General Instructions:

1. Sections A: Q. No. 1 contains **10** multiple choice questions carrying **one mark** each
Q. No. 2 contains **8** very short answer type questions carrying **one mark** each
2. **Section B:** Q. No. 3 to Q. No. 14 are **12** short answer-I type questions **carrying two marks** each. Attempt any **eight** questions.
3. Section C: Q. No. 15 to Q. No. 26 are **12** short answer-II type questions carrying **three marks** each. Attempt any **eight** questions.
4. Section D: Q. No 27 to Q. No. 31 are **5** long answer type questions carrying **four mark** Attempt any **three** questions.

SECTION A

Q.1. Select and write correct answer:

1 C) Integuments – Perisperm
2 D) All of these
3 B) Vg^+
4 B) Apneustic
5 A) 'a'
6 D) producers
7 D) circular, biconcave and non-nucleated
8 D) All of these
9 B) 61
10 C) Eustachian tube

Q.2 Answer the Following :

1 The key abiotic factors which influence any habitat are ambient temperature, availability of water, light and type of soil.
2 The term genome is the total genetic constitution of an organism. Alternatively, it is a complete copy of genetic (DNA) or one complete set of chromosome (monoploid or haploid) of an organism. This term was introduced in 1920 by H. Winkler.
3 An allosome is a sex chromosome which are responsible for the determination of sex. They differ from autosome in form, size or behavior. Human beings have X and Y chromosome as sex chromosome.
4 Gene flow, Gene mutation, Genetic recombination, Genetic drift, chromosome aberrations.
5 The partial pressure of oxygen of blood in pulmonary capillaries is 40 mmHg while in alveolar blood it is 104 mmHg.
6 The male urethra provides a common pathway for both the passage of urine as well as the passage of semen during coitus from the genital organ. It is therefore, referred to as a urinogenital duct.
7 It is junction between two nerve cells with a minute gap (synaptic cleft) in between them which allows transmission of synaptic transmission.
8 Denitrification is the process in which anaerobic can convert soil nitrates back into nitrogen gas. Denitrifying bacteria removes fixed nitrogen i.e. nitrates from the ecosystem and return it to the atmosphere in inert from. Example Bacillus spp., Paracoccus spp. And Pseudomonas denitrificans.

SECTION B

Attempt ant Eight :

Q.3 Blastula is an early developmental stage of the embryo and Gastrula is a mature embryo.
Blastula is a single layered hollow structure that contains undifferentiated cells. Whereas, gastrula is a three layered hollow structure that contains differentiated cells.

Q.4 1. Test cross is performed to find out the unknown genotype of hybrid.
2. To obtain this, the hybrid is back crossed with its recessive parent.
3. While a back cross is not necessarily back crossed with its recessive parent. It can be either

dominant or recessive. It is performed to introduce desired gene in the offspring.
4.Therefore, a test cross is always a back cross while back cross is not necessarily a test cross.

Q.5 Histones are the proteins that are rich in lysine and arginine residues.
Both these amino acid residues are basic amino acids and carry positive charges with them. So, histones are a set of positively charged, basic proteins (histones + protamine).
These histones organize themselves to make a unit of 8 molecules known as histone octamer.

Q.6 Match the following.
1 – b
2 – a
3 – d
4 - c

Q.7 Plants obtain a variety of substances like water, minerals, nutrients, food and gases like O, and CO,, from its surroundings.
2. The productivity in plants is mainly affected by the non-availability of water.
3. Hence, water is considered as the 'elixir of life' and has a great biological importance.
4. It constitutes almost 90 to 95% of most plant cells and tissues and helps to maintain turgidity and shape of the cells.

Q.8 1. Artificial insemination is a technique used for controlled breeding experiments.
2. In this method, superior males are selected and their semen is collected.
3. The collected semen can be injected into the genital tract of female immediately or can be frozen and used later.
4.In the frozen state, semen remains alive for long duration and is convenient for transport.
5. Artificial insemination is easy and helpful to overcome several problems of normal mating.

