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TS-B2

SEAT NUMBER



**IIT INSPIRE**  
**ACADEMY OF SCIENCE**  
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XI & XII Science (CBSE/state)  
IIT- JEE (Mains + Advance)

NEET, MH-CET, NDA

Mo. No. 9595445177/9021445177

Branches : Chhatrapati Sq., Mangalmurti Sq.

4

(4 Pages)

calculator is not allowed.

- All symbols having their usual meanings unless otherwise stated.
- For each MCQ, correct answer must be written along with its alphabet.
- Evaluation of each MCQ would be done for the first attempt only.

**SECTION-A**

**Q.1 Select and write the correct answers to the following questions:**

**[10]**

1) Which of the following types require pollination but result is genetically similar to autogamy?

Ans:

**a) Geitonogamy**

**(1)**

2) Test tube baby technique is called \_\_\_\_\_

Ans:

**c) In Vitro Fertilization**

**(1)**

3) A colour-blind man marries a woman, who is homozygous for normal vision. The probability of their son being colour blind is \_\_\_\_\_

Ans:

**a) 0%**

**(1)**

4) Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency?

Ans:

**c) Insulin-Hyperglycaemia**

**(1)**

5) Abscisic acid controls \_\_\_\_\_

Ans:

**b) leaf fall and dormancy**

**(1)**

6) Diapause is performed by \_\_\_\_\_

Ans:

**d) leucocytes**

**(1)**

7) After landslide which of the following type of succession occurs?

Ans:

**a) Primary**

**(1)**

8) \_\_\_\_\_ is in direct contact of brain in humans.

Ans:

**d) Pia mater**

(1)

9) Most commonly used substrate for industrial production of beer is \_\_\_\_\_

Ans:

**a) barley**

(1)

10) Choose an incorrect statement:

Ans:

**d) Value of Z always keeps on changing for every taxonomic group or the region** (1)

**Q.2 Answer the following questions in one sentence:**

[8]

(1) **What is hay fever?**

(1)

**Ans:**

Hay fever is the allergic symptoms observed in people who are sensitive to pollen grains mainly of anemophilous plants.

(2) **Why is the genetic code considered as commaless?**

(1)

**Ans:**

The triplet codons are arranged one after the other on m-RNA molecule without any gap or space and therefore genetic code is considered as commaless.

(3) **Who are the main contributors of modern synthetic theory of evolution?**

(1)

**Ans:**

R. Fischer, J.B.S. Haldane, T. Dobzhansky, Huxley, E. Mayr, Simpson, Stebbins, Fisher, Sewall Wright, Medel, T.H. Morgan, etc. are the main contributors of modern synthetic theory of evolution.

(4) **Give expanded forms of IAA and 2-4, D.**

(1)

**Ans:**

1. **IAA:** Indole acetic acid.

2. **2-4, D:** 2,4-dichlorophenoxy acetic acid

(5) **Identify the type of cross given below. Give definition of the same.**

Parents (P) :  $\begin{array}{ccc} TT & \times & tt \\ \text{(Tall)} & & \text{(Dwarf)} \end{array}$

Gametes of P :  $\begin{array}{ccc} T & \times & t \end{array}$

$F_1$  generation :  $Tt$  (Tall)

(1)

**Ans:**

This is a back cross.

**Definition of back cross:** The cross of  $F_1$  progeny with any of the parents, irrespective of being dominant or recessive is called back cross.

(6) **Give examples of natural physical mutagens.**

(1)

**Ans:**

Natural physical mutagens are high temperature, high concentration of  $CO_2$ , X-rays, UV rays.

(7) **Define bio control.**

(1)

**Ans:**

Biocontrol is the natural method of eliminating and controlling insects, pests and other disease-causing agents by using their natural, biological enemies.

