

Previous IPE  
**SOLVED PAPERS**

**MARCH -2024 (AP)**

**PREVIOUS PAPERS****IPE: MARCH-2024(AP)****Time : 3 Hours****SR.ZOOLOGY****Max.Marks : 60****SECTION-A****I. Answer ALL the following VSAQ:****10 × 2 = 20**

1. What is autocatalysis? Give two examples.
2. Define cardiac cycle and cardiac output.
3. What is organ of Corti?
4. What is triad system?
5. What is 'insulin shock'?
6. What is acromegaly? Name the hormone responsible for this disorder.
7. Mention the advantages of 'lactational amenorrhea method'.
8. What are the measures one has to take to prevent contracting STDs?
9. Define the term transgenic animal.
10. Define the terms layer and broiler.

**SECTION-B****II. Answer any SIX of the following SAQs:****6 × 4 = 24**

11. Draw a neat labelled diagram of L.S. of a tooth.
12. What are the major transport mechanisms for CO<sub>2</sub>? Explain.
13. Describe the structure of a Synovial joint with the help of a neat labelled diagram.
14. Write short notes on B-Cells.
15. How is sex determined in human beings?
16. Explain the different types of cancers.
17. Distinguish between homologous and analogous organs.
18. Explain Darwin's theory of Natural Selection with industrial melanism as an experimental proof.

**SECTION-C****III. Answer any TWO of the following LAQs:****2 × 8 = 16**

19. Explain the physiology of Urine formation.
20. Describe male reproductive system of a man. Draw a labelled diagram of it.
21. What are multiple alleles? Describe multiple alleles with the help of ABO blood groups in man.

# IPE AP MARCH-2024

## SOLUTIONS

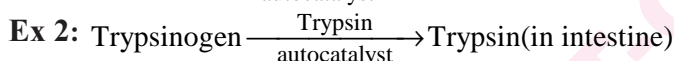
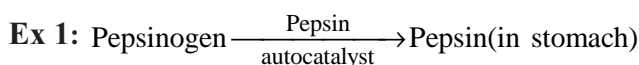
### SECTION-A

1. What is auto catalysis? Give two examples.

[AP 24]

**A:** 1) **Auto catalysis:** The catalysis reaction in which, catalyst itself is one of the products of the reaction is called autocatalysis. (or) When the same enzyme is used as catalyst for the activation of its proenzyme, the phenomenon is called autocatalysis.

2) **Ex:** Pepsin, Trypsin



2. Define cardiac cycle and cardiac output.

[AP 20,24]

**A:** 1) **Cardiac cycle:** Cardiac events that occur from the beginning of one heartbeat to the beginning of the next is called cardiac cycle. Its duration is about **0.8s**.

2) **Cardiac output :** It is the volume of blood pumped out by the ventricle per minute. It is approximately **5 litres**.

3. What is organ of Corti?

[AP 15,17,19,24]

**A:** 1) **Organ of Corti :** It is the sensory ridge formed by the cochlear epithelium, on the basilar membrane.  
2) It contains **hair cells**, which act as **auditory receptors**.

4. What is triad system?

[TS 15,16,17, 19, 20,22]

**A:** 1) **Triad System:** The triad is a skeletal muscle with 1 T-tubule and the 2 terminal Cisternae .  
2) Each T tubule is flanked on either side by several terminal cisternae of the sarcoplasmic reticulum.

5. What is 'insulin shock'?

[TS 24][AP 15,18,24]

**A:** 1) **Insulin shock:** It is a condition that occurs due to hyper secretion of insulin or due to over dosage of insulin in diabetic patients.  
2) It is characterised by hypoglycemia - low glucose levels in blood.

6. What is acromegaly? Name the hormone responsible for this disorder. [AP 15,24][TS 17]

- A:** 1) **Acromegaly** is a **hormonal disorder** that results when the pituitary gland produces **hypersecretion** of somatotropin or **growth hormone (GH) in adults**.
- 2) This disease is characterised by enlargement of the bones of the jaw, hand and feet, thickened nose, lips, eyelids and wide finger tips and **gorilla like appearance** of the person affected.
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7. Mention the advantages of 'lactational amenorrhea method'. [AP 19,22,24]

**A: Advantages of Lactational amenorrhea method(Breast feeding):**

- 1) As long as the mother breast feeds her child, the chances of conception are almost zero.
- 2) Breast fed babies have enhanced immunity and protection against allergies.
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8. What are the measures one has to take to prevent contracting STDs?

