



Code Number:

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Medical | IIT-JEE | Foundations

Corp. Office: Aakash Educational Services Limited, 3rd Floor, Incuspaze Campus- 2, Plot No. 13,
Sector- 18, Udyog Vihar, Gurugram, Haryana - 122015

Time: 3 hrs.

Mock Test Paper for Class-XII

Max. Marks: 60

ZOOLOGY

Answers & Solutions

1. Chyme is partly digested acidic food formed in the stomach. It is formed by mixing of ingested food with the gastric juice by churning movements of stomach.
2. Colostrum secreted by the mother during the initial days of lactation has abundant IgA antibodies so that colostrum protects the body from intestinal infections by pathogens. Breast feeding reduces gastro intestinal infections in infants by reducing the entry of pathogens of the environment.
3. A single gene often influence more than one phenotypic trait. This phenomenon of multiple effects of a single gene is called pleiotropy.
4. Cortical extensions among the renal pyramids are called columns of Bertin.
5. The birds which are raised exclusively for the production of eggs are called LAYERS. The birds which are raised only for their meat are called BROILERS.
6. In seminiferous tubules Sertoli cells are nourishing the spermatozoa and also producing a hormone called inhibin which inhibits the secretion of FSH.
7. 'Amniocentesis' is a diagnostic procedure to detect genetic defects in the unborn baby. Disorders that can be detected by amniocentesis are Down's syndrome, Edward's syndrome and Turner's syndrome.
8. Sudden appearance of some vestigial organs in a better developed condition as in the case of the tailed human baby is called atavism. Such organs are called atavistic organs, they strongly support the concept of organic evolution. **Eg.** a baby with tail
9. In many types of muscles, sarcolemma invaginates into sarcoplasm to form 'T' tubules at the level of Z line in non mammals but between A & I bands in mammals. T. tubules and the terminal cisternae at its both sides form triad system.
10. Bee-keeping or apiculture is the maintenance of hives of honey bees for the production of honey and wax.
11. The food bolus swallowed into the stomach mixed thoroughly with acidic gastric juice of the stomach by the churning movements of its muscular wall.
 - The partly digested acidic food formed in stomach is called chyme. The mucus and bicarbonates present in

the gastric juice play an important role in the lubrication and protection of the mucosal epithelium from excoriation by the highly concentrated HCL.

- HCL provides optimal pH (1.8) for the action of pepsin. It also kills the microorganisms ingested along with food.
- The proenzymes of gastric juice, the pepsinogen and prorennin on exposure to hydrochloric acid are converted into the active enzymes, pepsin, rennin respectively.
- Pepsin converts proteins into proteases and peptones. Rennin is proteolytic enzyme found in the gastric juice of infants. It acts on the milk protein, the casein in the presence of calcium ions and converts into calcium paracaseinate and proteoses. Pepsin acts on calcium paracaseinate and converts into peptones.

Prorennin (inactive) to by HCL Rennin(active)

Pepsinogen (inactive) to by HCL pepsin(active)

Casein to by rennin and Ca^{+} calcium paracaseinate + proteoses

Calcium paracaseinate to by pepsin peptones

Proteins to by pepsin proteoses + peptones.

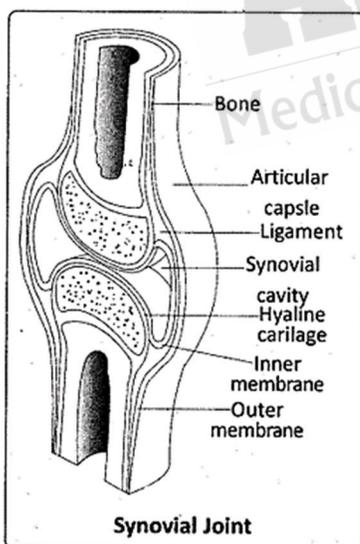
12. Synovial joint is covered by double layered synovial capsule.

1. Outer layer is formed by dense fibrous irregular connective tissue and is continuous with periosteum of bone and prevents dislocation of joints.
2. Inner layer is formed by areolar tissue and elastic tissue.

This inner layer secretes synovial fluid. Synovial fluid is with hyaluronic acid, phagocytes etc.

Synovial fluid acts as a lubricant and allows free movement of the joint.

(synovial joint diagram)



13. I. **Homologous Organs:** The organs which have similar structure and origin but not necessarily the same function are called homologous organs.