(8) **Name the causative agent of the following:**

(1)

(a) Typhoid (b) Ringworm

Ans:

- a) Typhoid: salmonella typhi  
b) ringworm: Trichophyton

### SECTION-B

Attempt any eight of the following questions:

[16]

Q.3 Match the column:

Column A	Column B
(1) Nutritive tissue of embryo	(a) Perisperm
(2) Remnants of nucellus in seed	(b) Cotyledon
(3) Nutritive tissue of developing microspores	(c) Endosperm
(4) First photosynthetic organ of embryo	(d) Tapetum

(2)

Ans:

- (1) Nutritive tissue of embryo – (c) Endosperm  
(2) Remnants of nucellus in seed – (a) Perisperm  
(3) Nutritive tissue of developing microspores – (d) Tapetum  
(4) First photosynthetic organ of embryo – (b) cotyledon

Q.4 Classify the following components of semen given below as per column 'A' and complete the column 'B' select from the given options:

(i) Acid phosphatase, (ii) Prostaglandins, (iii) Citric acid, (iv) Fructose, (v) Fibrinogen

Column A	Column B
(1) Seminal fluid	
(2) Prostatic fluid	

(2)

Ans:

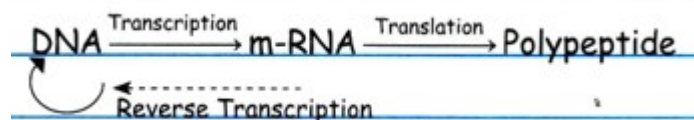
- 1) **Seminal fluid:** Prostaglandins, Fructose, fibrinogen  
2) **Prostatic fluid:** Acid phosphatase, Citric acid

Q.5 Explain central dogma of molecular biology.

(2)

Ans:

- Central dogma of molecular biology was postulated by F.H.C. crick in 1958. It is expressed as follows:  
DNA Transcription → m-RNA Translation polypeptide
- DNA gets transcribed to form m-RNA, m-RNA acts as a messenger and gets translated to form a polypeptide chain (protein) having specific amino acid sequence.
- This unidirectional flow of information from DNA to RNA and from RNA to proteins is referred as central dogma of molecular biology.
- Temin (1970) and Baltimore (1970) : Central dogma in retroviruses.



Q.6 Arrange the following stages of the human evolution in the order of their increasing cranial capacity.

(a) Neanderthal man, (b) Cro-Magnon man, (c) Homo erectus, (d) Homo habilis. (2)

Ans:

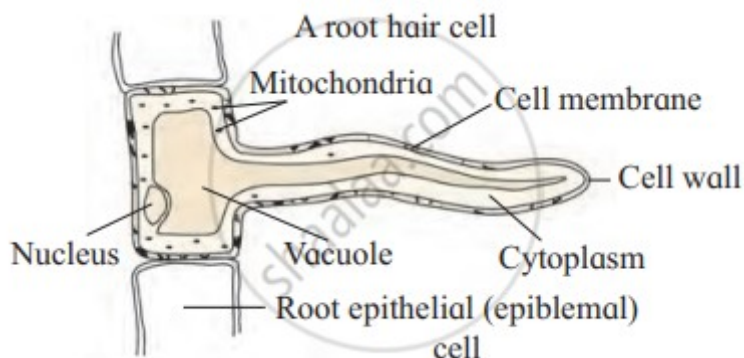
- (d) Homo Habilis\_(650-800 cc)  
(c) Homo erectus (850-1200 cc)

- (a) Neanderthal man (1400 cc)
- (b) Cro-Mango man (1450 cc)

**Q.7 Sketch and label the structure of root hair.**

**(2)**

**Ans:**



**Q.8 Where is water available for absorption by the roots? What is the meaning of combined water?**

**(2)**

**Ans:**

1. Water absorbed by the roots is present in their surrounding environment or rhizosphere.
2. The water present in the form of hydrated oxides of silicon, aluminium, etc. which cannot be absorbed by roots is called combined water.

**Q.9 Give functions of the following:**

**(a) Bulbourethral glands      (b) Bartholin's glands.**

**(2)**

**Ans:**

- a) Bulbourethral glands: Bulbourethral glands secrete alkaline, viscous mucus like fluid which provides lubrication during copulation.
- b) Bartholin's glands: Bartholin glands secrete lubricating mucus like fluid which is released in vestibule.