Q.9 Rh (D) antigen induces a strong immunogenic response when introduced into Rh-ve individuals. The Rh +ve RBCs from the foetus may enter the mother's circulatory system during child birth, causing her to produce anti-Rh antibodies. As a result, subsequent Rh+ve foetuses will be exposed to the anti-Rh antibodies produced by mother, which result in haemolytic disease of the new born (HDN). In order to prevent HDN, Rh-ve mother is injected with the anti-Rh antibody during all pregnancies carrying Rh +ve foetus.

Q.10 **Fill in the blanks and complete the chart.**
Insect resistance property
ii. Flavr savr tomato
(C) To reduce vitamin A deficiency disease
(d) Improved meat production ability, milk yield and quality and disease free status

Q.11 1. For plants, herbivores are the predators; therefore they have evolved variety of morphological and chemical defenses against them.
2. Among them, thorns are the most common morphological means of defence.
3. Many plants produce and store chemicals which
makes the herbivore sick.
4. Also a wide variety of chemical substances such as nicotine, caffeine, quinine, strychnine, opium, etc. are the secondary metabolites which are produced by plants acts as a defense against grazers and browsers.

Q.12 1. Reduction of noise in our industries can be brought about by use of sound absorbent materials or by muffling the noise.
2. Laws which prohibit blowing horn in the areas of schools and hospitals, need to be implemented strictly to curb decibel levels.
3. Government of India has rules and regulations against firecrackers and loudspeakers.
4. Supreme Court of India has banned loudspeakers

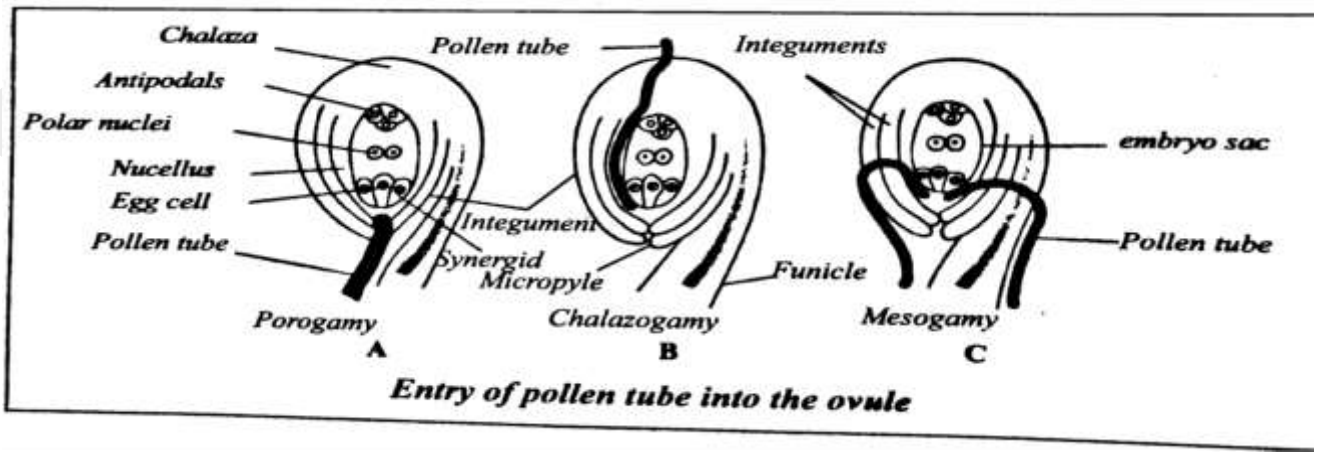
at public gatherings after 10 pm.

Q.13 1. These are the main respiratory organs of humans.
2. One pair of spongy and elastic lungs are present in the thoracic cavity.
3. Each lung is enclosed and protected by a double pleural membrane
4. Outer parietal and inner visceral membrane.
5. Between the two pleura is a pleural cavity filled with a lubricating fluid called pleural fluid.
6. This pleural fluid is secreted by the membranes.
7. The right lung is larger and divided into 3 lobes, while the left lung is smaller and divided into 2 lobes.
8. Each lobe of the lung has the terminal bronchioles ending in a bunch of air sacs, each with 10 to 12 alveoli.

