



Code Number:

A

Aakash

Medical | IIT-JEE | Foundations

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

Time: 3 hrs.

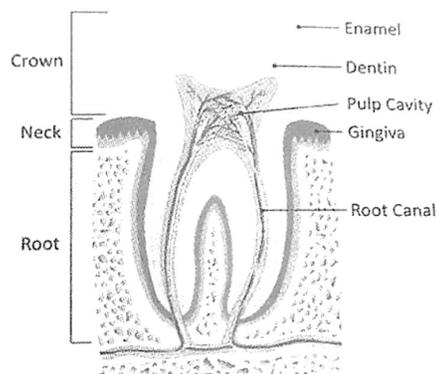
Mock Test Paper for Class-XII

Max. Marks: 60

ZOOLOGY

Answers & Solutions

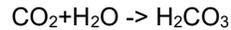
1. The hardest substance in human body is enamel that covers the crown of tooth. It is secreted by ameloblasts of ectodermal origin.
2. The events that occur from the beginning of one heart beat to the beginning of the next constitute a cardiac cycle.
3. Organ of Corti: It is a hearing apparatus present in the middle canal of the cochlea. It consists of cochlear epithelium, which forms a sensory ridge on the basilar membrane, which contains hair cells that act as auditory receptors.
4. 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 and I bands in mammals. T-tubules and the terminal cisternae at its both sides form the triad system.
5. Adrenaline (epinephrine) and noradrenaline (nor epinephrine) are secreted from the adrenal medulla in response to stress; hence they are called emergency hormones or hormones of fight or flight.
6. (1) Kupffer cells (present in liver) (2) Microglia (In brain)
(3) Osteoclasts (in the bone) (4) Synovial cells (in the synovial fluid)
7. The advantages of lactational amenorrhea is, ovulation will not occur during the period of intense lactation so that pregnancy is prevented. Some couple utilize the contraceptive benefit of this method.
8. Cortical extensions among the renal pyramids are called columns of berthini
9. The birds which are raised exclusively of the production of eggs are called LAYERS. The birds which are raised only for their meat are called BROILERS.
10. Gene P53 is popularly called 'Guardian Angel of cell's genome' because P53 protein guards the integrity of DNA
- 11.



12. **Ans:** CO₂ is transported in three ways:

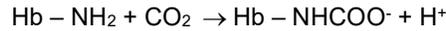
(i) **In dissolved state:**

7 percent of CO₂ is carried in dissolved state (physical solution) through plasma.



(ii) **As carbamino compounds:**

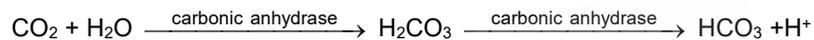
About 20 to 25 percent of CO₂ combines directly with amino group of haemoglobin and forms carbamino-haemoglobin in a reversible manner.



When pCO₂ is high & pO₂ is low, (as in the tissues) binding of more CO₂ occurs; when pCO₂ is low and pO₂ is high (as in the alveoli), dissociation of CO₂ from carbamino-haemoglobin occurs. Carbamino compounds are also formed by the union of CO₂ with plasma proteins.

(iii) **As bicarbonates:**

About 70 percent of CO₂ is transported as bicarbonate. Carbonic anhydrase enzyme (present in a very high concentration in the RBC) facilitates the following reaction in both the directions:



At the tissues where pCO₂ is high, CO₂ diffuses into the blood (RBC & plasma) and forms carbonic acid (H₂CO₃) which dissociates into HCO₃⁻ and H⁺. At the alveolar site where pCO₂ is low, the reaction proceeds in the opposite direction leading to the formation of CO₂ & water. Thus, CO₂ is mostly trapped as bicarbonate at the tissues and transported to the alveoli where it is released out as CO₂.

Every 100 ml of deoxygenated blood delivers approximately 4 ml of CO₂ to the alveolar air.

13. 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 fibres.
- (3) This inner layer secretes synovial fluid. Synovial fluid is with hyaluronic acid, phagocytes etc.
- (4) Synovial fluid acts as lubricant and allows free movement of the joint

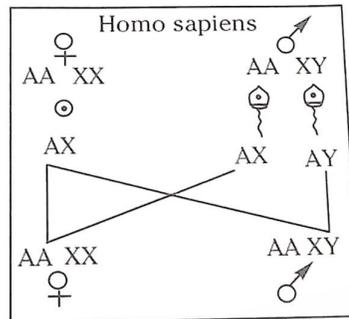
14. **Addison's disease:** It is due to hyposecretion of glucocorticoids by adrenal cortex. The characters are loss of weight, muscle weakness, fatigue, reduced B.P, darkening of the skin both exposed and non exposed parts of the body. This disorder does not allow the patient to respond to stress.

Cushing's syndrome: It is due to over production of glucocorticoids. The characters are breakdown of muscle proteins, redistribution of body fat leads in spindly arms and legs followed by moon face, buffalo hump on back, pendulous abdomen, poor wound healing. The hypersecretions of cortisol causes hyperglycemia, over deposition of glycogen in liver and rapid gain of weight.

