

MM : 70

BIOLOGY THEORY  
SOLUTIONS

Time : 3 Hrs

## Entire Syllabus

## SECTION A

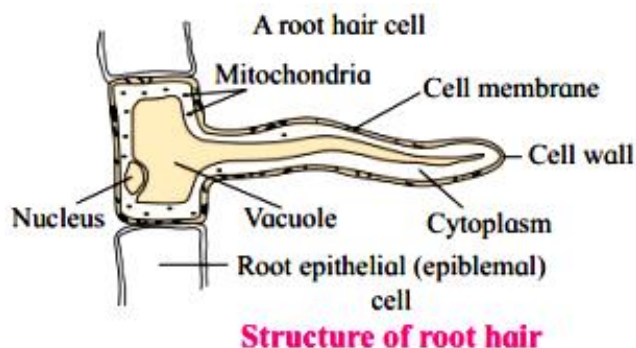
<b>Q.1</b>	<b>Select &amp; Write the correct Answer</b>	<b>10M</b>
i.	b) Self-replication in bacterial cells	1M
ii.	b) The invaded land does not have its natural predator	1M
iii.	c) Pleura	1M
iv.	c) 1400 cc	1M
v.	d) Medulla oblongata	1M
vi.	b) Capillary water	1M
vii.	c) protozoan	1M
viii.	d) interfascicular cambium	1M
ix.	c) LNG 20	1M
x.	c) Steady	1M
<b>Q.2</b>	<b>Short Answers (1 Mark Each)</b>	<b>8M</b>
i.	Examples of X-linked traits are hemophilia, red-green colour blindness, myopia (near sightedness), and for Y-linked are hypertrichosis, ichthyosis, etc.	1M
ii.	Australopithecus is the ancestor of humans which is described as a man with an ape brain.	1M
iii.	Root hairs are ephemeral structures in the roots.	1M
iv.	India has three of world's biodiversity, viz. Western Ghats, Indo-Burma and Eastern Himalayas.	1M
v.	Melatonin	1M
vi.	Salmonella typhi	1M
vii.	Flocs are the masses of bacteria held together by slime and fungal hyphae to form mesh like masses.	1M
viii.	The gradual and predictable changes in the composition of a given area are called ecological succession.	1M

## SECTION B

	<b>Attempt Any Eight Questions</b>	<b>16M</b>
<b>Q.3</b>	1. A human male has 44 autosomes + XY sex chromosomes, whereas a female has 44 autosomes + XX sex chromosomes.	<b>2M</b>
	2. During gamete formation in male, the diploid germ cells in testis undergo spermatogenesis to produce two types of haploid sperms, 50% sperms contain 22 autosomes and X chromosome while 50% sperms contain 22 autosomes and Y chromosome.	
	3. In females, the diploid germ cells in ovaries undergo oogenesis to produce only one type of egg. All eggs contain 22 autosomes and the X chromosome.	

4. Thus human male is heterogameic and female is homogametic.
5. If a sperm containing X chromosome fertilizes the egg (ovum), the diploid zygote formed after fertilization grows into a female child
6. If a sperm containing Y chromosome fertilizes the egg. then diploid zygote formed after fertilization grows into a male child.
7. The sex of a child depends on the type of sperm fertilizing the egg and hence the father is responsible for the determination of sex of the child and not the mother

Q.4



2M

- Q.5 i. The agents which are employed for biological control are called **biocontrol agents**. 2M
- ii. Microbes like bacteria, fungi, viruses, and protozoans act as biocontrol agents. They act in three ways, either they cause the disease to the pest or compete or kill them.

**Example:****i. Bacillus thuringiensis**

- a. It is used to get rid of the butterfly, caterpillars where dried spores of *Bacillus thuringiensis* are mixed with water and sprayed onto vulnerable plants such as Brassica and fruit trees.
- b. These spores are then eaten by insect larvae.
- c. In the gut of the larvae, the toxin (cry protein) is released and the larvae get killed eventually.