- The evolutionary pattern that describes the occurrence of similarity in origin and internal structure is called homology. Such organs show adaptive radiation, hence divergent evolution.

Example:

- The appendages of vertebrates such as the flippers of whale, wings of bat, forelimbs of horse, paw of cat and hand of man, have a common pattern in arrangement of bones even though their external form and functions may vary to suit their mode of life.
- It explains that all the vertebrates might have had common ancestor.

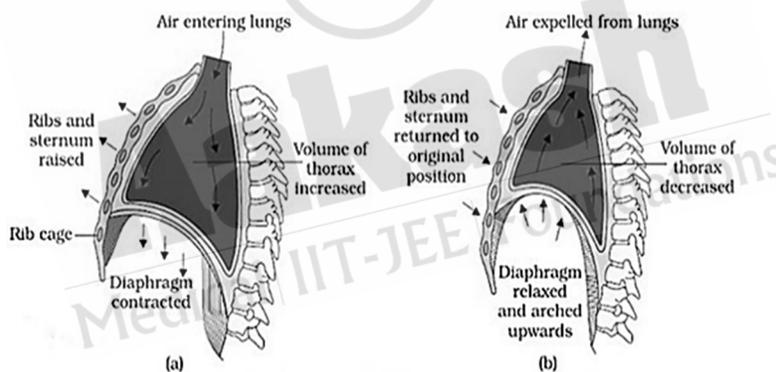
II Analogous organs:

- The organs which have dissimilar structure and origin but perform the same function are called the analogous organs. Analogous organs suggest 'convergent evolution'

Example: wings of butterfly and wings of a bird.

14. Breathing is a means of maximizing the process of gaseous exchange. It involves two stages inspiration and expiration.

Inspiration: Intake of atmospheric air into lungs is called inspiration. It is an active process as it takes place by the contraction of the muscles of the diaphragm & the external inter costal muscles. The contraction of the diaphragm (phrenic muscles) increases the volume of the thoracic chamber in the antero posterior axis. The contraction of the external inter costal muscles lift up the ribs & the sternum increasing the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes an increase in the pulmonary volume. This decreases the intra-pulmonary pressure, which forces the air from the outside to move into the lungs.



Mechanism of Breathing
a. Inspiration
b. Expiration

Expiration: Release of the alveolar air to the exterior is called expiration. It is a passive process. Relaxation of the diaphragm and the external inter costal muscles returns the diaphragm and sternum to their normal positions, and reduces the thoracic volume thereby the pulmonary volume. This leads to an increase in the intra-pulmonary pressure to slightly above that of the atmospheric pressure, causing of expulsion of air from the lungs.

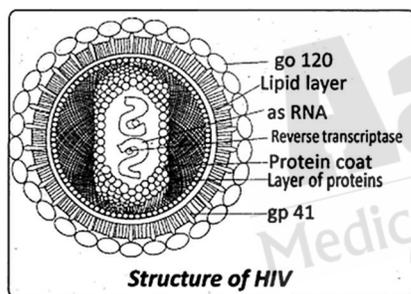
15. It is found the Rh positive children born to a Rh negative mother and Rh positive father.
- During the delivery of the first Rh positive child, the blood with foetal RBCs having Rh antigen mixes with the blood of Rh negative mother, due to the rupture of blood vessels of placenta between mother and child.
 - The immune system of the mother recognizes the Rh antigens, gets sensitized and produces anti Rh antibodies (IgG antibodies) and also memory cells. The first Rh+ child is thus not affected as it takes time for mother to get sensitized.

- During the second Rh⁺ pregnancy, the anti Rh antibodies increase due to memory cells. As they are small sized antibodies, they can cross the placenta and enter the blood circulation of that foetus.
- These anti Rh antibodies destroy the Rh⁺ foetal RBCs and cause the disorder erythroblastosis foetalis or HDNB

16. Main targets of HIV are T_H cells, macrophages and dendritic cells having CD4 receptors.

- gp120 of HIV attach to CD4 receptors of human cells mostly the T_H cells.
- In these cells the viral RNA is reverse transcribed to form double-stranded viral DNA by using the enzyme 'Reverse transcriptase'
- This viral DNA integrated into the DNA of the host cells by a viral enzyme called 'integrase' and is now called 'Provirus'.
- Transcription of DNA results in the production of RNA, which can act as the 'genome' for the new viruses (or) it can be translated into viral proteins
- The infected human cells continue to produce viral particles and they act like 'HIV generating factories'
- New viruses 'bud off' from the host cell.
- This leads to a progressive decrease in the number of T_H cells.