Q.14 1. Ovaries produce hormones such as Estrogen, Progesterone, Relaxin and Inhibin.
2. **Estrogen** is responsible for secondary sexual characters in female.
3. **Progesterone** is essential for thickening of uterine endometrium, thus preparing the uterus for implantation of fertilized ovum. It is responsible for development of mammary glands during pregnancy. It inhibits uterine contractions during pregnancy.
4. **Relaxin** relaxes the cervix of the pregnant female and ligaments of pelvic girdle for easy birth of young one.
5. **Inhibin** inhibits the FSH and GnRH production.

SECTION C
Attempt Any Eight

Q.15 1. After a pollen grain has reached the surface of the stigma, it germinates and forms a pollen tube, which penetrates the stigma, style, ovary chamber and then enters ovule.
2. The growth of pollen tube is guided by the chemicals secreted by the synergids.
3.It usually enters ovule through the micropyle.
4.It is termed as porogamy. But in some cases, it is found to enter through chalaza, known as chalazogamy and in some plants by piercing the integuments, called mesogamy.
5. Finally, it penetrates embryo sac of ovule through its micropylar end.



Entry of pollen tube into the ovule

Q.16 1. The Human Genome Project is a multinational research project to determine the genome structure of humans. It began in 1990 and was completed in 2003.
2. The work of HGP has allowed researchers to begin to understand the blue print in building and constructing the human genome. This knowledge will have a major impact in the fields like medicine, biotechnology and like sciences.
3. The main aims of HGP project are:
a. Mapping the entire human genome at the level of nucleotide sequences.

b. To store the information collected from the project in databases.
c. To develop tools and techniques for analysis of the data.
d. Transfer of the related technologies to the private sectors, such as industries.
e. Taking care of the legal, ethical and social issues which may arise from project.

Q.17. 1. Industrial melanism is one of the best example for natural selection.
2. In Great Britain, before industrialization (1845) grey white winged moths (Biston betularia) were more in number than the black-winged moth (Biston carbonaria).
3. These moths are nocturnal and during day time they rest on tree trunk.
4. White-winged moth can camouflage, well with the lichen covered trees that helped them to escape from the predatory birds.
5. On other hand, the black-winged moth resting on lichen covered tree trunks were easy victims for the predatory birds and their number was reduced.

6. During industrial revolution, large number of industries came up in Great Britain. The industries released black sooty smoke that covered and killed the lichens growing on tree and turn the tree black due to pollution.
7. This change become an advantage to the black- winged moth that camouflaged well with the black tree trunks and their number increased while the white-winged moth become victims to predatory birds due to which their number reduced.
8. Thus natural selection has resulted in the establishment of a phenotypic traits in changing the environmental conditions

Q.18. Sperm is the male gamete. It is a motile, microscopic elongated cell. It is divisible into three parts- head, middle piece and tail.

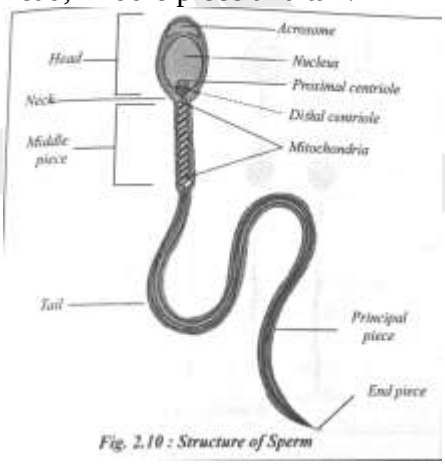
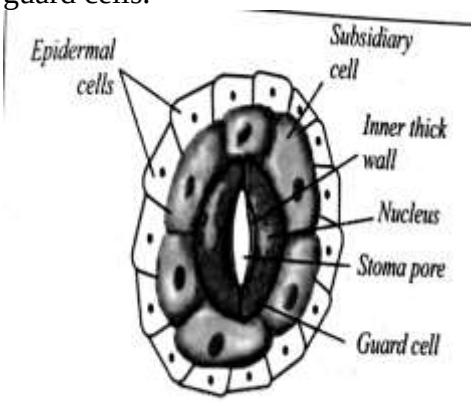


Fig. 2.10 : Structure of Sperm

(a) Head: The sperm head is oval in shape and contains haploid nucleus. Above the nucleus, there is a cap like structure called acrosome. It is formed from the Golgi body. Acrosome contains hydrolytic enzymes; hyaluronidase and proteolytic enzymes like zona lysin and corona penetrating enzymes.
(b) Neck: It is a very short region having two centrioles i.e. proximal centriole and distal centriole.
(c) Middle piece: It has an axial filament surrounded by 10-14 spiral turns of mitochondria (Nebenkern). It produces energy necessary for the movement of sperm.

