	Produce mucous	Decrease acidity	<input type="radio"/>

- (3) In which one of the following method of artificial vegetative propagation, a new plant can be grown on another plant?

- A. cutting B. tissue culturing
 C. cloning D. grafting

- (4) Which one of the following row shows substances that are present in each of the structures of excretory system of a healthy human?

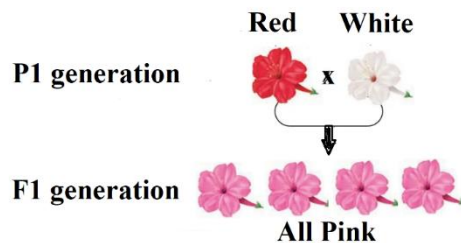
	Renal artery	Renal vein	Ureter	Urinary bladder	
A	glucose	glucose	salts	urea	<input checked="" type="radio"/>
B	protein	salts	water	protein	<input type="radio"/>
C	salts	water	protein	glucose	<input type="radio"/>
D	urea	glucose	protein	salts	<input type="radio"/>

- (5) Gouty arthritis is primarily caused due to:
- A. degeneration of cartilage
 - B. inflammation of membrane at joint
 - C. decreased calcium levels in bones
 - D. Accumulation of uric acid crystals

- (6) By identifying the plants in the following diagram, find the most relevant statement about such plants:



- A. They are protein rich so highly preferred food of the insects
 - B. They are most common in dry harsh conditioned such as deserts
 - C. They grow in the soil which lacks minerals & nitrogen compounds
 - D. They have mutualistic association with insects
- (7) Four characters of a specific hormone are listed below
- Increased rate and intensity of heart beat
 - Increased blood pressure
 - Decreased blood flow to skin & alimentary canal
 - Increased blood flow to limb
- Which one of the following is this hormone?
- A. Adrenaline
 - B. Glucagon
 - C. Insulin
 - D. Testosterone
- (8) Four-O'clock plants shows incomplete dominance for flower colour. Following diagram shows a cross between red and white-flowered pure parental generations producing all pink-flowered plants.

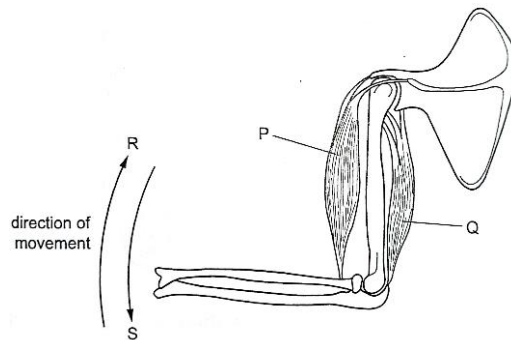


F1 x F1 (self crossed) = F2 generation (Phenotypic ratio = ?)

What will be the phenotypic ratio in F2 when two pink flowered plants of F1 are crossed?

- A. All pink flowered plants
- B. Red, Pink and white flowered plants in 1:2:1 ratio
- C. Red and white flowered plants in 1:1 ratio
- D. Red and white flowered plants in 3:1 ratio

- (9) Which one of the following statement is true for the eustachian tube?
 A. it separates middle ear from inner ear
 B. it has sound receptor cells
 C. it regulates air pressure on both sides of the tympanum
 D. it directs sound waves to inner ear
- (10) Which one of the following is true for the group of antibiotics called cephalosporins?
 A. they are bacteriostatic in action
 B. they interfere with synthesis of bacterial cell wall
 C. they inhibit the folic acid synthesis in bacteria
 D. they inhibit the bacterial protein synthesis
- (11) Diagram given below shows pair of antagonistic muscles and the direction of movement they produce:

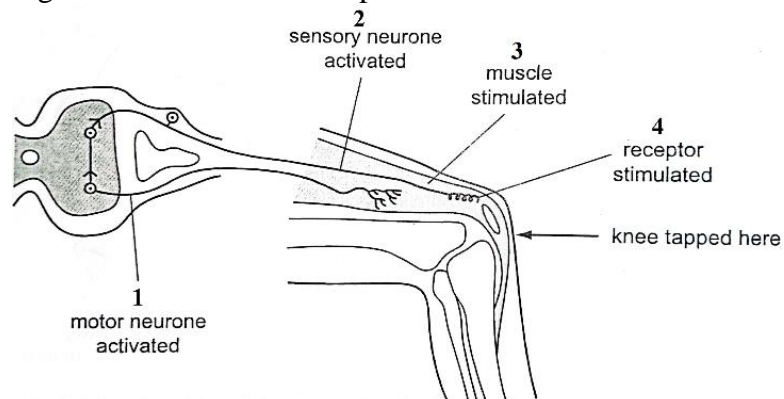


Which one of the following row correctly identifies these muscles and the direction of movement they produce on contraction?