Even though HIV attacks cells with CD4 receptors of human cell only the T_H cells are destroyed but not the macrophages.



17. **Hypothyroidism:** During pregnancy due to hypothyroidism leads to cretinism. It is characterized by physical and mental growth gets severely stunted followed by stunted growth, mental retardation, low IQ, abnormal skin, deafness and mutism.

In adult women hypothyroidism causes irregular menstrual cycles.

In adults (men and women) the hypothyroidism leads to myxedema, characterized by lethargy, mental impairment, intolerance to cold, puffiness of face and dry skin.

Inadequate supply of iodine in diet leads to hypothyroidism and causes **simple goiter**

Hyperthyroidism: Over activity of thyroid, cancer of thyroid or development of nodules of thyroid leads to hyperthyroidism.

In adults it leads to exophthalmic goiter and characterized by protruded eyeballs, increases metabolic rate.

18. Surgical procedure to prevent pregnancy is also known as Sterilization. Sterilization procedure in male is called vasectomy and their in the female is called Tubectomy.

- I. **Vasectomy:** A small part of the vas deferens on either side is removed or tied up through a small incision on the scrotum. Thus the sperms are prevented from reaching seminal vesicle and so the 'semen' in 'vasectomised' males do not contain sperms.
- II. **Tubectomy:** A small part of the fallopian tube on both sides is removed or tied up through a small incision made in the abdomen or through vagina. This will block the entry of ova into the fallopian tubes and thus pregnancy is prevented.

19. **Structure of the heart:** the heart is the central pumping organ of the blood vascular system. It is a thick-walled, muscular, pulsating organ, situated in the mediastinum, the region in the thorax between the two lungs. It is pear-shaped, broad anteriorly and the pointed apex is directed posteriorly to the left. The heart is mesodermal in origin.

Pericardium: The heart is covered by a pericardium. The pericardium consists of outer fibrous pericardium and the inner serous pericardium. Serous pericardium double-layered, formed by an outer parietal layer and an inner visceral layer. Parietal layer is fused with fibrous pericardium. Visceral layer or epicardium adheres to the surface of the heart. The two layers are separated by a narrow pericardial cavity. Which is filled with pericardial fluid. This fluid reduces friction between the two membranes and allows free movements.

Layers in the wall of heart: The wall of the heart consists of three layers:

- 1-the outermost epicardium(mesothelium)
- 2-the middle myocardium(cardiac muscles)
- 3-the innermost endocardium(endothelium).

External structure: The heart of man is four chambered and consists of two atria and two ventricles. Atria and ventricles are separated by a deep groove called coronary sulcus. A small muscular pouch like projections from each atrium is called auricular appendix(auricular appendage).

The ventricles are separated by two inter ventricular grooves (anterior and posterior) in which coronary arteries and their branches are lodged.

Internal structure

Atria: They are the anterior chambers of the heart. They are separated from each other by thin interatrial septum. In the foetal stage, this septum has small pore called foramen ovale. When lungs become functional, foramen ovale becomes closed leaving a depression now as fossa ovalis. If foramen ovale does not close properly it is called patent foramen ovale.

The right atrium is larger than the left and receives deoxygenated blood from different parts of the body (except lungs) through two major veins. Viz., the pre caval vein. The opening of post caval vein is guarded by the valve of inferior vena cava or Eustachian valve. It is nonfunctional in adult. In embryonic stage, it directs the blood from post caval vein into the left atrium through foramen ovale. Blood from the wall of heart is returned into the right atrium through a coronary sinus whose opening is guarded by the valve of Thebesius. Left atrium receives oxygenated blood from each lung through a pair of pulmonary veins, which opens into the left atrium through a common pore not guarded by any valve.

Atria and ventricles are separated by an atrioventricular septum. Right atrium opens into the right ventricle through right atrioventricular aperture. It is guarded by tricuspid valve. Left atrium opens into the left ventricle through left atrioventricular aperture. It is guarded by a bicuspid valve or mitral valve.