**Q.10 Match the columns:**

Column I	Column II
(1) Auxin	(a) Bolting in rosette plants
(2) Cytokinin	(b) Stimulate flowering in SDP
(3) Gibberellins	(c) Promotion of growth of lateral buds
(4) Abscissic acid	(d) Apical dominance

**(2)**

**Ans:**

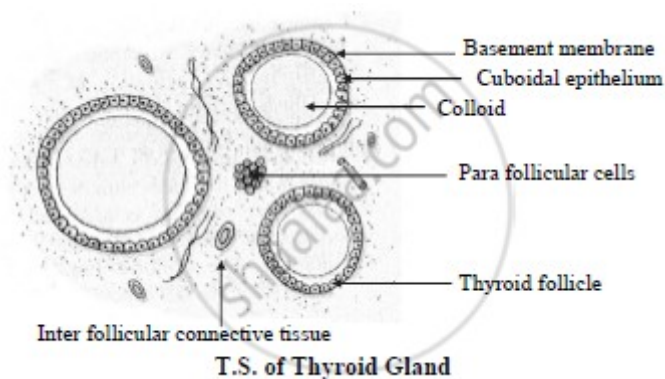
1. Auxin – (d) Apical dominance
2. Cytokinin – (c) Promotion of growth of lateral buds
3. Gibberellins – (a) Bolting in rosette plants
4. Abscissic acid – (b) Stimulate flowering in SDP

**Q.11 Sketch and label histology of thyroid gland.**

**(2)**

**Ans:**





**Q.12 Name the type of association seen in the following interactions:**

- (1) Humming bird and host flowering plants, (2) Crow feeding the hatchling of koel  
 (3) Cattle egret with buffalo (4) Tiger and deer. (2)

**Ans:**

1. Mutualism
2. Brood parasitism
3. Commensalism
4. Predator and prey relationship

**Q.13 Name eurythermal and stenothermal animals and plants.** (2)

**Ans:**

**Eurythermal animals:** Goat, man, cow, crab, bivalves, etc.

**Stenothermal animals:** Insects, reptiles, snakes, fishes, etc.

**Eurythermal plants:** Roses, daisies, oak trees, some fruits and orchids, some other fruits and vegetables.

**Q.14 Distinguish between blood and lymph.** (2)

**Ans:**

Blood	Lymph
1. Contains blood plasma with proteins and all three types of blood cells namely RBCs, WBCs and blood platelets.	1. Contains blood plasma without blood proteins, RBCs and platelets and contains lymphocytes.
2. Red in colour due to presence of RBCs.	2. Light yellow in colour and does not contain RBCs.
3. Carries oxygen in the body.	3. Does not carry oxygen.
4. The flow of blood in blood vessels is fast.	4. The flow of lymph in lymph capillaries is slow.
5. Lymphocytes are present.	5. Lymphocytes are present, more in number than those present in the blood.

**SECTION-C**

Attempt any eight of the following questions:

[24]

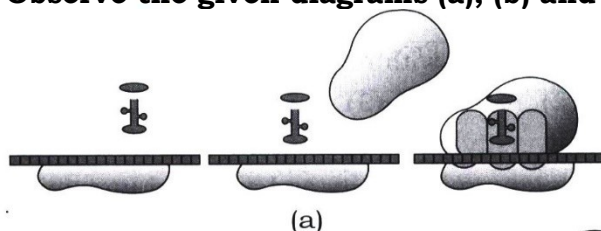
Q.15 Distinguish between proliferative phase and secretory phase of menstrual cycle.

(3)

