

Biology [set 1]

Academic Year: 2018-2019

Date & Time: 6th March 2019, 11:00 am

Marks: 70

Duration: 3h

SECTION -A (8)

Question 1:

As the base sequence present on one strand of DNA decides the base sequence of other strand, this strand is considered as _____ [1]

Descending strand

Leading strand

Lagging strand

Complimentary strand

Answer: Complimentary strand

Question 2:

_____ shows haplo-diploid type of sex-determination. [1]

Pigeon

Honey bee

Parrot

Snake

Answer: Honey bee

Question 3:

Membrane bound receptors and hormones produce second messengers like _____ [1]

Renin

IP₃

ANF

GHRF

Answer: IP₃

Question 4:

During double fertilization second male gamete fuses with _____ [1]

antipodal cell

egg cell

secondary nucleus

synergids

Answer: Secondary nucleus

Question 5: What is Sinus arrhythmias? [1]

Answer: Sinus arrhythmias : During inspiration heart rate increases and during expirations it falls. This phenomenon is known as sinus arrhythmia.

Question 6: By which process ammonia is converted into urea in liver?

Answer: In ornithine cycle is the pathway in which ammonia is converted into urea in the liver.

Question 7: By which process ammonia is converted into urea in liver? [1]

Give the role of Plasmids in bacterial cell.

Answer: Role of plasmids in bacterial cell: Plasmids in bacteria carry genes related to metabolic activity and allowing the carrier bacterium to survive and reproduce under unfavourable condition.

Question 8: A person is showing symptoms like increased BMR, heart rate, pulse rate, blood pressure and deposition of fats in eye sockets. Name the disease he is suffering from. [1]

Answer: A person is suffering from Exophthalmic goiter or Grave's disease

SECTION -B (20)

Question 9: Define apiculture. Name the products obtained from it. [2]

Answer: Definition : Apiculture or bee keeping deals with artificial rearing of honey bees to obtain bee products.

Bee products like honey, wax, pollen, bee venom and royal Jelly as well as for crop pollination.

Question 10: Define biofertilizers. Give two types of fungal biofertilizers [2]

Answer: Definition : The biofertilizers are mostly nitrogen-fixing microbes which enrich soil with nutrients. Mycorrhiza is a fungus. It forms symbiotic association with the roots of higher plants. There are two types ; Ectomycorrhiza, Endomycorrhiza.

Question 11: Give the types of blood proteins and human hormone's produced by recombinant DNA-technique [2]

Answer: Blood proteins : Erythropoietin; Factors VII , VIII, IX; Tissue plasminogen activator; Urokinase.

Human Hormones : Epidermal growth factor; Follicle stimulating hormone ; Insulin.

Question 12: Write any two scientific and commercial values of transgenic animals in favour of human being. [2]

Answer: Study of diseases : Many transgenic animals are designed to study how genes contribute to the development of disease. **Vaccine safety :** Transgenic mice are being used to test the safety of poliovaccine.

Bioreactors : Transgenic animals would also be useful as bioreactors to produce pharmacologically important proteins such as alpha – 1 – antitrypsin.

Chemical safety testing : Transgenic animals carry genes which make them more sensitive to toxic substances than non transgenic animals.

Question 13: Define 'Respiratory Quotient' (RQ) and calculate the Respiratory Quotient for Carbohydrate. [2]

Answer: The ratio of volume of CO₂ evolved to the volume of O₂ consumed in respiration is called the respiratory quotient (RQ) or respiratory ratio. When carbohydrates are used as respiratory substrate and are completely oxidized, the RQ is 1, because volume of CO₂ evolved is equal to volume of O₂ consumed, as shown in the equation.



$$\text{RQ} = \frac{6\text{CO}_2}{6\text{O}_2} = 1.0$$

Question 14: Light and dark reactions are interdependant Explain. [2]

Answer: Interdependence of light and dark reaction: The two phases of photosynthesis, i.e. light and dark reactions are interdependent. The products of light reaction, i.e. ATP & NADPH₂ (assimilatory power) are required for dark reaction i.e. for reduction of CO₂ into glucose. During dark phase, ADP, iP, & NADP get regenerated, and are required for the synthesis of ATP & NADPH₂ during light reaction. Thus the two are interdependent. The dark reactions also take place during day.