	Muscle P		Muscle Q	
	Name	Movement	Name	Movement
A	Biceps	S	Triceps	R
B	Triceps	R	Biceps	S
C	Triceps	S	Biceps	R
D	Biceps	R	Triceps	S

-

- (12) Diagram given below shows a simple reflex arc:



What is the correct sequence of events after the knee is tapped?

- A. 1 → 2 → 3 → 4
 B. 1 → 4 → 2 → 3
 C. 4 → 2 → 1 → 3
 D. 4 → 3 → 2 → 1



Federal Board SSC-II Examination
Biology Model Question Paper
(Curriculum 2006)

Time allowed: 2.45 hours

Total Marks: 53

Note: Answer any eleven parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 33)

Q.2 Attempt any **ELEVEN** parts from the following. All parts carry equal marks. Be brief and to the point. (11 × 3 = 33)

- i. a. How acid rains are produced? Describe any two damages caused by acid rains to the living organism. (2)

Answer: Smoke and gasses especially oxides of sulphur and nitrogen emitted due to burning of fossil fuels accumulate in atmosphere and interact with water vapors in the presence of sunlight and form sulphuric acid and nitric acid. These acids remain as vapors at high temperature but as temperature falls acid vapors condense to acid droplets and mix with rain or snow results acid rain.

Damages:

1. Causes soil poisoning, damages leaves, flowers fruits & stunted growth of plants.
2. Toxicify water in lakes and rivers making it unfit for aquatic life and kill adult and larval fish.

- b. How eutrophication affects a fresh water lake? (1)

Answer: Higher contents of inorganic nutrients especially nitrates and phosphates due to addition of fertilizers and sewage in water results eutrophication. Eutrophication promote algal bloom and increase decomposers resulting low oxygen and less light penetration to deep water producers.

- ii. Briefly state the roles of the following human organs in homeostasis. (3)
a. Lungs b. Skin c. Kidneys

Answer:

a. Lungs remove excess CO₂ from body which is an acidic gas and affect the pH of blood and body tissue. Lungs also balance the O₂ levels in the blood and other body tissue for use in aerobic respiration

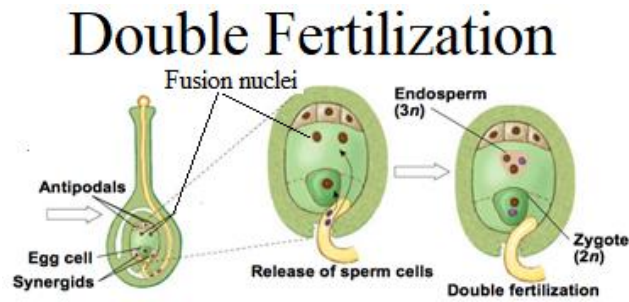
b. Skin maintains the body temperature (thermoregulation) by insulation of fat layer and “goose bumps” in cold and by evaporative cooling of sweat in hot. Skin also remove excessive salts and water during sweating and sebum.

c. Kidneys filter excess water, salts, urea, uric acid etc. and excrete in the form of urine thus balances the blood composition.

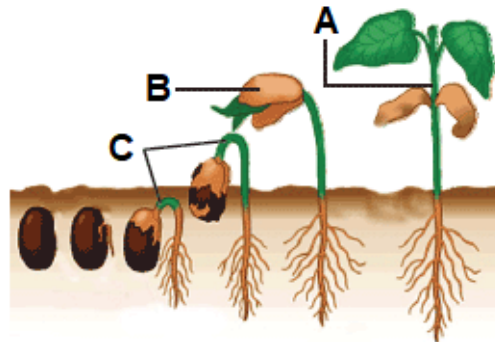
- iii. Double fertilization is a unique event in the life cycle of an angiospermic plant. Describe and sketch the process, also explain the fate of products of double fertilization. (3)

Answer: After pollination pollen grain germinate to develop a pollen tube containing a tube nucleus and two sperm nuclei. Inside the ovule macrospore undergo three consecutive mitosis to produce female gametophyte containing an egg (IN), fusion nuclei (2N) and other associated cells. Pollen tube enters the ovule and transfer both the sperms for fusion with two different cells of female gametophyte so called “double fertilization”.