**A: Measures to prevent STDs:** [AP 17,18, 23,24][TS 19]

- 1) Avoiding sex with unknown partner or multiple partners.
- 2) Using condoms compulsorily during intercourse.
- 3) Consulting qualified doctor for early detection of STDs.
- 4) Getting complete treatment in case of infection.
- 

9. Define the term transgenic animal. [AP 24]

- A: 1) Transgenic animal:** Transgenic animals are the animals that have their DNA manipulated to possess and express an extragene in addition their own genome.
- 2) **Ex:** Emphysema can be treated by  $\alpha$ -1 antitrypsin [human protein]
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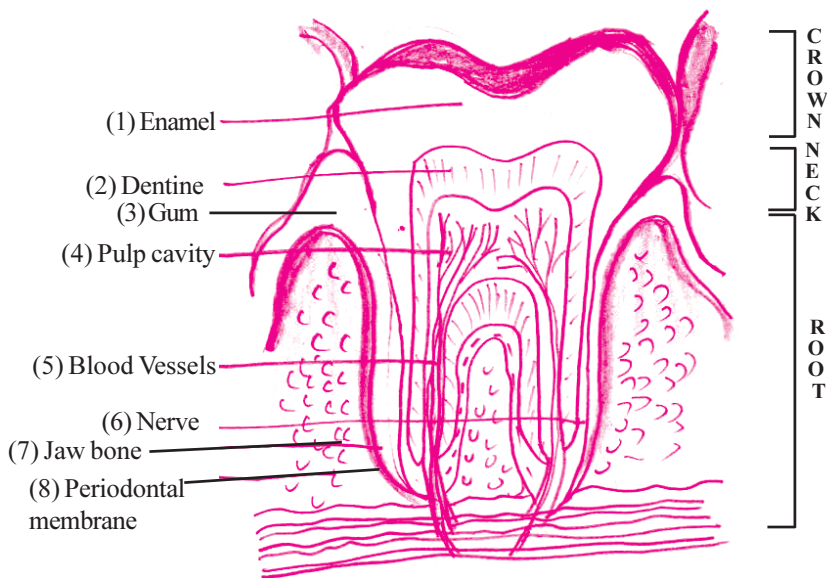
10. Define the terms layer and broiler. [TS 19,20,22] [ AP 15, 17,19,24]

- A:** 1) Layers are birds which are exclusively raised for the production of eggs.
- 2) Broilers are birds which are raised only for their meat. They are raised only upto 8 or 10 week and sent to market.

**SECTION-B**

11. Draw a neat labelled diagram of L.S. of a tooth.

A:



L.S.of tooth

12. What are the major transport mechanisms for CO<sub>2</sub> ? Explain.

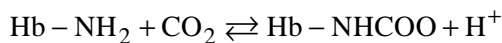
A: Transport Mechanism of CO<sub>2</sub>:

CO<sub>2</sub> is transported to lungs in three different ways.

(1) 7% as carbonic acid (2) About 20-25% as carbamino compound (3) About 70% as bicarbonates.

**1) As carbonic acid:** 7% of CO<sub>2</sub> combines with H<sub>2</sub>O to form carbonic acid. It is transported to lungs where it is dissociated into water and CO<sub>2</sub>.

**2) As carbamino compound:** About 20-25% of CO<sub>2</sub> combines with free amino group of haemoglobin and forms carbamino haemoglobin. It is a reversible reaction.



**3) As bicarbonates:** About 70% of CO<sub>2</sub> combines with water to form H<sub>2</sub>CO<sub>3</sub> in the presence of carbonic anhydrase. In RBC, the carbonic acid dissociates into  $\text{HCO}_3^- + \text{H}^+$ .

**4)** At the alveolar site where pCO<sub>2</sub> is low, the reaction proceeds in the opposite direction, leading to the formation of CO<sub>2</sub> and H<sub>2</sub>O.

**5)** Thus CO<sub>2</sub> is mostly trapped as bicarbonate at the tissues and transported to the alveoli, where it is released out as CO<sub>2</sub>.

**13. Describe the structure of synovial joint with the help of a neat labelled diagram.**

**A:** 1) **Synovial Joint** is a 'freely moving joint' between two bones.

2) Structural parts of Synovial Joint:

- i) Articular Capsule
- ii) Articular Cartilage (Hyaline)
- iii) Synovial Cavity

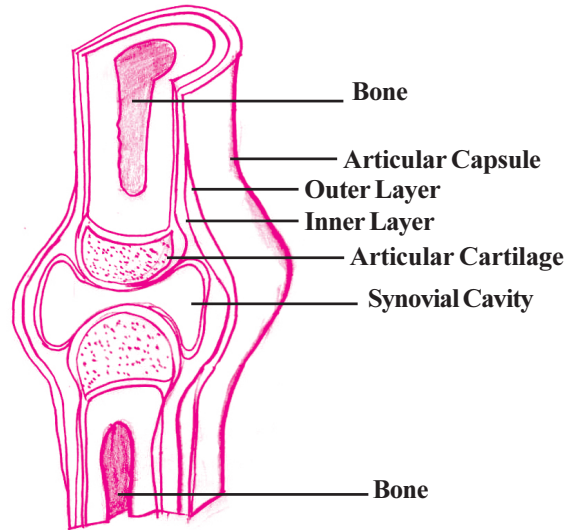
3) Articular Capsule consists of two layers.