(d) Tail: It is a long, slender and tapering part containing cytoplasm and fine thread- axial filament. The axial filament arises from the distal centriole and travels throughout the length of tail. It is partly surrounded by plasma membrane (main piece). The part without plasma membrane is called end piece.

Q.19. 1. A typical stoma is minute elliptical aperture, surrounded by two modified parenchyma cells called guard cells.



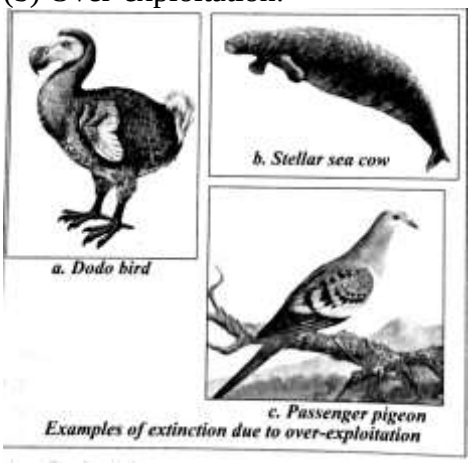
Structure of guard cell

2. The guard cells are kidney shaped in dicotyledonous plants and dumbbell shaped in most monocotyledonous plants.
3. The inner wall of guard cells which surrounds the aperture is thick due to presence of secondary wall layer.
4. The guard cells have outer thin and permeable wall
5. The guard cells are living cell with peripheral granular cytoplasm and a central vacuole.
6. Cytoplasm is with nucleus and many chloroplasts.
7. Epidermal cells are without chloroplasts.
8. In some plants, epidermal cells surrounding guard cells are specialised and are called subsidiary cells or accessory cells.
9. Opening and closing of stomata occurs due to osmotic changes in guard cells.
10.When the guard cells are turgid, the stomata get opened but when the guard cells become flaccid the stomata get closed.

Q.20. 1. According to Mendel, when in heterozygous condition, the dominant gene shows its expression while the expression of the recessive gene is masked by dominant gene.
2. However, there are many cases where the dominance is not complete or absent. These show deviations from Mendelian inheritance. It was observed that phenotypic expression of a gene can be influenced or modified by other gene.
3. These gene interactions are of two types : intragenic and intergenic.
4. Intragenic interactions occur between alleles of same gene. e.g. incomplete dominance, co-dominance and multiple alleles.
5. Intergenic interactions occur between the alleles of different genes such as pleiotropy, polygenes, epistasis, supplementary and complementary genes. Therefore, law of dominance is not universally applicable.

Q.21. There are four major causes popularly known as, "The Evil Quartet', they are:
(a) Habitat loss and fragmentation:
1. It is the prime cause of destruction.
2. Reduction in vast natural habitats and local degradation by pollution, create crisis situation for the living beings.
3. Loss of local habitat due to human activities,

creates threat to migratory birds as well as those animals that need larger territories.
4. Tropical rain forests are being lost at an alarming rate.
5. Tropical rain forest cover has reduced from 14% to 6% over the years.
(b) Over-exploitation:



Examples of extinction due to over-exploitation

Basic difference between human beings and other animals is that, humans have the tendency to accumulate beyond their needs.
2. This has resulted in the over-exploitation of resources which in turn causes threats to various organisms.
3. pigeon are few examples of extinction due to Dodo bird, Stellar sea cow and Passenger overexploitation.
(c) Alien species invasion :
1. When a new species gets introduced into any ecosystem accidentally or intentionally, there are chances that it proves harmful for existing species.
2. Sometimes, it can lead to extinction of local species. In such a case, it is called as invasive species.
3. E.g. the carrot grass (Parthenium), Lantana and water hyacinth (Eichhornia). Introduction of predator fish - Nile perch in Lake Victoria, proved deleterious for 200 local species of Cichlid fish.
4. In India, introduction of African catfish Clarias gariepinus for aquaculture purpose has proved harmful to endemic catfish varieties.
5. One of the major reasons of such a harmful cating the effect of alien species is, lack of local predator.
(d) Co-extinction:
1. Many a times, organisms are associated with each other in obligatory way.
2. In such cases, extinction of one variety leads to loss of associate variety from the ecosystem.
3. E.g., Extinction of host fish causes extinction of unique parasites. Coevolved plant-pollinator, also will have such a threat