15. 1. **XX-XY method** of sex determination is found in human beings and *Drosophila*. But, there is a difference in the functioning of the 'Y' chromosome.
2. Man is with **22 pairs of autosomes** and **XY allosomes**.
3. He is **heterogametic**. Two types of sperms which differ in allosome are produced by him. Half of the total no. of sperms are with 22 autosomes and a **'Y' chromosome** and the other half are with 22 autosomes and an **'X' chromosome**.

4. Woman is with **22 pairs of autosomes** and **XX allosomes**. She is **homogametic**. All the ova produced by her are with 22 autosomes and an **'X' chromosome**.
5. Sex of offspring in case of human beings depends on the **fertilizing sperm**.
6. If the sperm with **'Y' chromosome** fertilizes the ovum, the zygote develops into **male offspring**.
7. If the sperm with **'X' chromosome** fertilizes the ovum, the zygote becomes **female offspring**.

XY method of sex determination:



16. Mutation theory was proposed by **Hugo de Vries**, a Dutch botanist who coined the term mutation. Mutations are sudden, random inheritable changes that occur in organisms.

(1) Hugo de Vries found different forms in **Oenothera lamarckiana** (evening primrose); the mutants of *Oenothera* are:

- O. brevistylis** — small style
- O. levifolia** — smooth leaves
- O. gigas** — the giant form
- O. nanella** — the dwarf form (mutant varieties)

(2) **T.H. Morgan** studied the inheritance pattern of mutations in **Drosophila melanogaster**. **Darwin** called mutations (large variations) as **sports of nature** or **saltations**, whereas **Bateson** called them **discontinuous variations**.

Salient Features of Mutation theory:

1. Mutations occur from time to time in naturally breeding populations.
2. They are discontinuous and are not accumulated over generations.
3. They are full-fledged and so there are no intermediate forms.
4. They are subjected to natural selection.

17. (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 the 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 a 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 a butterfly and wings of a bird.

18. Types of cancers: Based on the origin, cancers are four types. They are:

Carcinomas: Cancers derived from epithelial tissue are called carcinomas.

Sarcomas: Cancers arising from connective tissue are called sarcomas.

Leukemias: Leukemia is cancer of bone marrow cells characterized by abnormal increase of WBC.

Lymphomas: Lymphoma is cancer of lymphatic system. It is a type of blood cancer which involves abnormal proliferation of B cells and T cells.

Based on inheritance, cancers are of two types. They are:

(a) **Familial cancers:** They are inherited and occur in families, e.g. certain breast and ovarian cancers.

(b) **Sporadic cancers:** They are non-hereditary occurring without any family history. The vast majority of cancers are sporadic.

19. i) 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 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.

ii) Pericardium: The heart is covered by pericardium. The pericardium consists of outer fibrous pericardium and the inner serous pericardium. Serous pericardium is double-layered formed by an outer parietal 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 movement of the heart.

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

The outermost epicardium (mesothelium)

The middle myocardium (cardiac muscles) and

the innermost endocardium (endothelium).

iv) 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 projection 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

i) Atria: They are the anterior chambers of the heart. They are separated from each other by a 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 known 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 and a post caval vein. The opening of post caval vein is guarded by the valve of inferior venacava or Eustachian valve. It is

nonfunctional in adults. 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.

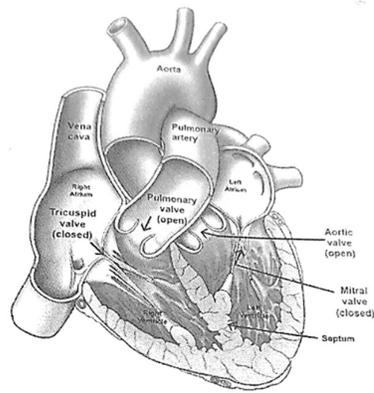
Atria and ventricles are separated by an atrioventricular septum. Right atrium opens into the right ventricle through right atrioventricular aperture. It is guarded by a tricuspid valve. Left atrium opens into the left ventricle through left atrioventricular aperture. It is guarded by a bicuspid valve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

ii) 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 larger than the right. The wall of the left ventricle is thicker than that of right ventricle. The inner surface of ventricles is raised into muscular ridges called columnae carnaeae. 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 cusps of atrioventricular valves (AV valves) from bulging too far into the atrium.

iii) Nodal tissue:

- 1) It is the specialized cardiac musculature.
- 2) **SAN (Sinoatrial node)** is the modified cardiac tissue. It is present in the right upper corner of the right atrium near the opening of the superior vena cava (pre caval vein). It is pace maker.
- 3) **AVN (Atrioventricular node)** is another mass of cardiac tissue 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 node into the inter ventricular septum.
- 5) It divides into right and left bundle branches.
- 6) These branches give rise to minute fibers called **purkinje fibres** which spreads throughout the walls of the respective sides.

iv) 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.