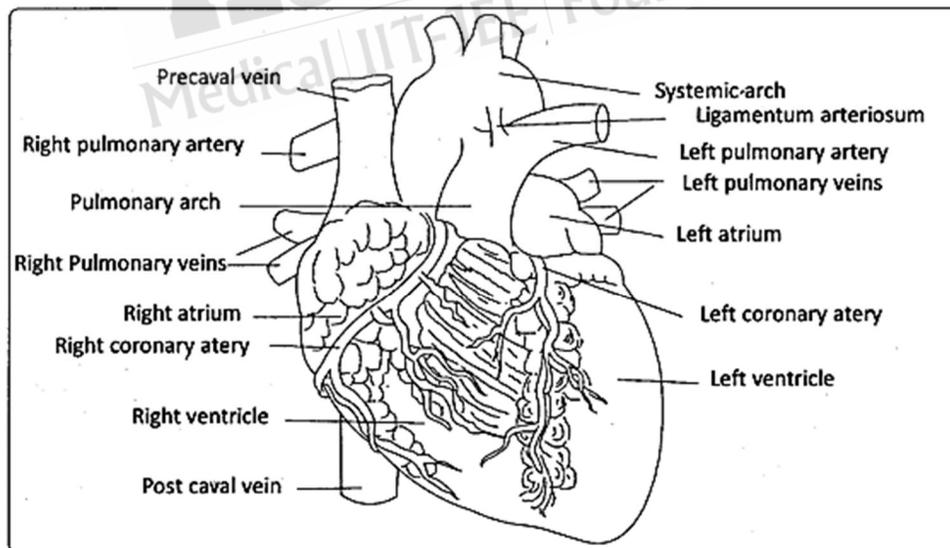
Ventricles: there are two ventricles (left and right), which form the posterior part of the heart. They are separated

from each other by an inter ventricular septum. Left ventricle is large then the right. The wall of the left ventricle is thicket then that of the right ventricle. The inner surface of ventricles is raised into muscular ridges called columnae corneae. Some of these ridges are large and conical, and are called papillary muscles. Extending between atrioventricular valves and papillary muscles are tendon-like cords, called chordae tendineae. They prevent the cups of atrioventricular valves (AV valves) from bulging too far into the atrium.

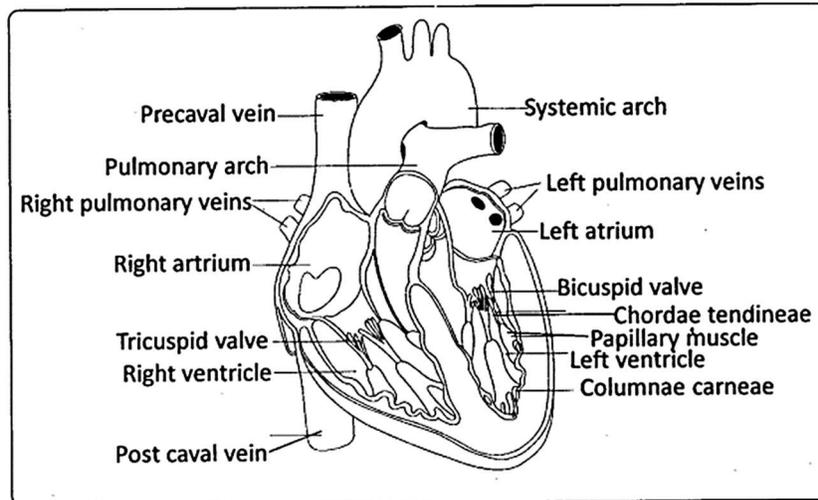
Nodal tissue:

- 1) It is the specialized cardiac musculature
- 2) **SAN (Sino atrial node)** is the modified cardiac tissue. It is present in the right upper corner of the right atrium near the opening of the superior venacava (precaval vein). It is pace maker.
- 3) **AVN (atrioventricular node)** is another mass of cardiac tissue is present in the lower left corner of the right atrium. It acts as a relay point.
- 4) **Atrioventricular bundle (AV bundle/His bundle)** continues from the AV bode into the inter ventricular septum.
- 5) It divides into right and left bundle of branches.
- 6) These branches give rise to minute fibers called purkinje fibres which spreads throughout the walls of the respective sides.

Aortic arches: pulmonary arch arises from the left anterior angle of the right ventricle. It carries deoxygenated blood to lungs. Systemic arch arises from the left ventricle and supplies oxygenated blood to different parts of the body. Opening of right ventricle into pulmonary arch and opening of left ventricle into systemic arch are respectively guarded by pulmonary valve and aortic valve. Each of these valves is made up of three crescent-shaped cusps. Hence, they are known as the semilunar valves. A fibrous strand, known as ligamentum arteriosum is present at the point of contact of the systemic arch and pulmonary arch. It is a remnant of ductus arteriosus (ductus botalli), which connects the systemic and pulmonary arches in the embryonic stage.