Q.22. 1. The A, B and O blood groups were discovered by Karl Landsteiner in 1900.
2. Later on, the blood group AB was discovered by Landsteiner's students Decastello and Sturli in 1902.
3. Landsteiner was awarded the Nobel Prize for his discovery of human blood groups.
4. He found two antigens or agglutinogens on the surface of human red blood cells and named them as antigen A and antigen B.
5. He also noticed the corresponding antibodies or 1976 agglutinins in the serum called 'a' and 'b'
6. In ABO system, the blood groups are determined by the presence or absence of antigen A and antigen B, the blood group of person is classified into four groups A, B, AB and O.
(a) **Blood group A**: Individuals, with blood group 'A' have the antigen A on the surface of their red

blood cells (RBCs) and antibody 'b' in their plasma.
(b) **Blood group B**: Individuals with blood group 'B' have the antigen B on the surface of their RBCs and antibodies 'a' in their plasma.
(c) **Blood group AB**: Individuals with blood group 'AB' have both antigens A and B on the surface of their RBCs and no antibodies in their plasma. (d) Blood group O: Individuals with blood group 'O' lack both antigens A and B on the surface of their RBCs and show presence of both 'a' and 'b' antibodies in their plasma.

Q.23 Principles of farm management are :
1. Selection of high yielding breeds
2. Knowing the food requirement of animals
3. Supply of adequate nutritional sources
4. Cleanliness of environment
5. Maintenance of health and veterinary supervision
6. Vaccination
7. High yielding cross-breed development
8. Preservation and production of products
9. Distribution and marketing of the products

Q.24 1. The lymphatic system consists of lymph, lymphatic capillaries, lymphatic vessels and lymph nodes.
Lymph is a colourless fluid. It is blood without by RBCs, platelets and some proteins.
3. The lymphatic capillaries are thin walled vessels present in tissue spaces, interwoven with blood capillaries, but not connected.
4. Lymphatic capillaries unite to form lymphatic vessels. These have thin walls and numerous valves to prevent back flow.
5. The lymphatic system helps drain the excess fluid from the extracellular spaces back into the blood stream.
6. It even carries carbon dioxide and metabolic wastes to diffuse back into the blood.
7. It helps destroy invading microorganisms. The lymph nodes are usually where the foreign bodies are destroyed.

Q.25 Endocrine cells of pancreas form groups of cells called od Islets of Langerhans. There are four kinds of cells in islets of Langerhans which secrete hormones.
1. Alpha (a) cells (20%) secrete glucagon. It stimulates liver for glycogenolysis to increase blood glucose level.
2.Beta (B) cells (70%) secrete insulin. It stimulates liver and muscles for glycogenesis. This lowers blood glucose level.
3.Delta (8) cell (5%) secrete somatostatin which inhibits the secretion of glucagon and insulin. It also decreases the gastric secretions, motility and sup absorption in digestive tract.
4. PP cells or F cells (5%) secrete pancreatic polypeptide (PP). It inhibits the release of pancreatic juice.

Q.26 1. It occurs in several steps and starts with combination of atmospheric nitrogen with oxygen under the influence of electric discharge and thunder storm produce nitric oxide.

$N_2 + O_2 \xrightarrow{\text{Electric discharge}} 2\ NO$

The nitric oxide is then oxidized to nitrogen peroxide in the presence of oxygen.

$2NO_2 + O_2 \xrightarrow{\text{Oxidation}} 2\ NO_2$

3. During rains, the nitrogen peroxide combines with rain water to form nitrous acid and nitric acid which come to ground along with rains.