One sperm fertilizes with egg to produce diploid zygote (2N) and other sperm fuses with diploid fusion nuclei to produce triploid endosperm (3N) nucleus. Zygote develops into embryo and endosperm develops into food tissue for embryo in the seed.



iv. Following diagram shows a type of seed germination.



- Label the parts B and C (0.5)
- Name and describe this type of seed germination and give example. (1.5)
- Precisely state two basic requirements for seed germination. (1)

Answer:

a. Part B is **cotyledon** and Part C is **Hypocotyl**

b. Diagram represents epigeal seed germination, in which hypocotyl elongate and form a hook like structure which pulls the cotyledon above the ground. e.g. beans, cotton, castor and papaya.

c. Basic internal requirement for the seed germination are live embryo and sufficient food storage. External requirements include moisture (water), oxygen for aerobic respiration and suitable temperature range (25-30°C)

v. Why kidney stones are formed? How are they removed avoiding surgery?
Mention the contributions of Al-Farabi and Abul-Qasim in treatment of kidney stones. (1+1+1)

Answer:

Low intake of water results highly concentrated urine having crystals of different salts e.g. calcium oxalate, calcium, uric acids and ammonium phosphate. Such large crystals cannot pass in the urine and form hard deposits called kidney stones. Major causes of kidney stones are age, recurring urinary tract infections, alcohol consumption and diet rich in oxalates, salts and vitamins.

Most common non-surgical method for kidney stone removals is lithotripsy. Non-electrical shockwaves are bombarded from outside of the body targeting the dense stone to break. Small pieces of stone become sand like and pass through the urine.

Abu Nasar Al-Farabi wrote many books having information about kidney diseases, e.g., Kitab-ul-Burhan, Philosophy of Al-Farabi.

Abul-Qasim, great Muslim surgeon. He invented many surgical methods and over 200 surgical instruments. He is famous in removal of kidney and bladder stones.

- vi. Re-draw and complete the following table by adding the functions of given parts of the brain. (3)

Parts of Brain	Functions
Hypothalamus	
Hippocampus	
Medulla oblongata	

Answer:

Parts of Brain	Functions
Hypothalamus	Links the nervous system with endocrine system. Control the secretions of pituitary gland. Control the feelings of rage , pain, pleasure, water balance, thermoregulation
Hippocampus	Formation of new memories
Medulla oblongata	Controls autonomic function like breathing, heartbeat, swallowing and reflexes such as sneezing, coughing and vomiting.

- vii. Name two severely harmful components present in the cigarette smoke. How they affect health and social life of a smoker? (3)

Answer: Major harmful components in tobacco smoke include tar, nicotine, carbon monoxide, benzene and some heavy metals.

Tar has many carcinogens so cause cancer and increase production of mucous and phlegm. Tar also stains teeth and damage lungs tissue.

Nicotine causes increased heart rate and blood pressure, constricted blood vessels, increased platelets stickiness & blood clots and damages brain tissue.

So, Smokers have higher risk of having life threatening diseases e.g. lung and other cancers, cardiovascular and brain diseases. Socially smokers are disliked and people avoid sitting with them due to bad smell and injurious effects of smoking.

- viii. a. How bones and cartilage differ in their structure and cell types? (2)

Answer:

a.	Bone	Cartilage
Structure	Hardest connective tissue of body. Ground substance (matrix) of bone is made up of collagen fiber saturated with minerals e.g. calcium and phosphate.	Soft, elastic but tough connective tissue. Ground substance (matrix) of cartilage is also made up of collagen fiber.
	Outer hard layer is called compact bone, interior soft and porous part is called spongy bone which contain blood vessels and bone marrow (sight of blood cell production)	Cartilage lacks blood vessels. No blood cells are produced in cartilage.
Cell type	Mature bone cells called osteoblast.	Mature cartilage cells called chondrocyte.

- b. Name different types of cartilage. Which type of cartilage is present in larynx and trachea? (1)

Answer:

Three different types of cartilage are

- i) Hyaline cartilage ii) Elastic cartilage iii) Fibrocartilage

Hyaline cartilage is present in larynx and trachea.

- ix. a. Define antibiotics. Enlist the precautions that we must take while using antibiotics. (2)

Answer:

Any substance that kills or inhibits the growth and replication of any pathogen (bacteria) is called antibiotics. Following precautions must be followed for use of antibiotics.