**ii. Trichoderma**

- a. *Trichoderma* species are free-living fungi found in the root ecosystem (rhizosphere).
- b. These are effective as biocontrol agents of several soil-borne fungal plant pathogens.
- c. The fungus produces substances like viridin, gliotoxin, gliovirin, etc. that inhibit the other soil-borne pathogens attacking root, rhizomes, etc. causing rot disease.

Q.6 **Apical dominance :**

2M

- (1) The presence of apical bud inhibits the growth of lateral buds. This phenomenon in which the apical (terminal) bud is active and lateral buds remain inactive is called apical dominance.
- (2) It is believed that apical dominance is controlled by an auxin which is synthesized in the apical bud.
- (3) From the apical bud, the auxin migrates to the lateral buds and inhibits their growth.
- (4) When apical bud is removed, the lateral buds grow and form branches. For producing more branches therefore, the apical buds are removed.

- Q.7** Genetic variations are caused due to various aspects of mutation, recombination, and migration. The change in gene and gene frequencies is known as genetic variation. **2M**
- Q.8 Pacemaker :** **2M**
- (1) Pacemaker is the region in the heart which initiates the beating.
  - (2) The natural pacemaker of the heart is sinoatrial node (SA node).
  - (3) The pacemaker is autorhythmic, it is able to repeatedly and rhythmically generate impulses.
  - (4) SA node is responsible for initiation of cardiac excitation. Therefore, it is called pacemaker.
- Q.9 Alcoholic beverages :** **2M**
- (1) Alcoholic beverages are the products of alcoholic fermentation of particular substrates.
  - (2) Tubular tower fermenters are used to produce alcoholic beverages on a large scale.
  - (3) Wine and whisky are prepared respectively from grapes and fermenting mixed grains of wheat, barley and corn followed by the distillation of the products of fermentation.
  - (4) Liquors like beer, wine are produced without distillation while whisky, rum and brandy are distilled alcoholic beverages. Beer is produced from barley by fermentation. For the production of beer, strains of *Saccharomyces cerevisiae* are used.
  - (5) Toddy is prepared by fermenting the sugar sap extracted from palms and coconut palms while fenny is fermented by fleshy pedicels of cashew fruits.
- Q.10**
- i. Factors like overall stability of tropical regions for millions of years, lesser climatic changes throughout the year, and availability of plenty of sunlight have favoured speciation.
  - ii. Tropical areas have less often experienced drastic disturbances like periodic glaciations observed at poles. Such stability over millions of years might have favoured speciation.
  - iii. Lesser migrations in tropics might have reduced gene flow between geographically isolated regions and favoured speciation.
  - iv. Scientists also have considered the availability of more intense sunlight warmer temperatures and higher annual rainfall in tropics, as factors responsible for the bountifulness of these regions.
  - v. Some animals enjoy food preferences under climatic conditions and abundance of resources. e.g. Fruits being available throughout the year in rain forests, a variety of frugivorous organisms is obviously more as compared to the temperate regions.
  - vi. In short, species richness or diversity for plants and animals decreases as we move away from the equator to the poles. It is maximum in tropical rain forests. e.g. Amazon rain forest (40,000 plants, 1300 birds, 427 mammals, 3000 species). Hence, tropical regions exhibit species richness as compared to polar regions.

Q.11	Hypohydrophily	Epihydrophily	2M
	1. Pollination takes place below the surface of water. 2. Pollen grains are heavier and they sink in water. 3. Pollens are long, ribbon like without exine. 4. E.g. Zostera (sea grass)	1. Pollination takes place on the surface of water. 2. Pollen grains float on the water surface. 3. Pollens have specific gravity equal to water 4. E.g. Vallisneria	

**Q.12** Meninges are the membrane that cover the brain and and the spinal cord. These are of three types- dura mater, pia mater, arachnoid mater. Meninges provide support and protection to the central nervous system. It also connect the brain and spinal cord to the skull and spinal canal. The major function of meninges is that, it produces cerebrospinal fluid. Cerebrospinal fluid act as a shock absorber. 2M

**Q.13** (1) Flavr savr is genetically modified type of tomato. 2M  
 (2) It is developed by inserting antisense gene which retards ripening.  
 (3) Due to the presence of this gene a cell wall degrading enzyme called polygalactouronase is produced in lesser amounts.  
 (4) Owing to the above reasons. Flavr savr tomato has longer shelf life.