Question 15: Classify the chromosomes on the basis of position of centromere. [2]

Answer: Types of Chromosomes :

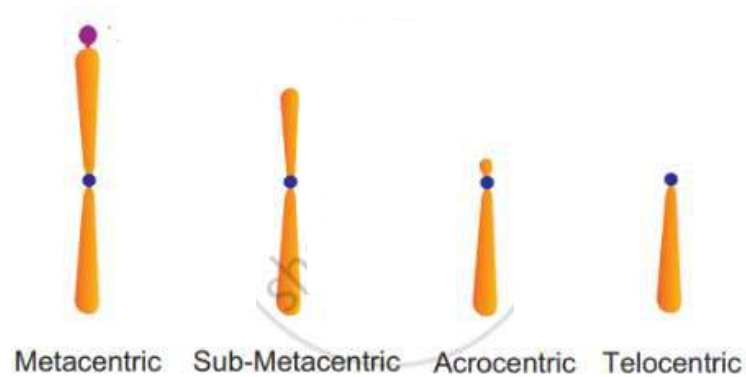
According to the position of the centromere, chromosomes are classified into following types

Metacentric : If the centromere is situated in the middle of the chromosomes it is called metacentric chromosomes.

Sub-metacentric : If the centromere is situated some distance away from the middle it is called submetacentric chromosomes.

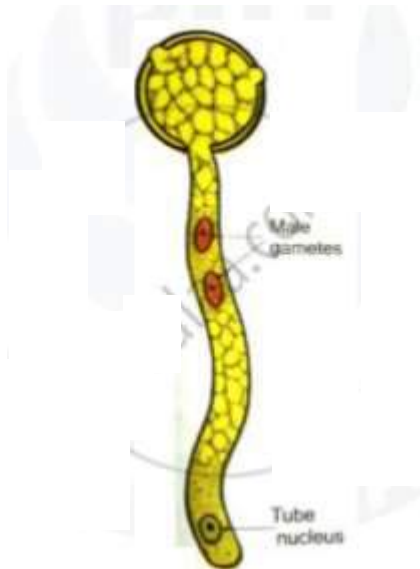
Acrocentric : If the centromere is situated near the end of the chromosomes it is called acrocentric chromosome

Telocentric : If the centromere is situated at the tip of the chromosome it is called telocentric chromosome.



Question 16: Sketch and label structure of male gametophyte in angiosperm. What is Siphonogamy? [2]

Answer:



Definition : The fertilization process in which non motile male gamete are transported up to the female gamete through a pollen tube is called Siphonogamy.

Question 17:

[2]

Group 'A'	Group 'B'
(a) Diethylc Carbamazine	(1) AIDS
(b) Widal test	(2) Pneumonia
(c) Albendazole	(3) Filariasis
(d) HAART	(4) Typhoid
	(5) Ascariasis

Answer:

Group 'A'	Answer
(a) Diethylc Carbamazine	(3) Filariasis
(b) Widal test	(4) Typhoid
(c) Albendazole	(5) Ascariasis
(d) HAART	(1) AIDS

Question 18:

[2]

Complete the following chart and rewrite.

Sr.No.	Agencies	type of pollination
1	Water
2	Entomophily
3	Bat
4	Ornithophily

(Or)

Explain outbreeding devices in angiospermic plants.

SECTION -C (27)

Question 19: What is Biofortification? Explain selective breeding with suitable example.

[3]

Answer:

Biofortification : It is a method of breeding crops to increase their nutritional value.

Selective Breeding : In this method, plant breeders search seed or germplasm banks for existing varieties of crops which are naturally high in nutrients.

(1) They then crossbreed these high-nutrient varieties with high - yielding varieties of crops, to provide a seed with high yields and increased nutritional value.

(2) Crops must be bred with sufficient amount of nutrients to have a measurably positive impact on human health.

(3) They must be developed with the involvement of nutritionists and should have extra nutrients, as storage, processing and cooking of the food affect their available nutrient levels. This method is prevalent at present, as it is quicker, cheaper, and less controversial than genetically engineering crops.

(4) Breeding crops with higher levels of vitamins and minerals or higher protein and healthier fats is the most practical means to improve public health.

(5) The objective of breeding for nutritional quality are improvement in protein content and quality, oil content and quality, vitamin content, micronutrient and mineral content.

For example :

1) Hybrid Maise with almost double the quantity of amino acids lysine and trptophan has been developed.

2) Wheat variety, Atlas - 66, with high protein content, has been used as a donor for improving cultivated wheat.