1. Antibiotics can be taken only after the prescription by a registered physician.
2. Strictly follow the doctor's prescription for dose and duration of antibiotics use.
3. Always check the expiry of any medicine before use.
4. In case of any reaction to any antibiotic, immediately consult your doctor for advice.

- b. Why antibiotics are not effective against viruses? (1)

Answer: Antibiotics are mostly used against bacteria because antibiotics act on their cell wall, cell membrane or inhibit their enzymes and replication whereas virus does not have any of these components for the action of antibiotics.

- x. Compare **diabetes insipidus** and **diabetes mellitus** using following headings.
a. Causative factor b. Symptoms c. Similarity (3)

Answer:

	diabetes insipidus	diabetes mellitus
Causative factor	Deficiency or absence of antidiuretic hormone (ADH)	Deficiency or absence of insulin hormone
Symptoms	More urine and more thirst	More urine with sugar in urine, loss of weight, muscle weakening and fatigue.
Similarity	More and frequent urine production	More and frequent urine production

- xi. Describe causes, symptoms and management (prevention & treatment) of asthma. (3)

Answer:

Causes: Bronchi and bronchioles become sensitive to different allergens (pollen, smoke, perfumes and dust containing fungal spores) and show immediate and excessive response of constriction.

Symptoms: shortness of breath (especially with exertion or at night), fatigue, wheezing, coughing with pain and feeling of chest tightening.

Management: Avoid exposure to sensitive allergens. Avoid exertion and fatigue. Use of anti-inflammatory (anti allergic) drugs. Use of bronchiole dilator inhalers in severe asthmatic attack.

- xii. Two patients A & B presented at the ophthalmology department of hospital, person A diagnosed with defective rod cells and person B diagnosed with defective cone cells.

- a. Where are the rod and cone cells located in the eye? (0.5)

Answer: Rod and cone cells are located in the innermost light sensitive layer, retina of eye.

- b. How rod cells are important for normal eye functioning? (1)

Answer: Rod cells perceive dim light. They give us the image of object but not the colours. They contains a pigment called rhodopsin which is synthesized from vitamin-A. Deficiency of vitamin-A lead to deficiency of rhodopsin which causes

poor night vision called night blindness. Light breakdown the rhodopsin and its breakdown products generate the nerve impulse in optic nerve.

c. What type of problems will be faced to the person B? **(1.5)**

Answer: Person B will be colour blind as he will not be able to distinguish different colors of the object. Each of the three types of cone cells produce three different pigments called opsins which are necessary to recognize three primary colors.

xiii. a. Differentiate between ligaments and tendons. How are they important in movement of limbs? **(2)**

Answer:

Tendon	Ligament
Bands of connective tissues made up of more collagen.	Bands of connective tissues made up of less collagen.
They are tough and inelastic.	They are strong but highly flexible.
Connects ends of the muscles with bone.	Connects two or more bones at joint.
It exert a pulling force on the attached bone to move the bones at joint when muscle contracts.	Connects two or more bones at joint, keep the bone ends at their place and resist dislocation.

b. Define hinge joints, give example. **(1)**

Answer: Hinge joint is the joint which allow the movement of bones at joint in one plane (like hinge of the door) and two directions (back and forth) only. e.g. joint elbow and knee joints.

xiv. Define recombinant DNA technology. Outline the basic steps (in correct sequence) involved to achieve the objectives of recombinant DNA technology. **(3)**

Answer: It is the method used in genetic engineering in which selected DNA of one organism (donor) is cut and introduced to the genome (DNA) of another organism (recipient). So the DNA having combination of genes from two different organisms is called recombinant DNA.

Outline the basic steps

1. Isolation of gene of interest.
2. Insertion of gene into vector
3. Transfer of recombinant DNA vector into host organism.
4. Growth of the genetically modified organism
5. Expression of the genes.

xv. In the table given below, column-A represent names of chemicals or drugs (addictive & medicinal). Redraw the table and complete the column-B by describing the type and role of the chemical as done in first row. **(3)**

	Column-A (Names)	Column-B (Description)
1.	Marijuana	addictive drug & hallucinogen
2.	Aspirin	
3.	Cephalosporin	
4.	Diazepam	
5.	Dettol	
6.	Phenyl	
7.	Morphine	

Answer:

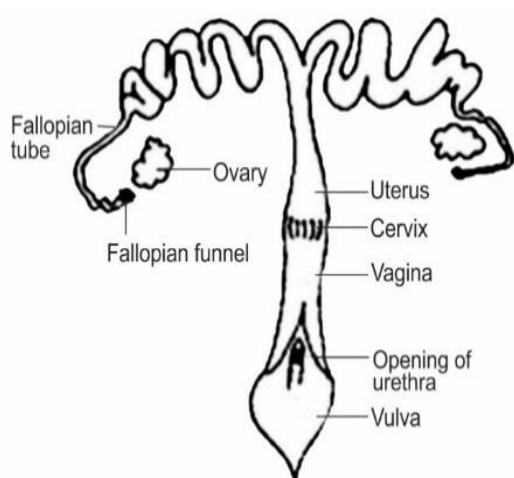
	Column-A (Names)	Column-B (Description)
1.	Marijuana	addictive drug & hallucinogen
2.	Aspirin	medicinal drug & analgesic
3.	Cephalosporin	medicinal drug & bactericidal antibiotic
4.	Diazepam	addictive medicine & sedative
5.	Dettol	antiseptic germicide
6.	Phenyl	disinfectant germicide
7.	Morphine	addictive narcotic & analgesic

SECTION – C (Marks 20)

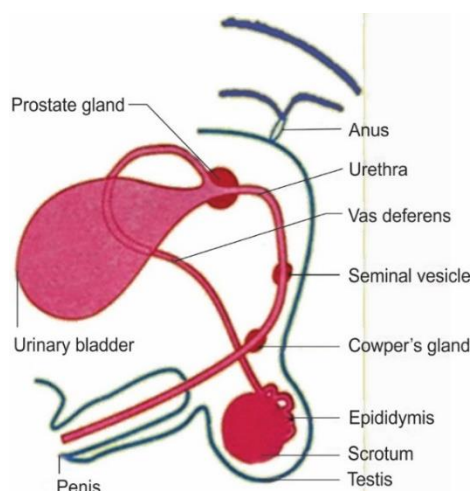
Note: Attempt any **TWO** questions. All questions carry equal marks. (2×10 = 20)

Q.3 a. Draw labeled diagrams of male and female reproductive systems of Rabbit. (2+2)

Answer:



FEMALE REPRODUCTIVE SYSTEM OF RABBIT



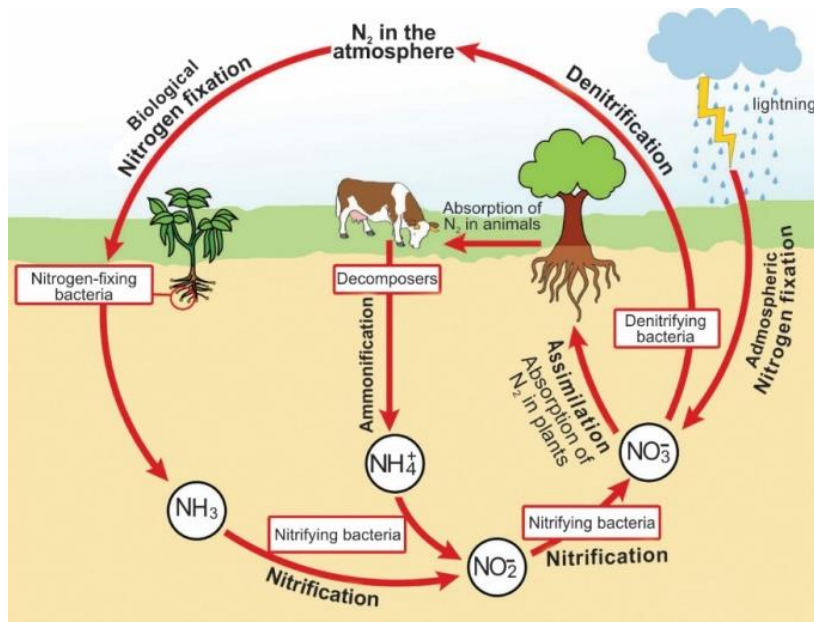
MALE REPRODUCTIVE SYSTEM OF RABBIT

b. Nitrogen cycle is an important biogeochemical cycle which enable the living organisms to manage their nitrogen as an essential component of major biomolecules. Describe and sketch different steps of Nitrogen cycle in detail. (4+2)

Answer:

Nitrogen Cycle

Nitrogen is needed by plants and animals for the synthesis of proteins and nucleic acids. Nitrogen gas makes up about 78% of the atmosphere by volume. Living organisms cannot use this nitrogen gas directly. Following are the steps involved in the process of nitrogen cycle.