**Q.14** (1) During early foetal life, the testes develop in the lumbar region of the abdominal cavity just below the kidney but during seventh month of embryonic development, they descend permanently into the respective scrotal sacs through a passage called inguinal canal. 2M  
 (2) For the development of the sperm, lesser temperature than the body temperature is required.  
 (3) If the testes remain in the abdominal cavity. Then the sperm production does not take place.  
 (4) This may result in impotency. Therefore, testes are located outside the body cavity.

### SECTION C

**Attempt Any Eight Questions** 24M

**Q.15** A – II, B – VI, C – I, D – III, E – IV, F - V 3M

**Q.16** i. When Rakesh fell down from his motorbike the inner membranes called meninges protected his brain from injury. 3M

ii. These meninges form a protective covering around the brain and spinal cord. They act as shock absorbers.

Meanings are protective membranes surrounding the brain and spinal cord. They are as follows

a. Dura mater : It is the outermost tough, non vascular, thick and fibrous meninx and is attached to the inner side of the cranium. It is separated from the underlying arachnoid mater by the subdural space, filled with a serous fluid.

b. Arachnoid mater : It is the middle, thin and non vascular layer of connective tissue having web like appearance. It is separated from the pia mater below by a narrow subarachnoid space filled with cerebro spinal fluid - CSF.

c. Pia mater : It is the innermost delicate, highly vascular membrane lies in close contact with the CNS.

**Q.17** Factors that are known to cause cancer are called carcinogens.

3M

Name of chemical carcinogen - Target tissue

i) Soot - Skin, Lungs

ii) Coal tar (3, 4 benzpyrene) - Skin lungs

**Causes of cancer:**

i. Chemicals : Several chemicals are known to induce cancer. These include nicotine, caffeine, products of combustion of coal and oil. Several polycyclic hydrocarbons, some sex hormone and steroids, if given or secreted in large amounts, may cause cancer. Breast cancer seems to have hormonal relationship. It is more commonly observed in women who avoid breast feeding.

ii. Radiation : The x-rays, gamma-rays cosmic rays, ultra-violet rays etc. are carcinogenic. Incidence of skin cancer is higher in the people working in very sunny areas due to UV radiation in the sunlight.

iii. Viruses : Viruses causing cancer have genes called viral oncogenes (v-onc genes). These viruses are also called oncogenic viruses. e.g. EBV(Epstein-barr virus), HPV (Human papiloma virus) etc.

iv. Oncogenes : Several genes called cellular oncogenes (c-onc genes) or proto-oncogenes have been identified in normal cells which when activated under certain condition could lead to oncogenic transformation of cells.

v. Addiction : Different types addictions likes smoking, chewing of tobacco lead to cancer of mouth, lips and lungs. Alcohol consumption may result in cancer of oesophagus, stomach, intestine and liver. Drugs also cause cancer e.g. Marijuana, anaerobic steroids etc.

**Q.18** The factors affecting blood pressure are:

3M

**1. Cardiac output:**

The normal cardiac output is 5 litres/mm. An increase in cardiac output increases systolic pressure.

**2. Peripheral resistance:**

It depends upon the diameter of blood vessels. A decrease in the diameter of arterioles and capillaries under the effect of vasoconstrictors like vasopressin or ADH cause increase in peripheral resistance and thereby increase in blood pressure.

**3. Blood volume:**

Blood loss in accidents decreases blood volume, and thus the blood pressure.

**4. Viscosity of blood:**

Blood pressure is directly proportional to the viscosity of blood.

**5. Age:**

Blood pressure increases with age due to the increase in inelasticity of blood vessels.