Question 20: In the light of Griffith's experiment, explain the action of two stains of *Diplococcus pneumoniae* and give his conclusion. [3]

Answer:

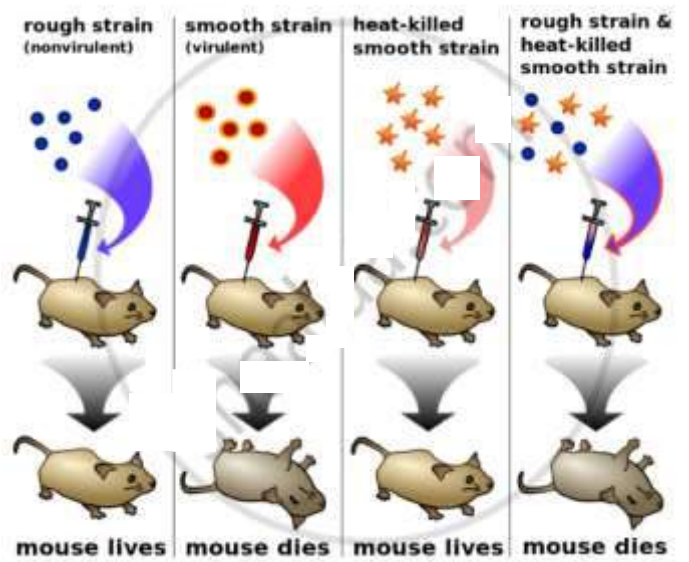
Griffith Experiment : The first series of experiments were performed by a British physician F. Griffith in 1928, using the bacterium *Diplococcus pneumoniae* which causes pneumonia in mammals. There are two types of strains;

(1) S-type, is capsulated and smooth and

(2) R-type is non - capsulated and rough.

When S-type of bacteria were injected into healthy mice, the mice developed pneumonia and died. Thus S-type of bacteria were injected into healthy mice, the mice developed pneumonia and died. Thus S-type is virulent or pathogenic. When R-type of bacteria were injected into healthy mice, they did not cause pneumonia. Thus R-type is avirulent or non-pathogenic. Conclusion: Griffith concluded that living R-type of bacteria must have picked up something from the surrounding medium that contains heat killed S-type, and got changed to S-type. This change is due to the phenomenon transformation.

He named that something as transforming principle. It was later proved that this transforming principle is DNA.



Question 21: Give scientific reasons:

[3]

- (A) The pyramid of energy is always upright.
- (B) In an ecosystem the energy flow is always unidirectional.
- (C) Ozone present in the stratosphere is called as “good ozone”.

Answer: (A) The pyramid of energy is always upright, it can never be inverted. When energy flows from a particular trophic level to next, some energy is lost as heat at every step.

(B) Energy flow in ecosystem is unidirectional as the energy captured by autotrophs does not go back to solar energy which passes to herbivores does not go back to autotrophs.

(C) Ozone present in the stratosphere is called as good ozone as this ozone absorbs UV rays from the sun which is harmful to living organisms. DNA and protein of living organisms absorb UV rays and its high energy breaks down the chemical bonds within these molecules. This causes damage to skin cells and skin cancer of different types. High dose of UV-B causes inflammation of cornea called snow-blindness cataract. This all is prevented by this stratosphere ozone as it absorbs UV rays.

Question 22: Define ‘reproductive isolation’ and explain two types of reproductive isolation.

[3]

Answer: Reproductive Isolation: Prevents interbreeding between the populations whether they are geographically isolation or living close together.

Types of Isolating mechanisms :

1. Pre-mating or pre-zygotic isolating mechanisms : In habitat Isolation, members of a population living in the same region occupy different habitat. Thus potential mates do not meet. In seasonal isolation, members of a population attains sexual isolation, members of a population attain sexual maturity at the different times, thus preventing interbreeding.

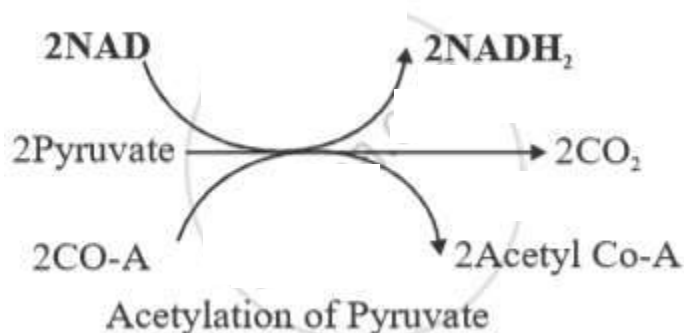
In ethological isolation, members of two populations have different mating behaviours. This prevents interbreeding.

In mechanical isolation, the members of two populations have differences in the structure of reproductive organs. So interbreeding is not possible.