1. Formation of Nitrates

It is done in following ways.

I. Nitrogen Fixation:

The conversion of nitrogen gas into ammonia or nitrates is called nitrogen fixation. It can occur by:

- a. **Atmospheric nitrogen fixation:** During thunderstorm atmospheric nitrogen combines with oxygen to form nitrates.
- b. **Biological nitrogen fixation:** Nitrogen fixing bacteria transform nitrogen gas into ammonia. Some of these nitrogen fixing bacteria live as symbionts in the roots of pea, beans etc., and also as free-living in the soil.
- c. **Industrial nitrogen fixation:** Nitrogen fixation is also done in industries. When hydrogen is combined with atmospheric nitrogen under high pressure and temperature it produces ammonia. Ammonia is converted into ammonium nitrate fertilizer.

I. **Ammonification:** The breakdown of proteins of dead organisms and nitrogenous wastes (urea, uric acid etc.) to ammonia is called ammonification. This process is done by ammonifying bacteria.

II. **Nitrification:** Ammonia is converted into nitrites and nitrates by a process called **nitrification**. It is done by nitrifying bacteria. First ammonia is converted into nitrites by bacteria e.g., *Nitrosomonas*. The nitrites are then converted into nitrates by other bacteria e.g., *Nitrobacter*.

2. Assimilation

The nitrates are absorbed by plants and utilized for making proteins, nucleic acid etc.

3. Denitrification

The conversion of the nitrates into nitrogen gas which escapes to the atmosphere is called denitrification. It is done by denitrifying bacteria.

Q.4 a. Describe and draw labeled flow diagram to show the production of insulin through genetic engineering. (4+2)

Answer:

To produce many products of interest such as insulin hormone through genetic engineering. Following are the basic steps in genetic engineering for gene transplantation.

1. Gene of interest

A gene is identified that controls insulin production. DNA containing insulin gene is collected from the donor organism that naturally has this gene.

2. Vector selection

Scientists isolate plasmid DNA from bacteria. This ring of DNA will carry the gene to the new organism. The plasmids or bacteriophage viruses can serve as a vector.

3. Restriction endonuclease

The insulin DNA and the plasmid DNA are mixed with restriction endonuclease enzyme (cutting enzyme). This enzyme cuts both kinds of DNA into pieces at special sequence.

4. Formation of recombinant DNA

The pieces of DNA which have complementary sequences join together to make a complete plasmid. This plasmid is now a ring of DNA that has a new gene in it so it is called recombinant DNA. DNA ligase (joining enzyme) is used to make bond between two types of DNA.

5. Transfer of recombinant DNA into host

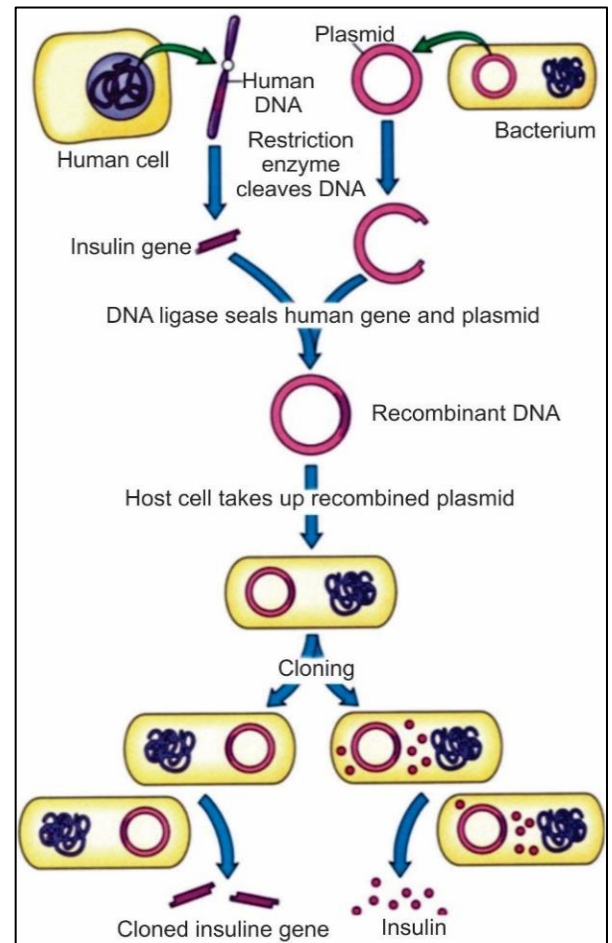
The recombinant DNA is mixed with other bacterial cells. Some of these bacteria will take the plasmids into their cells by a process called transformation. The cells containing the gene are identified and separated. These are genetically modified organism (GMO).