$2NO_2 + \text{Rain water} \rightarrow HNO_2 + HNO_3$

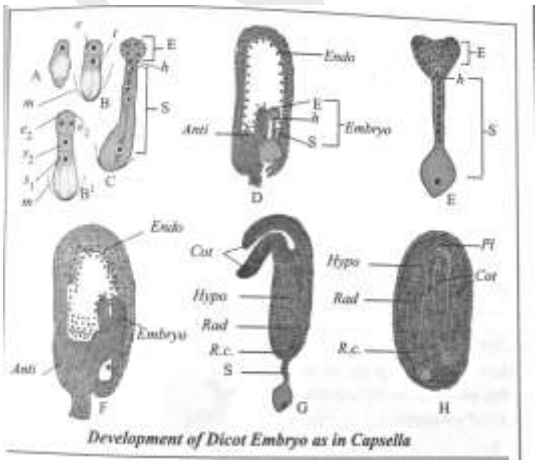
HNO2 + HNO3
Nitrous Acid Nitric Acid
4. On ground, the alkali radicals of soil react with nitric acid to produce nitrites and nitrates. (absorbable form)
HNO_3 + Ca or K salts → Ca or K nitrates
5. Industrial nitrogen fixation. It occurs by Haber- Bosch nitrate process at high temperature and pressure.
$N_2 + 3H_2 \frac{450^0C}{200\ atm} 2NH_3$
6. ,Ammonia is then converted to urea as it is less toxic.

SECTION D

Attempt any Three :

Q.27 a) Thyroxine secreted by thyroid gland
b) Relaxin secreted by ovary
c) Gastrin, Secretin, Cholecystokinin (CCK) secreted by Gastro-Intestinal Tract.
d) Parathyroid hormone secreted by parathyroid gland
e) Anti-diuretic hormone (ADH) secreted by hypothalamus.
f) Anti-diuretic hormone (ADH) secreted by hypothalamus.
g) Aldosterone secreted from adrenal glands.
h) Thyroxine and triiodothyronine from thyroid gland.
i) Oxytocin which is produced in hypothalamus and posterior pituitary gland secretes it into blood stream.
j) Epinephrine and nor-epinephrine secreted by adrenal glands.
k) Growth hormone releasing hormones (GHRH) and Somatostatin produced by hypothalamus.
l) Luteinizing hormones secreted by pituitary glands.

Q.28 1. The process of development of zygote into an embryo is called embryogenesis. The embryo is developed at the micropylar end of embryo sac. The growth of embryo triggers only after certain amount of endosperm is formed. After fertilization the embryonic development begins.
2. The zygote divides to form two- celled proembryo. The larger towards the micropyle is called basal or suspensor initial cell and smaller cell towards chalaza is called terminal or embryonal initial cell. The suspensor cell divides transversely in one plane to produce filamentous suspensor of 6-10 cells.
3. The first cell of the suspensor towards the micropylar end becomes swollen and function as a haustorium. The lowermost cell of suspensor is known as hypophysis. The suspensor helps in pushing the embryo in the endosperm. The embryonal initial undergoes three successive mitotic visions to form octant.



Development of Dicot Embryo as in Capsella

4. The planes of divisions are at right angles to each other. The lower tier of four cells of octant give rise to hypocotyl and radicle whereas four cells of upper tier form the plumule and the one or two cotyledons.
5 The hypophysis by further division gives rise to the part of radicle and root cap. Subsequently, the cells in the upper tier of octant divide in several planes so as to become heart shaped which then forms two lateral cotyledons and a terminal plumule. Further enlargement of hypocotyl and cotyledons result in a curvature of embryo and it appears horse-shoe shaped.

Q.29. 1. The statement of law of independent assortment states that "When hybrid possessing two (or more) pairs of contrasting factors (alleles) forms gametes, the factors in each pair segregate independently of the other pair".
2. This law is based on dihybrid cross. It is basic principle of genetics developed by Mendel.
3. It describes how different genes or alleles present on separate chromosomes independently separate from each other, during the formation of gametes.
4. These alleles are then randomly united in fertilization.
5. In dihybrid cross, the F2 phenotypic ratio 9:3:3: 1 indicates that the two pairs of characters behave independent of each other.
6. It can be concluded that the two characters under consideration are assorted independently giving rise to different combinations.