2. Post-mating or post zygotic isolating mechanisms are : Gamete mortality (Sperms transfer takes place but egg is not fertilized), Zygote mortality (Egg is fertilized but zygote dies) and hybrid sterility (Hybrids are sterile)

Question 23: Name the connecting link between glycolysis and TCA cycle and explain it. [3]

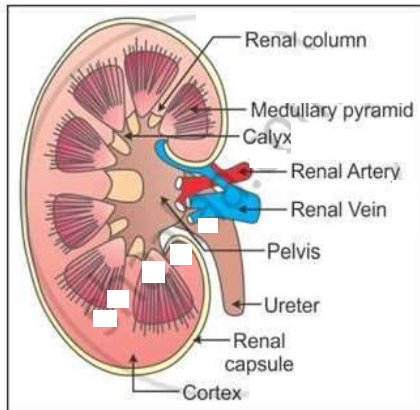
Answer: The connecting link between glycolysis and TCA cycle is Acetylation of pyruvate. Link reaction or acetylation of pyruvate: Pyruvic acid undergoes oxidative decarboxylation before entering Krebs cycle. Removal of carbon dioxide along with oxidation by removal of $2H^+$ takes place. The reaction is catalyzed by enzyme pyruvic dehydrogenase (oxidase). Co-enzyme NAD and co-enzyme -A, are required for this reaction. Pyruvic acid (3C) undergoes decarboxylation first and then oxidation by removal of $2H^+$, which is taken up by NAD and $NADH_2$ is formed. Acetyl fraction (2C) that remains after decarboxylation is taken up by co-enzyme A and Acetyl Co-A is formed. This is called Acetylation of pyruvate. Glycolysis ends with the formation of pyruvate and after acetylation enters as acetyl Co-A in the Kerbs cycle. Therefore, formation of acetyl Co-A or acetylation of pyruvate is called connecting link between glycolysis and Krebs cycle to link reaction. Pyruvate is converted to acetyl coenzyme-A in the perimitochondiral space. The whole process can be represented as follows.



Question 24: Explain internal structure of kidney with the help of suitable diagram. [3]

Answer: L.S. of kidney :

Each kidney is covered by semi-liquid fatty tissue called adipose capsule. Outer covering of this capsule is made up of tough fibrous connective tissue called renal fascia. In L.S., the kidney shows two regions within the capsule. Outer, renal cortex and inner, renal medulla.



Renal cortex: It is the outer region of kidney.

Renal medulla: It is lighter in color and divided into number of pyramidal regions called renal pyramids (6 to 20).

Renal pyramid- Each pyramid has a wide base attached to the cortex and narrow apex directed towards an inner space called renal papillae. Pyramids show striations that converge towards the apex.

Columns of Bertini: The renal column of Bertini is the part of the cortex continued inside medulla between pyramids.

Renal sinus/pelvis: The large funnel shaped space of the calyx is continued into pelvis situated near the hilum. The ureter is connected into pelvis situated near the hilum. The ureter is connected to the pelvis. This hollow region of the kidney is filled with its secretion i.e. the urine in the natural state. The edge of the pelvis contains cup like extensions called major and minor calyces. Each minor calyx receives urine from collecting ducts and about 7-8 collecting ducts join to form duct of Bellini toward papilla of pyramid.

Question 25: Explain the mechanism of reflex action with the help of a suitable diagram. [3]

Answer: Mechanism of Reflex action : The reflex action is completed in a series of events. The events that occur are,

- (1) Pricking of needle stimulates skin receptors by receiving stimulus,
- (2) Sensory impulse is formed and it is carried by dendrites innervating the skin.
- (3) Impulse is carried to the association neuron by axon of sensory neuron,
- (4) When impulse reaches the end of the axon there is a synapse.

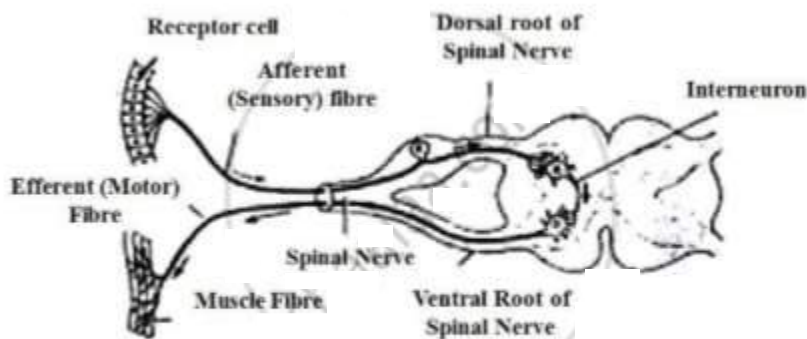


Diagram showing simple reflex arc

(5) Synaptic transmission is chemical: The synaptic buttons at the end of the axon releases a neurotransmitter substance acetylcholine. It fills the synaptic gap and helps in chemical transmission of the impulse from axon of one neuron to dendron of the other neuron. Once the impulse reaches the dendrites of association neuron, axonic buttons release an enzyme acetylcholine estrase which neutralizes the acetylcholine and again a synaptic gap is formed. This mechanism helps to receive new impulse or avoid the mixing of different impulses.

(6) The association neuron receive sensory impulse, interprets it, analyses it and generates motor impulse.