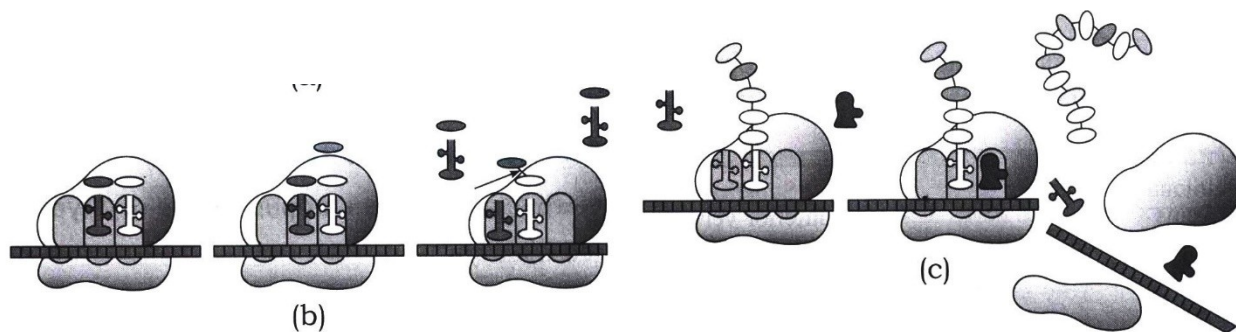
Ans:

Proliferative Phase	Secretory Phase
1. Proliferative phase begins with the repair of endometrium.	1. Secretory phase begins with ovulation.
2. Time required for proliferative phase is 5th to 13th day of menstrual cycle.	2. Time required for secretory phase is 15th to 28th day of menstrual cycle.
3. Proliferative phase always ends with ovulation.	3. Secretory phase ends with menstruation if egg is not fertilized. It continues further if egg is fertilized.
4. Proliferative phase is in uterus which coincides with follicular phase in ovary during which there is formation of Graafian follicle.	4. Secretory phase is in uterus which coincides with luteal phase in ovary during which there is formation of corpus luteum.
5. Proliferative phase is controlled by FSH from anterior pituitary.	5. Secretory phase is controlled by LH from anterior pituitary.
6. Hormone estrogen is secreted during this phase. It causes the development of blood vessels and thickening of endometrium of uterus.	6. Hormone progesterone is secreted during this phase. It causes further thickening and secretory activity of the glands of endometrium of uterus.

Q.16 Observe the given diagrams (a), (b) and (c) and answer the questions given







- (1) Which step of protein synthesis is shown in the following diagrams?
- (2) During initiation, which subunit of ribosome binds with m-RNA?
- (3) What are the three binding sites for t-RNA on ribosomes?
- (4) On which site of ribosome second and subsequent t-RNA arrives?
- (5) Which link is binding amino acids in diagram (b)?
- (6) Which chain is being released from ribosome in diagram (c)?

**Ans:**

- 1) Translation
- 2) 30S or 40S
- 3) P site, A site and E site
- 4) A site
- 5) Peptide link
- 6) Polypeptide chain

**Q.17 Write a short note on Homo habilis.** (3)

**Ans:**

- 1) Homo habilis is described as Handy man. His fossils were obtained from Olduvai Gorge in Tanzania, Africa.
- 2) He existed in late Pliocene or early Pleistocene about 2.5 to 1.5 million years ago.
- 3) He was lightly built.
- 4) Fossil of lower jaw was obtained which showed that his dentition was more like modern man with small molars.
- 5) He walked erect. His cranial capacity was 640 to 800 cc.
- 6) He did not eat meat and made stone tools.

**Q.18 Give an account of any six applications of gibberellins.** (3)

**Ans:**

- 1) Gibberellins break dormancy of bud, dormancy of seed.
- 2) They promote seed germination in cereals by activating or synthesizing enzyme amylase to produce sugar.
- 3) Gibberellins induce elongation of the cells in stem hence increase in internode length is noticed.
- 4) In rosette plants like cabbage, it causes 'bolting', that is increase in internode length before flowering.
- 5) Gibberellins are more effective in inducing parthenocarpy than auxins in plants like tomato, apple and pear.
- 6) It is also used to increase fruit size and length of bunches in grapes.

**Q.19 Name the gastrointestinal hormones and explain function of each in brief.** (3)

**Ans:**

- 1) There are scattered endocrine cells in different parts of alimentary canal.
- 2) These cells secrete four peptide hormones which are gastrin, secretin, cholecystokinin (CCK) and gastric inhibitory peptide (GIP).
- 3) Gastrin stimulates gastric glands for the secretion of hydrochloric acid and pepsinogen.

- 4) The secretin acts on exocrine pancreas and stimulates secretion of water and bicarbonate ions to form pancreatic juice.
- 5) CCK acts on pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice respectively.
- 6) GIP inhibit gastric secretion and motility.