20. **The Female Reproductive System:**

1. 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.
2. These parts of the system along with a pair of the mammary glands are integrated structurally and functionally to support the process of ovulation, fertilization, pregnancy, birth and child care.

Ovaries:

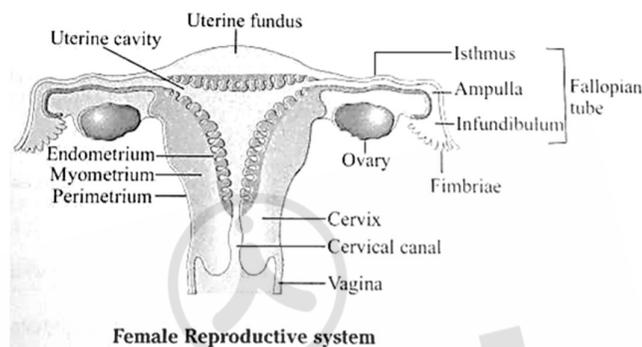
1. Ovaries are the primary female sex organs that produce the female gametes (ova) and several steroid hormones (ovarian hormones).
2. A pair of ovaries is located one on each side of the lower abdomen.
3. The double layered fold of peritoneum connecting the ovary with the wall of the abdominal cavity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

Fallopian tubes (Oviducts)

1. Each fallopian tube extends from the periphery of each ovary to the uterus, and it bears a funnel shaped infundibulum.
2. The edges of the infundibulum possess finger like projections called **fimbriae**, which help in collection of the ovum after 'ovulation'.
3. The infundibulum leads to a wider part of the oviduct called **ampulla**.
4. The last part of the oviduct, **isthmus** has a narrow lumen and it joins the uterus.
5. Fallopian tube is the site of fertilization.
6. It conducts the ovum or zygote towards the uterus by peristalsis.
7. The fallopian tube is attached to the abdominal wall by a peritoneal fold called **mesosalpinx**.

Uterus:

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



Vagina:

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

Vulva:

1. The term vulva (vulva = to wrap around) or pudendum refers to the external genital of the female.
2. The vestibule has two apertures—the upper external urethral orifice of the urethra and the lower vaginal orifice of vagina.
3. Vaginal orifice is often covered partially by a membrane called hymen which is a mucous membrane.
4. Vestibule is bound by two pairs of fleshy folds of tissue called labia minora (inner) and larger pair called labia majora (outer).
5. Clitoris is a sensitive, erectile structure, which lies at the upper junction of the two labia minora above the urethral opening.
6. The clitoris is homologous to the penis of a male as both are supported by corpora cavernosa internally.
7. 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:

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

(a) Bartholin's glands:

1. 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.
2. They secrete mucus to lubricate the vagina and are homologous to the bulbourethral glands of the male reproductive system.

(b) Skene's glands:

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

(c) Mammary glands:

1. A functional mammary gland is characteristic of all female mammals.
 2. The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat.
 3. The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli.
 4. The cells of the alveoli secrete milk, which is stored in the cavities (lumens) of the alveoli.
 5. The alveoli open into mammary tubules.
 6. The tubules of each lobe join to form a mammary duct.
 7. 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.
21. Inheritance of a character from male parent to the male young ones of second generation through the females (carrier) of the first generation is called '**Criss cross inheritance**' or '**Skip generation inheritance**'.
1. The sex-linked recessive inheritance is due to X-linked genes.
 2. The X-linked recessive character follows criss cross pattern of inheritance.
 3. Sex-linked recessive traits in human are:
 - (a) Duchenne muscular dystrophy
 - (b) Haemophilia
 - (c) Colour blindness

(A) Colour blindness:

- (i) Retina of the eye in man contains cells sensitive to red and green colours. This trait is controlled by the gene located on X chromosome only.
- (ii) Red colour blindness is protanopia type; green colour blindness is deuteranopia type.
- (iii) Men are colour blind if they have single recessive gene for colour blindness on their X-chromosomes. They are normal if dominant gene for normal vision is on X-chromosome.
- (iv) Women have normal vision, if gene for colour blindness is absent on both of her X-chromosomes (Homozygous) or if they have only one gene for colour blindness on one of their X-chromosomes (Heterozygous-carrier).
- (v) Women will be colour blind only when she has recessive gene for colour blindness on both of her X-chromosomes.

- (vi) When a normal vision woman (Homozygous) marries a colour blind man, all the sons and daughters are with normal vision but daughters are carriers.
- (vii) If carrier woman marries normal man, all the daughters have normal vision but 50% sons are colourblind.
- (viii) Colour blind trait is inherited from male P1 to his grandson (male F2) through carrier daughter of F1. This is called criss cross inheritance.
- (ix) If colour blind female marries a normal male, all daughters become carriers but all sons become colour blind.
- (x) If carrier female marries a colour blind man, 50% of their progeny is colourblind.



Aakash
Medical | IIT-JEE | Foundations