(7) Motor impulse again travels through synapse between association neuron and motor neuron.

(8) Impulse travels through motor neuron and reaches effector organ like skeletal muscles or the gland.

(9) The effector organ gives a proper response like contraction of the muscles or secretion by the gland.

For e.g., when the hand is pricked with a needle, immediately hand is withdrawn from the source.

Question 26: Define pollution. "Industries are pouring poison in water" – Explain [3]

Answer: Definition : "Substances present in the air / water / soil produced by the activity of mankind in concentration sufficient to cause harmful effect to his health, vegetables, property or to interfere with the enjoyment of his property is called as pollution".

(1) Most of the Indian rivers and fresh water streams are seriously polluted by industrial wastes and effluents. Such pollutants come along waste waters of different industries such as petrochemical complexes; fertilizer factories; oil refineries; pulp, paper, textile, sugar and steel mills, tanneries, distillaries, coal washeries, synthetic material plant for drugs, fibres, rubber, plastic etc.

(2) In India all the 14 rivers have become polluted. Some most polluted rivers in Maharashtra like Mula-Maratha in Pune, Panchganga in Kolhapur, Patalaganaga in Panvel are heavily polluted having a variety of industrial and petrochemical wastes. The river Ganga from Hardwar and Kolkata is regarded as one unending sewer which is fit only to carry urban liquid wastes, half burnt dead bodies, pesticides and insecticides.

Question 27: With the help of a suitable diagram, describe Ultra structure of the cell organelle, which is essential for photosynthesis. [3]

(OR)

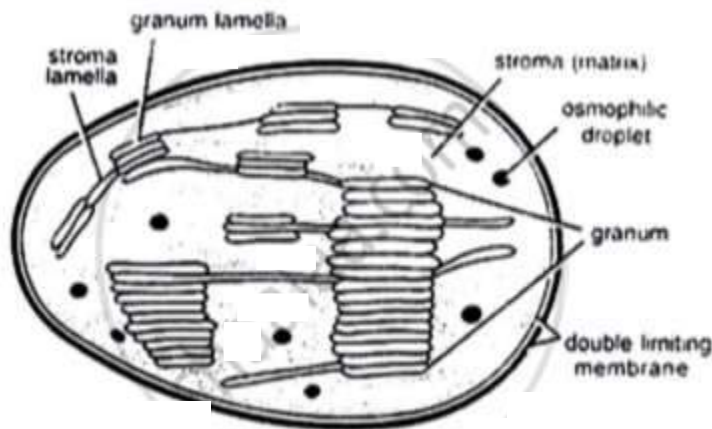
During photosynthesis "O₂ is evolved from water molecule and not from CO₂". Give the experimental proof given by Robert Hill.

Answer: (1) Chloroplast is a double membrane bound structure and an outer and inner membrane is collectively called peristromium.

(2) It encloses colourless, colloidal matrix called stroma, which contains enzymes for reduction of CO₂ into glucose (dark reaction), 70S ribosomes and DNA.

(3) DNA is circular, closed, naked ring and is called plastidome.

(4) As DNA is present, Chloroplast is self-replicating and semi-autonomous cell organelle.



Structure of chloroplast (redrawn after electron micrograph).

(5) Embedded in the stroma, there are approximately 40 to 60 green coloured structures called grana. Each granum consists of small, disc-like lamellae or thylakoids.

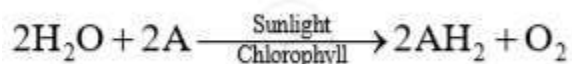
(6) Photosynthetic pigments are embedded in the thylakoids. ATP synthesis (light reactions) takes place in grana.

(7) Grana are interconnected by membranes called stroma – lamellae or intergrana or

fret membranes, which help in rapid transport of materials. (In prokaryotes, chloroplasts are absent and pigments are located in lamellae i.e. thylakoids).

(OR)

Robert Hill (1937) performed an experiment in which he suspended isolated chloroplasts from spinach leaves in water which was without CO₂. He then added ferric salts as hydrogen acceptor and the suspension was exposed to sunlight. He observed that ferric salts are reduced to ferrous and O₂ bubbles evolve. This is called photolysis of water of Hill Reaction and is represented as follows;



Here, 'A' is unknown hydrogen acceptor present in the chloroplasts.