Q.30. 1. Blastulation is the process of formation of the hollow and multi-cellular blastocyst.

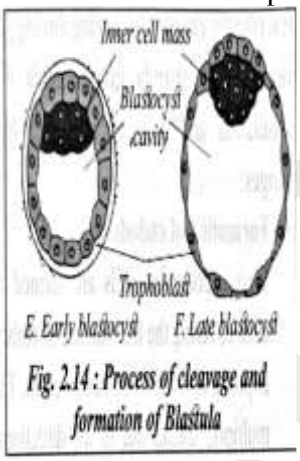


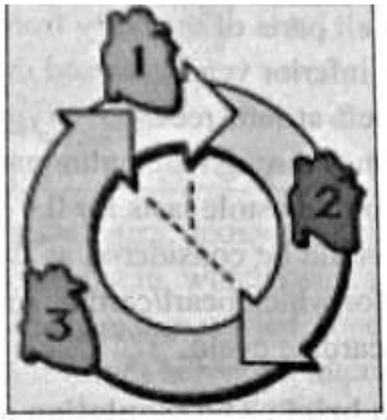
Fig. 2.14 : Process of cleavage and formation of Blastula

2. The embryo (blastocyst) that enters the uterus remains floating in cavity for 2-4 days after its entry, i.e. till the end of 7th day after fertilization. The outer layer of cells seen in the morula now forms the layer called 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. With more fluid entering inside the blastocyst cavity is formed.
5. These outer cells become flat and are called trophoblast cells (since they help only in absorbing nutrition for the developing embryo).
6. The inner larger cells form inner cell mass or embryoblast remain attached to the trophoblasts on only one side. The trophoblast cells in contact with the embryonal knob are called cells of Rauber. At this stage, the blastocyst shows polarity.
7. The side with inner cell mass is called the embryonal end and the side opposite to it is the abembryonal end.
8. By the end of the 7th day the blastocyst is fully formed. It is now ready for implantation and gastrulation.
9. 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, hence zona pellucida now ruptures.

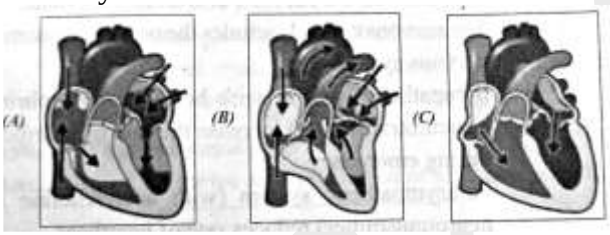
Q.31. The events associated with one heart beat is called cardiac cycle. A cardiac cycle lasts for 0.8 seconds.

Each heart beat includes: Atrial systole, Ventricular systole and Joint diastole.



Cardiac cycle

Atrial systole :



1. During the atrial systole, deoxygenated blood from the right atrium enters the right ventricle through the atrioventricular aperture called tricuspid valve, to prevent back flow.
2. At the same time oxygenated blood from the left atrium enters the left ventricle through the atrioventricular aperture called bicuspid valve, to prevent back flow.
3. The atrial systole lasts for 0.1 second.

Ventricular systole : (Fig B)

4. During ventricular systole, deoxygenated blood tomed from the right ventricle enters the pulmonary and artery and is carried to the lungs for oxygenation.
5. Simultaneously, the oxygenated blood from the VAS left ventricle enters the aorta, to be carried to all parts of the body.
6. The back flow is avoided in both the vessels due to the presence of semilunar valves at the base of each blood vessel, the pulmonary artery and the aorta.
7. The ventricular systole lasts for 0.3 seconds.

Joint diastole or complete cardiac diastole : (Fig C)

1. During the joint diastole, both the atria and ventricles undergo relaxation.
2. The right atrium receives deoxygenated blood from all parts of the body from the superior vena cava, inferior vena cava and the coronary sinus.
3. The left atrium receives oxygenated blood from the lungs through the pulmonary veins.
4. The joint diastole lasts for 0.4 seconds.
5. This could be considered as the small fraction of time for which heart/cardiac muscles relax during each cardiac cycle.