6. Growth of the GMO

Colonies of GMO are provided suitable growth conditions, as in fermenter.

7. Expression of the gene

The GMO contains the insulin gene and produces insulin hormone, which is separated from culture medium



b. Compare the mechanisms of hemodialysis with peritoneal dialysis. Give one merit and one demerit of both types (2+2)

Answer:

Hemodialysis	Peritoneal Dialysis
Membrane of dialysis machine is used as dialyzer	Peritoneum in abdominal cavity is used as dialyzer
Dialysis fluid automatically keep on circulating and replaced during the procedure	Dialysis fluid remains stagnant in peritoneal cavity during the procedure, so it has to be replaced repeatedly.
Patient has to be hospitalize and remain connected with machine during the dialysis	It can be performed at home and the patient remain free to do routine work during the dialysis

Merits	
More efficient	No hospitalization needed, patient remain at home
Demerits	
Patient has to be hospitalized	Less efficient

- Q.5** a. Describe mechanism of evolution by natural selection relating variation, competition and differential survival of moths in England. (5)

Answer:

The result of natural selection is a change in gene frequencies within the population over time, that is individuals with more favourable characteristics will become more common in the population and individuals with less favourable characteristics will become less common. A good piece of evidence for natural selection is seen in industrial melanism of the peppered moth *Bistonbetularia* in Britain.

Analyzing a case study of Variation and Selection

“Changes in the environment can bring about changes in a population by natural selection” In UK till 1848 all reported forms of the peppered moth (*Bistonbetularia*) appeared light coloured with dark patches. In 1848 a dark coloured moth was recorded and by 1895, 95% of the peppered moth population was dark coloured. This dark coloured variety arose by mutation.

The moths fly at night and during the day they rest on the trunks of trees. The light coloured moth was extremely well camouflaged as its colouration merged with that of the lichens growing on the trunk. With the spread of the industrial revolution, sulphur dioxide pollution from burning of coal killed off lichens growing on trees in industrial areas, exposing the darker bark. The tree trunk was further darkened by soot deposits



(a): Unpolluted Environment



(b): Polluted Environment

Fig. (a) The light and dark colored forms of the peppered moth are resting on a lichen-covered tree. (b) The light and dark colored forms of the peppered moth are resting on a lichen free tree trunk, which was darkened by industrial air pollution.

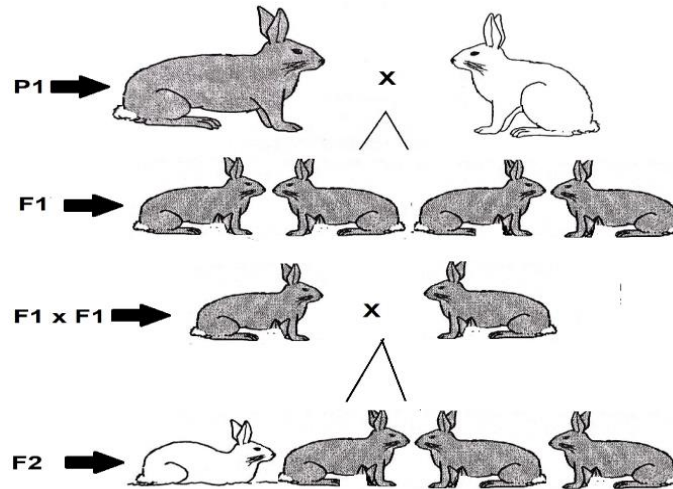
When the dark coloured moths rest on light trunks, they are seen and eaten by the birds. When light coloured moths rest on dark coloured trunk they are ‘seen and eaten by the birds’. The birds are acting as selective agents. The adaptive variation which produced the selective advantage was the dark colour. During the industrially polluted era of England, 90% of the peppered moth was black. The particular phenomenon is called ‘industrial melanism’. After 1950s the industrial pollution was controlled in England as a result light coloured moth number increased again.