SECTION -D (15)

Question 28: Explain with the help of a suitable diagram conducting system of human heart. [5]

(OR)

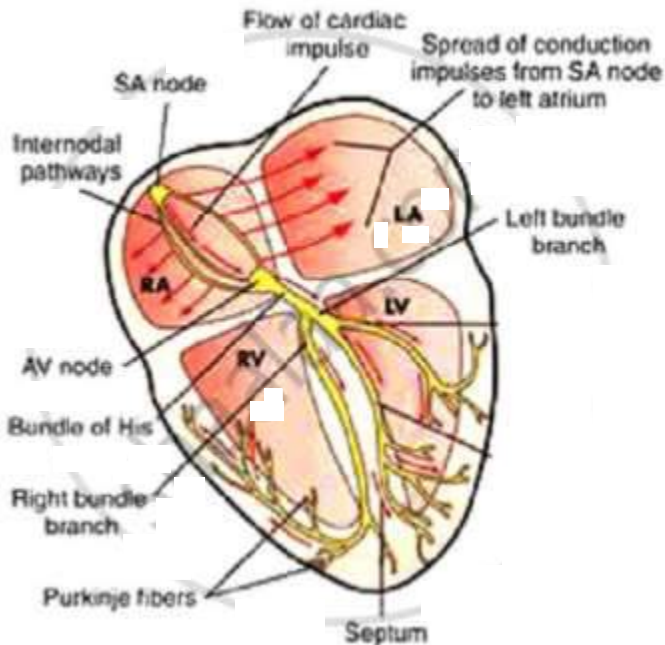
Give reasons :

- (1) Lymphatic vessels are milky in appearance.
- (2) Monocytes are called scavengers.
- (3) The wall of left ventricle is thicker than right ventricle.
- (4) Valves are present in the veins.
- (5) Pulmonary veins carry oxygenated blood.

Answer: Conducting system of heart :

- (1) Human heart is myogenic (myo-muscle, genic-originating from).
- (2) The heart beat originates in modified cardiac muscles called Sinoatrial node (SA node) which lies in the wall of right atrium near the opening of superior vena cava.
- (3) The SA node is called pace maker because it has power of generation of wave of contraction.
- (4) The wave of contraction of cardiac impulse generated by SA node is conducted by

cardiac fibres to both the atria causing their contraction (atrial systole).



(5) The atrioventricular node (AV node) is located in the wall of right atrium near the opening of coronary sinus receives the wave of contraction generated by SA node through internodal pathway.

(6) Bundle of His arises from AV nodes and divides into right and left bundle branches located in the interventricular septum.

(7) The bundle branches give rise to Purkinje fibres which penetrate into myocardium of ventricles.

(8) The bundle of His and Purkinje fibres conduct the wave of contraction from AV node to myocardium of ventricles causing their contraction (ventricular systole).

(OR)

(1) Lymphatic vessels are milky in appearance as fats are directly absorbed in intestine. Such lymphatic vessels are called lacteals.

(2) At the site of infection monocytes enlarge and differentiate into macrophages which engulf microorganisms and remove cell debris. Hence they are also called scavengers.

(3) Left ventricle has thickest wall as it has to pump blood to all parts of the body.

(4) They are thin walled with semilunar valves to prevent backward flow of blood.

(5) Pulmonary veins carry oxygenated blood as these came from lungs (other organ of the body) to the heart. In lungs, there is oxygenation of blood.

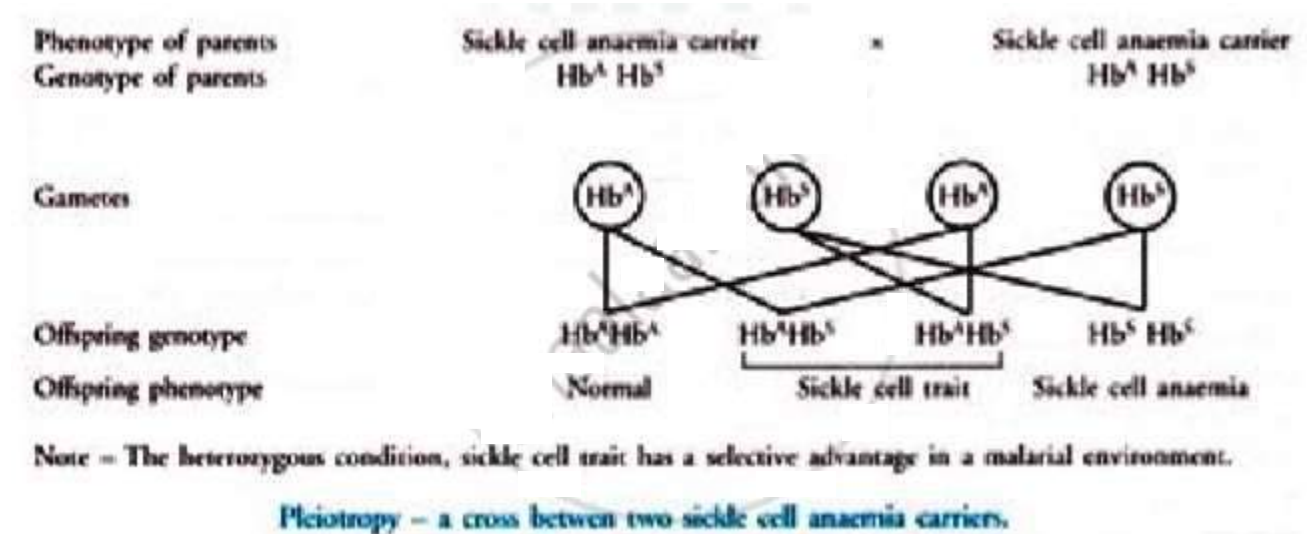
Question 29: Which phenomenon gives 2 : 1 ratio instead of 3 : 1 ratio? Describe with graphical representation. [5]