**6. Venous return:**

The amount of blood brought to the heart via the veins per unit time is called the venous return. It is directly proportional to blood pressure.

**7. Length of blood vessel:**

Blood pressure is also directly proportional to the total length of the blood vessel. Blood pressure can also be affected by vasoconstriction or vasodilation.

**8. Gender:**

Females have slightly lower BP than males before the age of menopause. However, the risk of high B. P. increases in the females after menopause sets in.

- Q.19** The chromosomal theory of inheritance was proposed by Sutton and Boveri. **3M**  
**Following are the postulates of chromosomal theory of inheritance:**
1. Chromosomes are found in pairs in somatic or diploid cells.
  2. During gamete formation, homologous chromosomes pair, segregate and assort independently at meiosis. Due to this, each gamete contains only one chromosome of a pair.
  3. Hereditary characters are carried by chromosomes which are present in the nucleus of these gametes.
  4. Gametes (sperm and egg) contain all the hereditary characters. They form the link between parents and offsprings.
  5. The union of sperm and egg during fertilization restores the diploid number of chromosomes.
- Q.20** (1) **Apomixis** : The phenomenon of formation of embryo(s) by asexual methods without formation of gametes and fertilization is termed as apomixis. **3M**
- (2) There are three main categories of apomixis. (a) Recurrent (b) Non-recurrent and (c) Adventive embryony.
- (a) **Recurrent apomixis** : in this diploid sporophytic cell, archesporial cell or nucellus form embryos, when diploid megaspore mother cell forms embryo sac it is known as diplospory. It is also called apospory.
- (b) **Non-recurrent apomixis** : Haploid embryo sac is formed but the embryos arise either from egg cell or any other haploid cell. It is also known as apogamy.
- (c) **Adventive Embryony** : In this in addition to normal zygotic embryo, additional embryos develop from nucellus or integuments. It results in polyembryony.
- Q.21** (1) Rhizosphere water : The microenvironment surrounding the root is called rhizosphere. Water present here is absorbed by plants. **3M**
- (2) Water present in the deep soil is gravitational water. This is not available to plants for absorption as it percolated deep down in to the soil due to gravity.
- (3) Other types of water occur in the form of hygroscopic water, combined water and capillary water.
- (4) Hygroscopic water is present in the fine soil particles of soil. Water present in the form of hydrated oxides of silicon and aluminium is called combined water.
- (5) Both these types of water is not available to plants.
- (6) Capillary water which is present in the pores present between the neighbouring soil particles, due to capillarity is available for the plants.
- Q.22** **Succession in aquatic habitat** : **3M**
- (1) In aquatic habitats the pioneer species in primary succession are the small phytoplankton.
- (2) Phytoplankton are replaced by rooted-submerged plants (e.g. *Hydrilla*), rooted-floating angiosperms (e.g. Lotus) followed by free-floating plants (e.g. *Pistia*), then reed swamp (e.g. *Typha*), marsh-meadow (e.g. *Cyperus*), scrub (e.g. *Alnus*) and finally the trees (e.g. *Quercus*) in a very systematic and gradual way.

(3) The climax again would be formation of forest. With passage of time, the water body is converted into land.

- Q.23** i. The first cytokinin was discovered by Skoog and Miller (1954) during investigation of nutritional requirements of callus tissue culture of *Nicotina tabacum* (Tobacco). **3M**
- ii. They observed that the callus proliferated when the nutrient medium was supplemented with coconut milk and degraded sample of DNA (obtained from herring sperm). They named it as kinetin. Chemically kinetin are 6-furfurylamino purine.
- iii. First natural cytokinin was obtained from unripe maize grains by Letham et al. It is known as Zeatin.
- iv. Seven different types of cytokinins are recorded from plants.
- v. Natural cytokinins are also reported from plants like Banana flowers, apple and tomato fruits, coconut milk, etc.
- vi. 6-benzyl adenine is a synthetic cytokinin hormone.