External structure of the heart



Internal structure of the Heart (L.S.)

20. **Female reproductive system:**

- The female reproductive system consists of a pair of ovaries along with a pair of oviducts, uterus, vagina, and the external genitalia located in the pelvic region.
- These parts of the system along with a pair of the mammary glands are integrated structurally and functionally to support the processes of ovulation, pregnancy, birth and child care.

Ovaries:

- Ovaries are the primary female sex organs that produce the female gametes (ova) and several steroid hormones(ovarian hormones).
- A pair of ovaries is located one on each side of the lower abdomen.
- The doubled layered fold of peritoneum connecting the ovary with the wall of the abdominal cavity is known as the mesovarium.
- The ovaries are covered on the outside by a layer of simple cuboidal epithelium called germinal (ovarian)epithelium.
- This actually the visceral peritoneum that envelops the ovaries.
- Underneath this layer there is a dense connective tissue capsule, the tunica albuginea.
- The ovarian stroma is distinctly divided into an outer cortex and an inner medulla.
- The cortex appears more dense and granular due to the presence of numerous ovarian follicles in the various stages of development.
- The medulla is a loose connective tissue with abundant blood vessels, lymphatic vessels, nerve fibers.

Fallopian tube(Oviducts)

- Each fallopian tube extends from the periphery of each ovary to the uterus, and it bears a funnel shaped infundibulum.
- The edges of the infundibulum possess finger like projections called fimbriae, which help in collection of the ovum after 'ovulation'.
- The infundibulum leads to a wider part of the oviduct called ampulla.
- The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.
- Fallopian tube is the site of fertilization.
- It conducts the ovum or zygote towards the uterus by peristalsis.

- The fallopian tube is attached to abdominal wall by a peritoneal fold called mesosalpinx.

Uterus

- the uterus is single and it is also called womb.
- It is a large, muscular, highly vascular and inverted pear shaped structure present in the pelvis between the bladder and the rectum.
- the uterus is connected to the abdominal wall by the peritoneal fold called mesometrium.
- The lower, narrow part through which the uterus opens into the vagina is called the cervix.
- the cavity of the cervix is called cervical canal which along with vagina forms the birth canal.
- The wall of uterus has three layers of tissue.
- The external thin membranous perimetrium, the middle thick layer of smooth muscle called myometrium and inner glandular lining of layer called endometrium.
- The endometrium undergoes cyclic changes during menstrual cycle while the myometrium exhibits strong contractions during parturition.

Vagina

- the vagina is a large, median fibro-muscular tube that extends from the cervix to the vestibule (the space between the labia minora).
- It is lined by non-keratinised stratified squamous epithelium.
- It is highly vascular, and opens into the vestibule by the vaginal orifice.

Vulva

- The term vulva (vulva=to wrap around) or pudendum refers to the external genital of the female.
- The vestibule has two apertures-the upper external urethral orifice of the urethra and the lower vaginal orifice of vagina.
- Vaginal orifice is often covered by a membrane called hymen which is a mucous membrane.
- Vestibule is bound by two pairs of fleshy folds of tissue called labia minora (inner) and larger pair called labia majora (outer).
- Clitoris is a sensitive erectile structure, which lies at the upper junction of the two labia minora above the urethral opening.
- The clitoris is homologous to the penis of a male as both are supported by corpora cavernosa internally.
- There is a cushion of fatty tissue covered by skin and pubic hair present above the labia majora, known as mons pubis.

Accessory reproductive glands of female:

- These glands include Bartholin's glands, Skene's glands and mammary glands.

Bartholin's glands:

- The Bartholin's glands (Greater vestibular glands) are two glands located slightly posterior and to the left and right of the opening of the vagina.
- They secrete mucus to lubricate the vagina and are homologous to the bulbourethral glands of the male reproductive system.

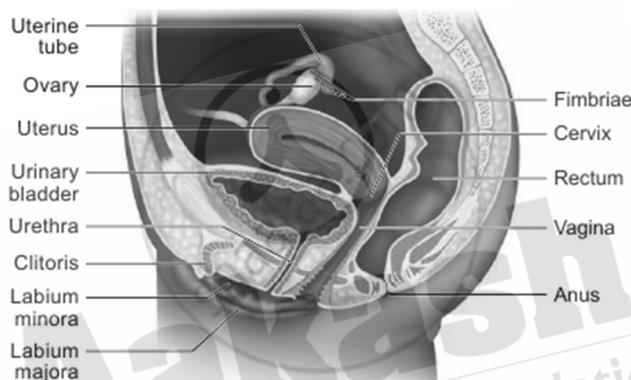
Skene's glands:

- The Skene's gland (lesser vestibular glands) are located on the anterior wall of the vagina, around the lower end of the urethra.
- The Skene's glands are homologous to the prostate gland, of the male reproductive system.