(OR)

A pea plant homozygous for yellow round seed is crossed with its recessive parents. Calculate the phenotypic and genotypic ratio with the help of checker board.

Answer: In Pleiotropy the ratio is 2 : 1 instead of 3 : 1.

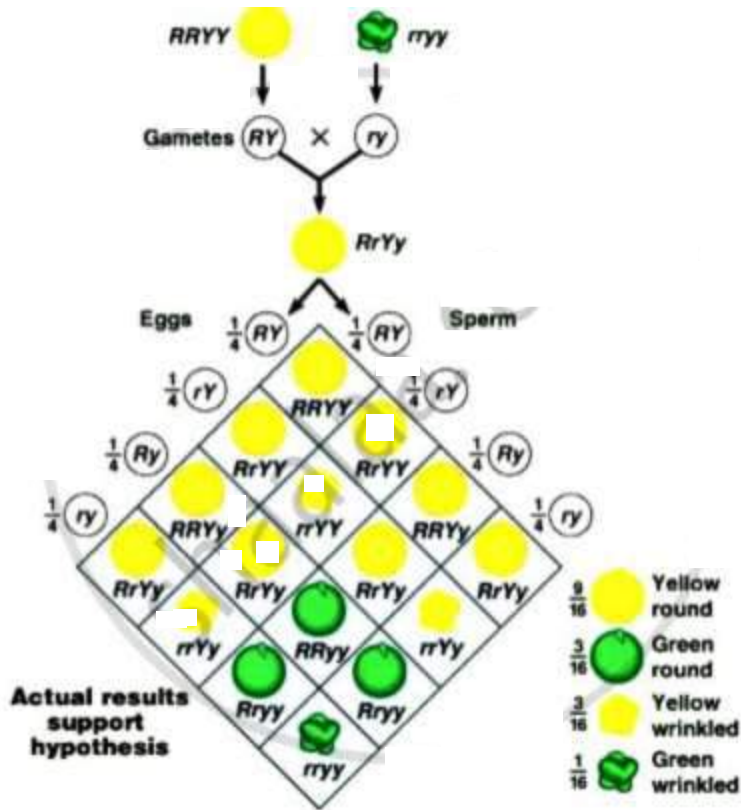
For example, the disease, sickle-cell anaemia, is caused by a gene HbS. Normal or healthy gene HbA, is dominant. The carriers (heterozygotes – HbA/HbS) show signs of mild anaemia as their RBCs become sickleshaped (half-moon-shaped) in oxygen deficiency. They are said to have sickle-cell trait and are normal in normal conditions. The homozygotes with recessive gene HbS, however, die of fatal anaemia. Thus the gene for sickle-cell anaemia is lethal in homozygous condition and produces sickle-cell trait in heterozygous carrier. Two different expressions are produced by a single gene and this is example of pleiotropy. (A gene which causes death of the bearer is called lethal gene) A marriage between two carrier will produce normal, carriers and sickle-cell anaemia children in 1 : 2 : 1 ratio.



Sickle – cel anaemics die leaving carriers and normals in the ratio 2 : 1.

(OR)

Mendel started with pure lines. Therefore, genotype of parent with yellow round seeds in YYRR and that of parent with green wrinkled seeds is yyrr. Both the parents are homozygous. Therefore, they would produce only one type of gamete i.e. YR and yr respectively. All F1 dihybrid seeds resulting from the cross will be heterozygous for both the traits and with genotype YyRr. Due to dominance, all the seeds of F1 generation will be yellow round.



Mendel allowed selfing of F1 dihybrids. During gamete formation by the dihybrids, the alleles in both the pairs separate (law of segregation). Each gamete will receive only one allele from each pair. A gamete that receives 'Y' for colour may receive 'R' for shape or 'r' for shape. This would result in the formation of YR and yr types of gametes. Similarly, a gamete that receives 'y' for colour may receive 'R' or 'r' for shape. This would result in formation of yR and yr types of gametes (Independent assortment). Thus F1 dihybrid would produce four different types of gametes in equal proportion. (Each type will be 25%).