**Q.20 Give reason: Healthy root nodules appear pink in colour.**

**(3)**

**Ans:**

- 1) Rhizobium has symbiotic relationship with roots of leguminous plants.
- 2) It infects root cortex and form root nodules.
- 3) Root nodules are the site of nitrogen fixation.
- 4) Enzyme nitrogenase which catalyzes nitrogen fixation, gets inhibited by oxygen.
- 5) But root nodule contains a pigment called leghemoglobin which acts as oxygen scavenger and protects nitrogenase from getting inhibited.
- 6) Leghemoglobin is pink in colour. Hence, healthy root nodules are pink in colour.

**Q.21 What are basic requirements of PCR technique?**

**(3)**

**Ans:**

The basic requirements of PCR technique as follows:

- 1) DNA containing the desired segment to be amplified.
- 2) Excess of forward and reverse primers which are synthetic oligonucleotides of 17 to 30 nucleotide. They are complementary to the sequence present in DNA.
- 3) dNTPs which are of four types such as dATP, dGTP, dTTP and dCTP.
- 4) A thermostable DNA polymerase (e.g., Taq DNA polymerase enzyme) that can withstand a high temperature of 90-98°C.
- 5) Appropriate quantities of Mg<sup>++</sup> ions.
- 6) Thermal cycler, a device required to carry out PCR reactions.

**Q.22 Complete the following table:**

Organism	Habitat	Respiratory surface/organ
1. Insects	Terrestrial	
2. Amphibian tadpoles of frog, salamanders		
3. Fish	Aquatic	
4. Reptiles, Birds and Mammals		

**(3)**

**Ans:**

Organism	Habitat	Respiratory surface/organ
1. Insects	Terrestrial	Tracheal tubes and spiracles
2. Amphibian tadpoles of frog, salamanders	Aquatic	External gills
3. Fish	Aquatic	Internal gills
4. Reptiles, Birds and Mammals	Terrestrial	Lungs



**Q.23 Give reason: Water is the molecule that connects physical world with biological processes. (3)**

**Ans:**

- 1) Water is an important constituent of cell. About 90-95% of protoplasm is water.
- 2) Water in liquid state is best solvent in which various minerals and food molecules are dissolve and transported.
- 3) Water acts as the thermal buffer has high specific heat.
- 4) Water molecules have high adhesive and cohesive forces of attraction.
- 5) It can rise in capillaries due to high surface tension and adhesive forces. E.g., Ascent of sap in plants.
- 6) Due to all these important factors, it is a significant molecule connecting physical world with biological processes.

**Q.24 Explain the following terms with reference to ecological succession: (1) Seral stages (2) Pioneers (3) Hydrosere (3)**

**Ans:**

- 1) Seral stage: The developmental stages of the ecological succession are known as seral stages.
- 2) Pioneers: The organisms belonging to first seral stage in the ecological succession are known as pioneers.
- 3) Hydrosere: Hydrosere or hydrarch succession is a type of ecological succession which is determined by the amount of water available during succession. Hydrosere occurs when there is abundant water available in the area where organisms reside.

**Q.25 How does genetic diversity affect sustenance of species? (3)**

**Ans:**

- 1) Genetic diversity develops the capability of the species to adapt to the varying changes in the environment.
- 2) The large variation of the different gene sets allows an individual or the whole population to have the capacity to endure the increasing pollution in the environment whereas some do not have it.
- 3) Those who are able to endure and adapt to this change survive and live in a better way.
- 4) This is called natural selection which leads to a loss of genetic diversity in particular habits. Thus, genetic diversity, can affect sustenance of some species.

**Q.26 Distinguish between inborn immunity and acquired immunity. (3)**

**Ans:**

Inborn Immunity	Acquired Immunity
1. Inborn immunity or innate immunity is also called natural immunity.	1. Acquired immunity is also called adaptive immunity.
2. Innate immunity is present right from the birth.	2. Acquired immunity is not present at birth, but is acquired during lifetime of the individual.