Analysis:

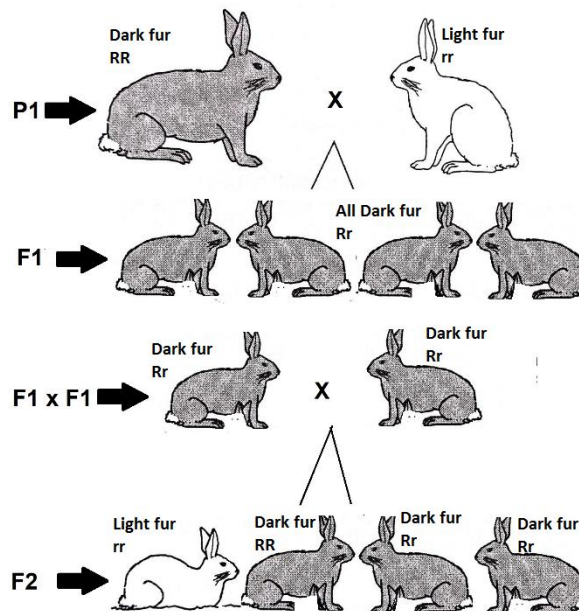
- (1) It is an example of variation that is subject to selection (by the birds) in the changing environment (change in the colour of bark).

- (2) It shows that evolution is truly an interaction of organism and environment.
- (3) It points out that evolution and natural selection operate on the basis of genetic change within a population.

- b. In rabbits, the allele for dark fur, “R” is dominant to the allele for white fur, “r”. The diagram given below, shows a series of crosses, starting from parental (P1) generation to first filial (F1) and finally to second filial (F2).

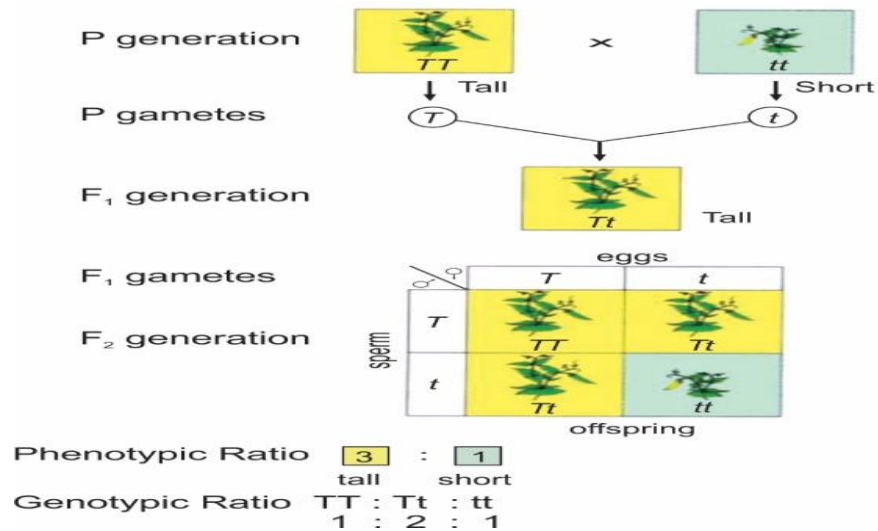


- i. Label the phenotypes and genotypes of the rabbits in the crosses (1)
Answer:



- ii. Recalling your knowledge of Mendel’s laws of inheritance and using phenotypic and genotypic ratios in above cross name, define and explain the law to which these crosses belong. (4)

Answer:



Phenotypic and genotypic ratios in above cross explains the law of segregation.

LAW OF SEGREGATION

One such experiment performed by Mendel involved height of plant, which may be tall or short. He selected true breeding plant varieties of contrasting heights. A true breeder produces offspring of its own type in successive generations if self-fertilization takes place.

He crossed true breeding tall plant with a true breeding short plant. All the offspring of next generation produced tall height. He called them monohybrid (hybrid in one trait) plants. Hybrid is a variety produced by crossing two contrasting true breeding parents. Also it showed dominance of tall height over short height.

The parental generation is denoted as P₁ generation. The offspring of P₁ generation are first filial generation F₁. The cross in F₁ generation produces F₂ generation.

The short height which being recessive failed to express in F₁ generation, appeared again in F₂ generation. The phenotypic ratio between tall and short height offspring of F₂ generation was 3:1.

Mendel also made crosses using six other pairs of contrasting traits and found similar results. On the basis of these results he concluded;

- True breeding varieties possess two factors (alleles) for any given trait.
- The F₁ generation possessed one allele from each parent which is carried by gametes.
- The alleles retain their individuality in F₁ generation.
- Only dominant allele shows its effect in F₁ generation and recessive factor reappears when in homozygous condition in F₂ generation.

These conclusions were called law of segregation which states: Traits of organisms are determined by two alleles which separate in gametes and reunite again at fertilization.

* * * *