There would be four types of male gametes and four types of female gametes and random fusion will take place during selfing. Due to this chance fusion ($4 \times 4 = 16$) sixteen combinations which fall into nine categories as shown in Punnett square are possible.

The nine different genotype are ; YYRR, YYRr, YyRR, YyRr, Yyrr, yyRR, yyRr and yyrr. The genotypic ratio is 1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1. Due to dominance there are only four phenotypes. The phenotypic ratio 9 : 3 : 3 : 1, is called dihybrid ratio.

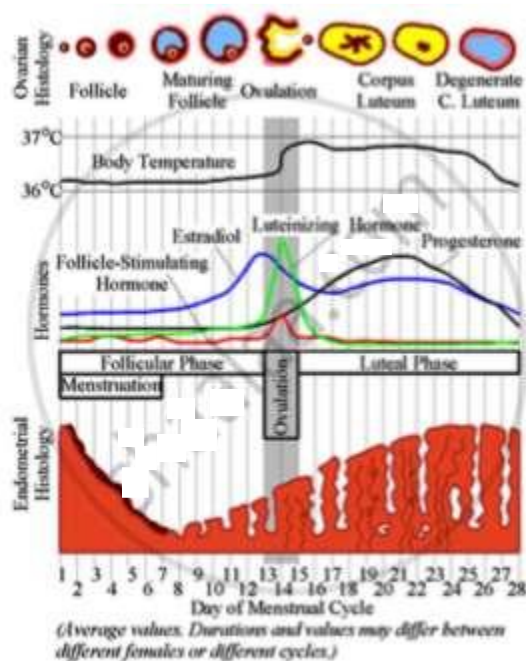
Question 30: After puberty human female shows cyclic changes in her reproductive system. Explain structural and hormonal changes in the uterus. [5]

(OR)

Give reasons :

- (1) Scrotal sac serves as thermoregulator.
- (2) Corpus luteum gets converted into corpus albicans in absence of fertilization.
- (3) Missing of menses is the first indication of pregnancy.
- (4) Surgical sterilization is a permanent method of birth control.
- (5) Human egg is microlecithal.

Answer: 1) Menstrual phase : When the ovum is not fertilized the high level progesterone inhibits secretion of luteinising hormone and LH level decreases. This results in decrease in the level of progesterone from corpus luteum. When the amount of progesterone further decreases and stimulates – anterior pituitary to secrete FSH and proliferative phase begins the basal part of endometrium remains intact and thickness is only about 1 mm.



2) **Proliferative phase :** During this phase the primordial follicle of the ovary develops into Graafian follicle. Many primordial follicles are already present in the ovary. The ovum becomes eccentric and it is connected by few follicular cells called germ cell or cumulus oophorus or discus proligerous. The granulosa cells lining the antrum form membrana granulosa and follicular cells surrounding the ovum are called corona radiata. The ovum increases in size.

Thick membrane is formed surrounding the outer surface of ovum. This is called zona pellucida. From stroma of ovary, follicle is covered with two layers called theca interna and theca externa. Theca interna is vascular layer with loose connective tissue. These cells become endocrine and secrete female sex hormone called oestrogens. Changes in Uterus : Oestrogen secreted by follicular cells of ovary stimulate

endometrial glands. This causes repair of endometrium. The endometrial cells proliferate and thickness of endometrium grows to about 3 mm to 5 mm.

3) **Ovulatory Phase** : Ovulation is the process in which there is rupture of Graafian follicle with discharge of ovum into abdominal cavity. It is under the influence of luteinising hormone. A sudden rise in level of LH stimulates ovulation which occurs usually on 14th day of menstrual cycle.

4) **Secretory phase** : Corpus luteum formed in ovary secretes progesterone. It causes further growth of endometrial glands. Uterine glands secrete fluid which is rich in glycogen for nourishing the dividing embryo. It is also called uterine milk. Thus, further increase in thickness of endometrium takes place (5 mm to 6 mm). If fertilization occurs, embryo is implanted in thickened endometrium.

(OR)

Scrotal sac serves as thermoregulator as it

(1) Regulates temperature for spermatogenesis in testis.

(2) As there is no fertilization at the end of secretory phase corpus luteum stops secreting progesterone and LH secretion also stops from anterior pituitary so corpus luteum gets degenerates to corpus albicans.

(3) Due to fertilization, corpus luteum increases in size and secretes progesterone and maintains thickness of endometrium due to this there is no menstruation. So, missing of menses is the first indication of pregnancy.

(4) Surgical sterilization is a permanent method of birth control as surgical intervention blocks gamete transport and prevent pregnancy.

(5) Human egg is microlecithal as it is almost free of yolk.