3. Inborn immunity does not depend upon the previous exposure to a pathogen or foreign substance.	3. Acquired immunity always depends upon the previous exposure to a pathogen or foreign substance.
4. It is non-specific immunity as it can offer resistance to any pathogen.	4. It is specific immunity as it can offer resistance only to a particular pathogen.
5. Innate immunity consists of various types of barriers for defence against the pathogens.	5. Acquired immunity consists of various types of cells which are able to produce antibodies.
6. Inborn immunity shows immediate effect in the body.	6. Acquired immunity requires several days to become activated.
7. Inborn immunity is seen in all animals.	7. Acquired immunity is seen only in vertebrates.
8. Inborn immunity is genetic in nature and is heritable.	8. Acquired immunity is non-genetic in nature and is non-heritable.

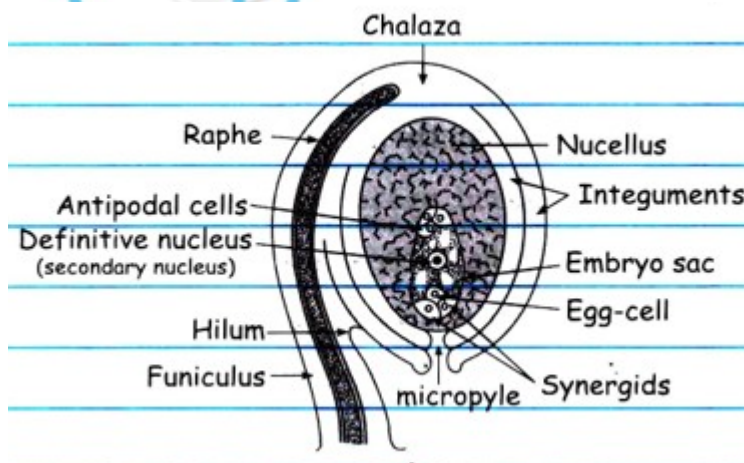
### SECTION-D

Attempt any three of the following question:

**Q.27 Describe the structure of a mature anatropous ovule of a typical angiosperm plant with a neat, labelled diagram.** [12]

**Ans:**

The ovule which has a bent axis and downwardly directed micropyle is called anatropous ovule. (4)





This is the most common type of ovule in angiosperms.

- 1) The matured anatropous ovule consists of two parts, viz., the stalk and the body. The stalk of the ovule is called the funicle or funiculus. The funicle attaches the ovule with the placenta.
- 2) The point at which the funicle is attached to the body of the ovule is called hilum.
- 3) Nucellus: It is made up of diploid parenchymatous cells. The basal part of the nucellus is called chalaza. The protective coverings of the nucellus are called integuments.
- 4) Micropyle: The integuments do not completely cover the nucellus. They leave a small opening called micropyle at the tip.
- 5) Embryo sac: In a mature ovule, the nucellus shows an oval-shaped structure toward its micropylar end called embryo sac or female gametophyte.

**Q.28 What is a dihybrid cross? Explain with suitable example and checker board method. (4)**

**Ans:**

- 1) A cross which involves two pairs of alleles is called a dihybrid cross. A phenotypic ratio 9:3:3:1 obtained in the  $F_2$  generation of a dihybrid cross is called a dihybrid ratio.
- 2) Thus, for example, when we cross a true breeding pea plant bearing round yellow seeds with a true breeding pea plant bearing wrinkled and green seeds, we get pea plants bearing round and yellow seeds in the  $F_1$  generation.
- 3) When  $F_1$  plants are selfed, we get a ratio of 9:3:3:1 in the  $F_2$  generation, where 9 plants bear yellow round seeds, 3 plants bear yellow wrinkled seeds, 3 plants bear green round seeds and 1 plant bears green wrinkled seeds.