**Q.24 Griffith's transformation experiment :** **3M**

(1) In 1928, Frederick Griffith, carried out experiments with bacterium *Streptococcus pneumoniae* (which causes pneumonia in humans and other mammals).

(2) Griffith used two strains of *Streptococcus pneumoniae* :

- (a) S-type (Virulent, smooth, pathogenic and encapsulated).  
(b) R-type (Non-virulent, rough, non-pathogenic and non-capsulated).

(3) Experiments carried out by F. Griffith :

- (a) Mice were injected with R-strain bacteria and they survived (no pneumonia).  
(b) Mice injected with S-strain bacteria developed pneumonia and died.  
(c) When heat-killed S-strain bacteria were injected in mice, the mice survived.  
(d) On injecting a mixture of heat-killed S-bacteria and live R bacteria, the mice died.

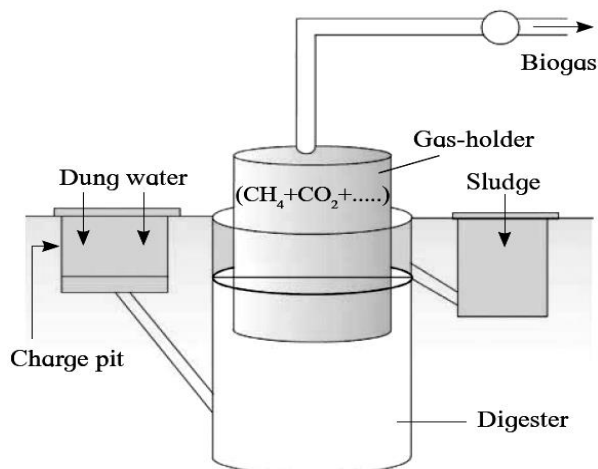
(4) Griffith obtained live S-strain bacteria from the blood of the dead mice.

(5) He concluded that the live R-strain bacteria must have picked up something (which he called transforming principle) from the heat killed S bacterium, and got changed into S-type. Transforming principle allowed R-type to synthesize capsule and it became virulent.

(6) Thus, F. Griffith first demonstrated genetic transformations.

**Q.25 What is bio-gas? Write in brief about the production process.** **3M**

Biogas is a mixture of gases produced from decomposable organic matter by the activity of various anaerobic bacteria that can be used as a fuel.



Anaerobic digestion involves in three processes :

**i. Hydrolysis or solubilization :** In initial stage raw material (cattle dung) is mixed with water in equal proportion to make slurry which is then fed into the digester. Here anaerobic hydrolytic bacteria (e.g. *Clostridium*, *Pseudomonas*) hydrolyse carbohydrates into simple sugars, proteins into amino acids and lipids into fatty acids.

**ii. Acidogenesis :** In this stage, facultative anaerobic, acidogenic bacteria and obligate anaerobic organisms, convert simple organic material into acids like formic acid, acetic acid,  $H_2$  and  $CO_2$ .

**iii. Methanogenesis :** This is last stage in which anaerobic Methanogenic bacteria like *Methanobacterium*, *Methanococcus* convert acetate,  $H_2$  and  $CO_2$  into Methane,  $CO_2$  and  $H_2O$  and other products.

- $12\text{mol } CH_3COOH \longrightarrow 12CH_4 + 12CO_2$   
(acetic acid) methane
- $4\text{mol } H.COOH \longrightarrow CH_4 + 3CO_2 + 2H_2O$   
(formic acid)
- $CO_2 + 4H_2 \longrightarrow CH_4 + 2H_2O$

Q.26

	Habitat	Niche
i.	A habitat is an area, where a species lives and interact with the other factors and prosper	Niche not only describes the position of a species in an environment but also describes the functional role played by an organism.
ii.	Habitat deals with effects of temperature, rainfall and other abiotic factors.	Niche deals with the flow of energy from one organism to another.
iii.	Habitat supports numerous species at a time.	Niche supports a single species at a time.
iv.	Habitat is a physical place.	Niche is an activity performed by organisms.
v.	Habitat is not species specific	Niche is species specific.