Mammary glands:

- A functional mammary gland is characteristic of all female mammals.
- The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat.
- The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli.
- The cells of the alveoli secrete milk, which is stored in the cavities (lumens) of the alveoli.
- The alveoli open into mammary tubules.
- The tubules of each lobe join to form a mammary duct.

Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct through which milk is sucked out by the baby.



Female reproductive system diagram.

21. **Chromosomal theory of sex determination**

- In most of the animals, a pair of chromosomes called sex chromosomes or allosomes are responsible for determination of sex. The chromosomes other than sex chromosomes are called autosomes
- Male and female animals differ in sex chromosomes either in their number or nature.
- Correns proposed heterogametic theory of sex determination. The individual producing two types of dissimilar gametes is heterogametic and the other producing one type of gametes is homogametic.

I. Sex determination based on number of sex chromosomes

In this method, the no. of chromosomes is different in male and female

XX-XO method:

- It is found in bugs (Hemiptera), grasshoppers and cockroaches (Orthoptera)
- Female is with two X-chromosomes and male is with one X-chromosome. Unpaired chromosome determines male sex.
- Female with the karyotype AAXX ('A' refers to haploid set of autosomes) produces ova with AX. Male with the karyotype AAXO produces two types of sperms. Half of them with AX and the other half AO (without

allosome).

- Males are heterogametic. Females are homogametic. Sex of offspring depends on fertilizing sperm

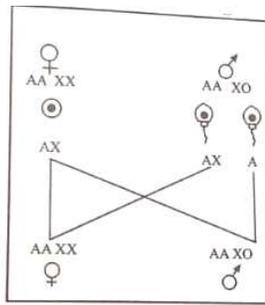


Figure : Sex Determination in Grass Hopper

ZO-ZZ method:

- It is found in moths and some butterflies. Female is heterogametic (ZO) with one Z-chromosome. Male is homogametic with ZZ chromosomes.
- All sperms are similar with AZ chromosomes. Ova are two types (AZ and AO)
- Sex of the offspring depends on fertilizing ovum.

II. Sex determination based on differences in sex chromosomes

- Male and female have same no. of chromosomes. But they differ in the nature of allosomes.

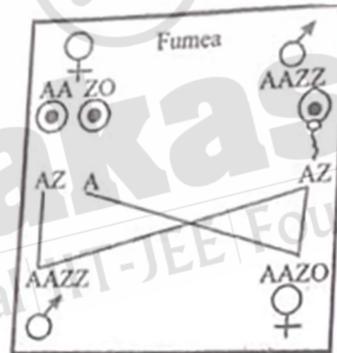
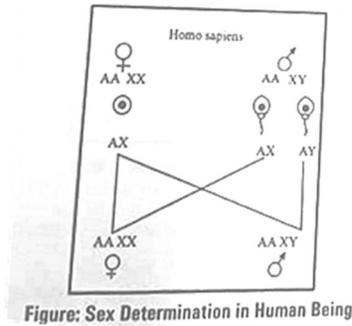


Figure: Sex Determination in Fumea

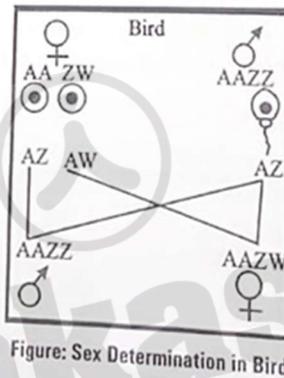
XX-XY method:

- It is found in human being and insects like Drosophila
- Females are homogametic with XX chromosomes. They produce one type of ova with AX.
- Males are heterogametic with X and Y chromosomes. They produce two types of sperms (AX and AY)
- Sex of the offspring depends on fertilizing sperm.



ZW-ZZ method:

- It is found in birds, reptiles and some fishes.
- Females are heterogametic with ZW chromosomes. They produce two types of ova (AZ and AW)
- Males are homogametic with ZZ chromosomes. They produce one type of sperms with AZ chromosomes
- Sex of the offspring depends on fertilizing ovum.



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