4) Parents ( $P_1$ ) : RRYY × rryy

Gametes of  $P_1$ : RY and ry

$F_1$  generation : RrYy (Yellow round)

On selfing  $F_1$  : RrYy × RrYy

Gametes of  $F_1$  : RY, Ry, rY, ry

$P_2$  generation:

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

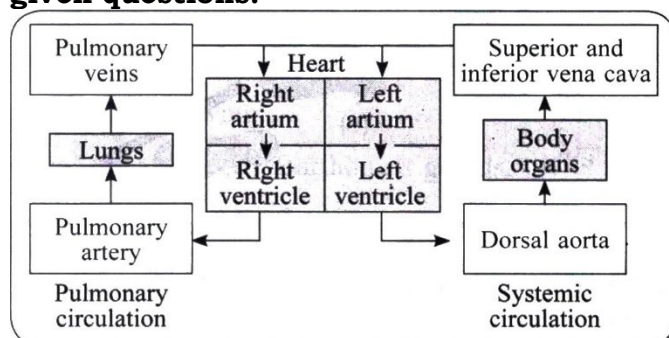
Round Yellow : 9, Round green : 3

Wrinkled yellow : 3, Wrinkled green : 1

Phenotypic ratio : 9:3:3:1

Genotypic ratio: 1:2:1:2:4:2:1:2:1

**Q.29 Observe the diagrammatic representation of double circulation and answer the given questions.**





- (1) **Why is the circulation shown in the above diagram called double circulation?**
- (2) **What are the two main routes of double circulation?**
- (3) **Which blood vessels carry oxygenated blood to heart and deoxygenated blood to lungs?**
- (4) **Which blood vessels carry deoxygenated blood to heart and oxygenated blood to body organs?** (4)

**Ans:**

- 1) During circulation, blood passes twice through the heart, therefore it is called double circulation.
- 2)
  - a) Pulmonary circulation which is from heart to lungs and back from lungs to heart.
  - b) Systemic circulation which is from heart to body and back from all body organs to the heart.
- 3) Oxygenated blood is carried to the heart by pulmonary veins. Deoxygenated blood is carried to the lungs by pulmonary artery.
- 4) Deoxygenated blood is carried to heart by superior and inferior vena cavae. Oxygenated blood is carried to the body organs by systematic or dorsal aorta.

**Q.30 Give an account of structure of hindbrain.** (4)

**Ans:**

- 1) Hindbrain includes cerebellum, pons varolii and medulla oblongata.
- 2) Cerebellum is 11% of the total brain and is the second largest part of the brain.
- 3) It has three lobes, median vermis and lateral two cerebral hemispheres. It has outer gray and inner white matter.
- 4) Cerebral cortex shows sulci and gyri. The inner white matter of cerebellar medulla shows arbor vitae or branching tree-like processes.
- 5) Pons is the part that connects the two cerebral hemispheres. It has outer white and inner grey matter. Pons is made up of nerve fibers which form bridges between cerebrum and medulla oblongata.
- 6) Medulla oblongata is the last part of the hindbrain which continues further as a spinal cord. It has outer white and inner grey matter.
- 7) Its roof shows has posterior choroid plexus.
- 8) Eight pairs of cranial nerves arise from medulla oblongata.

**Q.31 Enlist and write in brief about the different biological tools required in r-DNA technology.** (4)

**Ans:**

The biological tools used in r-DNA technology are enzymes, cloning vectors and competent hosts.

1) **Enzymes:**

- a. Enzyme like lysozymes, nucleases (exonucleases and endonucleases), DNA ligase, reverse transcriptase, DNA polymerase, alkaline phosphatases, etc. are used in r-DNA technology.
- b. The restriction endonucleases are used as biological or molecular scissors. They are able to cut a DNA molecule at a specific recognition site.

2) **Cloning Vectors:**

- a. Cloning vectors are DNA molecules which carry foreign DNA segment and replicate inside the host cell.
- b. They may be plasmids, bacteriophages (M13, lambda virus), cosmid, phagemids, BAC (bacterial artificial chromosome), YAC (yeast artificial chromosomes (MACs)).
- c. Most commonly used vectors are plasmid vectors (pBR 322, pUC, Ti plasmid) and bacteriophages (lambda phage, M13 phage).

3) **Component host cells:**

- a. That are bacteria like Bacillus haemophilus, Helicobacter pylori and E. coli.
- b. Mostly E. coli is used for the transformation with recombinant DNA.