3M

## SECTION D

Attempt Any Three Questions

12M

**Q.27** The process of copying of genetic information from one (template) strand of DNA into a 4m single-stranded RNA transcript is called transcription.

The process of transcription is as follows:

- For transcription, promoter, structural gene, and terminator (together called transcription unit) are required.
- The DNA strand used for the synthesis of RNA is called antisense or template strand which is oriented in  $3' \rightarrow 5'$  direction,



while the other strand not involved in RNA synthesis is called the coding strand. It is oriented in  $5' \rightarrow 3'$  direction.

3. A small DNA sequence which provides a binding site for RNA polymerase is called promoter which is present towards  $5'$  end/upstream, while a small DNA sequence which terminates the transcription process called terminator is present towards  $3'$  end/downstream.

4. The process of transcription, in both prokaryotes and eukaryotes, involves three stages viz. Initiation, Elongation, and Termination.

5. During initiation, RNA polymerase binds to the promoter and moves along the DNA and causes local unwinding of DNA duplex into two chains in the region of the gene.

6. Exposed ATCG bases project into the nucleoplasm.

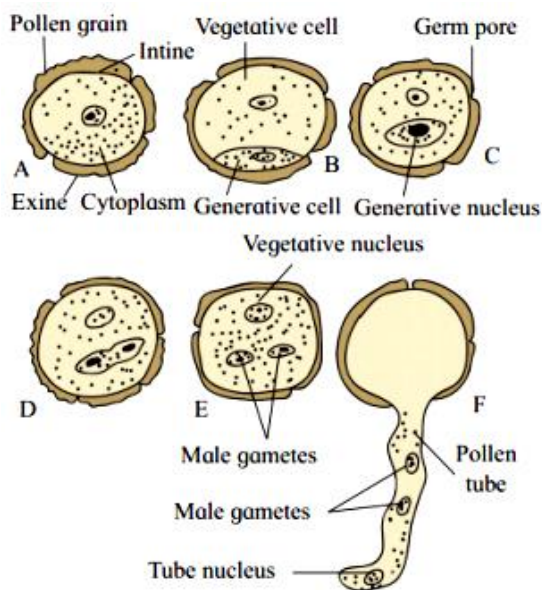
7. Only one strand functions as template (antisense strand) and the other strand is complementary which is actually a coding strand (sense strand).

8. During elongation, the ribonucleoside triphosphates join bases of the DNA template chain.

9. As transcription proceeds, the hybrid DNA-RNA molecule dissociates and makes mRNA molecules free.

10. As transcription proceeds, the hybrid DNA-RNA molecule dissociates and makes mRNA molecules free.

Q.28



4m

### Development of male gametophyte

1. Pollen grain/microspore marks the beginning of male gametophyte, thus it is the first cell of the male gametophyte.

2. It undergoes the first mitotic division to produce bigger, naked vegetative cells and small, thin-walled generative cells.

3. The vegetative cell is rich in food and having an irregularly shaped nucleus.

4. The generative cell floats in the cytoplasm of the vegetative cells.

5. The second mitotic division is concerned with generative cells only and gives rise to two non-motile male gametes.

6. The mitotic division of the generative cells takes place either in the pollen grain or in the pollen tube.

7. The pollen grains are shed from the anther, at this two-celled stage in most of the angiosperms.

**Q.29 Disorders of the thyroid gland are caused due to hypersecretion and hyposecretion of thyroid hormones.** 4m

**i. Hypersecretion of thyroid hormones:** It is caused by an increase in the levels of thyroid hormones. This increases metabolic rate, sensitivity, sweating, flushing, rapid respiration, bulging of eyeballs, and affects various physiological activities.

**Graves' disease:** Hyperthyroidism in adults results in this disorder. It is characterised by protruding eyeballs, increased BMR. And weight loss. Increased BMR produces a range of effects like increased heartbeat increased B.P., higher body temperature.

nervousness, irritability, and tremor of fingers.

**ii. Hyposecretion of thyroid hormone:** It is caused by a deficiency of thyroid hormones or removal of the thyroid gland (Thyroidectomy).

**a. Cretinism:** It is caused due to deficiency of thyroid hormones in infants. A cretin (individual suffering from cretinism) has reduced BMR and low oxidation. They are short-statured because the skeleton fails to grow. They are mentally retarded, show stunted growth and delayed puberty. They show dry skin, thick tongue, prolonged neonatal jaundice, lethargy and constipation.

This can be treated by early administration of thyroid hormones.

**b. Myxoedema:** It is caused due to the deficiency of thyroid hormones in adults. It is characterised by a peculiar thickening and puffiness of skin and subcutaneous tissue particularly of the face and extremities. The patient lacks alertness, intelligence. The patient suffers from slow heart rate, low B.P., low body temperature (feels cold) and stunted sexual development.

**c. Simple goitre:** It is iodine deficiency goitre. Iodine is required for the synthesis of thyroid hormone and if there is a deficiency of iodine in the diet it causes enlargement of the thyroid gland leading to simple goitre. This disease is common in hilly areas. Addition of iodine to table salt prevents this disease. The size of the thyroid gland is increased but the total output of thyroxine is decreased.

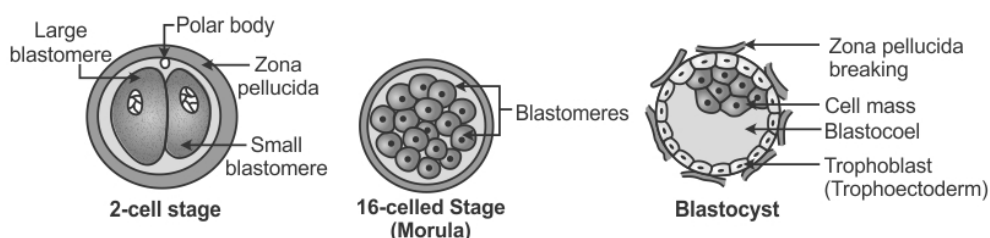
**iii.** Hyposecretion of thyroid hormones in pregnant females causes defective development and maturation of growing baby.

**Q.30** 1. Pulse is the series of pressure waves that travel through arteries due to ventricular systole. 4m

2. It is strongest in the arteries closer to the heart and gradually becomes weak in arteries away from the heart and will be the weakest till it reaches the vein.

3. When we keep a finger on the wrist or neck the superficial arteries like radial artery in the wrist and carotid artery in the neck. The pulse can be felt at particular points on the body cannot be felt in the veins.

**Q.31** Blastulation is the process of formation of the hollow and multicellular blastocyst. The process of blastulation can be summarized as follows: 4m



1. The embryo (blastocyst) that enters the uterus remains floating in uterine cavity for 2-4 days after its entry i.e. till the end of 7th day after fertilization.

2. The outer layer of cells seen in the morula now forms the layer called the trophoblast.
3. Cells from the trophoblast begin to absorb the glycogen rich uterine milk
4. The blastocyst doubles in size from 0.15 mm to 0.30 mm.
5. With more fluid entering inside the blastocyst cavity is formed.
6. These outer cells become flat and are called trophoblast cells (since they help only in absorbing nutrition for the developing embryo).
7. The larger inner cells form inner cell mass or embryoblast (the embryo proper develops from the embryoblasts).
8. These remain attached to the trophoblasts on only one side.
9. The trophoblast cells in contact with the embryonal knob are called cells of Rauber.
10. At this stage, the blastocyst shows polarity i.e. the side with inner cell mass is called the embryonal end and the side opposite to it is the abembryonic end.
11. By the end of the 7th day the blastocyst is fully formed and ready for implantation and gastrulation.
12. The function of zona pellucida is to prevent the implantation of the embryo at an abnormal site. It does not expose the sticky and phagocytic trophoblast cells till it reaches the implantation site i.e. within the uterus, after which the zona pellucida ruptures.

**Together we will make a difference**