Outer fibrous layer keeps the bones together without dislocating .

Inner layer seals the synovial fluid.

4) The ends of joint bones are formed with smooth Articular Cartilage which minimises friction between bones.

5) Synovial cavity is filled with 'Synovial fluid' which acts as Lubricator and Shock Absorber.



**Structure of Synovial Joint**

**14. Write short notes on B-cells.**

[AP 22,24][TS 17,19,22]

**A: B-cells:**

- 1) B-cells are lymphocytes which produce antibodies.
- 2) B-cells are produced from the bone marrow of adult mammals and from the **liver of foetus**.
- 3) Mature B Cells (MBC) produce various antibodies which are carried on their plasma membrane.
- 4) MBC are also called immuno competent B cells as these antibodies can take antigens.
- 5) MBC reach secondary lymphoid organs and develop into functional immune cells.
- 6) Functional immune cells transform into long lived memory cells and effector plasma cells.
- 7) Plasma cells produce antibodies specific to antigens.
- 8) Memory cells store information about the specific antigens and show quick response when the same antigen attacks the body infuture.

15. How is sex determined in human beings?

[AP 18, 23,24][ TS 15,22,24]

**A: Sex determination in human beings:**

- 1) The sex determining mechanism in case of humans is XX-XY type.
- 2) Out of 23 pairs of chromosomes present, 22 pairs are exactly same in both males and females.
- 3) The **female's Karyotype is 44XX**; The **male's Karyotype is 44XY**
- 4) Female produces same type of gametes. Male produces two types of gametes.
- 5) Gametes produced by female are 22X and Gametes produced by male are 22X and 22Y
- 6) When 22X sperm fertilizes 22X ovum, the result is a female child 44XX.  
When 22Y sperm fertilizes 22X ovum, the result is a male child 44XY.
- 7) So, it is clear that, it is the **genetic makeup of the sperm that determines the sex of the child.**
- 8) It is also clear that in each pregnancy there is always 50 percent probability for either a male or a female child.

16. Explain the different types of cancers.

[AP 18,24][TS 15,17,18,19,24]

**A: Based on the origin, cancers are classified as follows:**

- 1) **Sarcoma:** Cancer of **connective tissue**.
- 2) **Sporadic cancer:** Cancers that occur **without any family history**.
- 3) **Carcinoma:** Cancer of **epithelia tissue** or cells. It is the **most common type of cancer**.
- 4) **Lymphoma:** Cancer of **Lymphatic system**
- 5) **Leukemia:** A **liquid tumor**. It is the cancer of bone marrow resulting unrestricted production of W.B.C [Leukemia- blood cancer]
- 6) **Familial cancer:** Cancers that are **inherited from parents or grand parents**.

**17. Distinguish between homologous and analogous organs.**

**A:** Homologous and Analogous organs are evidences of evolution from comparative anatomy.

Homologous organs	Analogous organs
1) The organs which have similar structure and origin but not necessarily the same function are called homologous organs.	1) The organs which have different origin but have same function are analogous organs.
2) They suggest divergent evolution.	2) They suggest convergent evolution.
3) <b>Ex:</b> The forelimbs of vertebrates, Flipper of Whale, wings of birds, hand of man and wings of bat	3) <b>Ex:</b> Wings of butterfly and wings of birds.
4) All these organs have same arrangement of bones but their functions vary to suit their mode of life.	4) When the animals live in same habitat and lead a similar mode of life they tend to have same body form.

**18. Explain Darwin's theory of Natural Selection with industrial melanism as an experimental proof.** [ AP 16,17,18,23,24][ TS 15,16,17,19]

- A:**
- 1) Darwin's theory of natural selection explains that nature has its own way to eliminate the organisms which cannot survive.
  - 2) 'Natural selection of darker forms' due to Industrial pollution is known as 'industrial melanism'.
  - 3) 'Peppered moth' is taken as a scientific example to explain this.
  - 4) These moths were available in two colours grey and black.
  - 5) Grey moths were abundant before industrial revolution in all over England.
  - 6) Pollution from industries in the form of soot turned barks of trees into black.
  - 7) So grey moths were easily identified and were more predated by birds.
  - 8) Thus grey moths decreased in number, black moths increased in the population.



## SECTION-C

### 19. Explain the physiology of urine formation.

[AP 20,24]

**A: D) Urine Formation:** Kidneys are main excretory organs of human beings.

Urea along with water and other dissolved substances are collectively called urine.

Urine formation involves three processes.

1) Glomerular filtration 2) Selective reabsorption 3) Tubular secretion.

**1) Glomerular filtration:** Glomerular capillaries along with inner wall of Bowman's capsule form a sieve. The podocytes and slit pores help in this process. **Blood is filtered with a net filtration pressure of 10mm of Hg.** During this process the entire plasma is filtered except proteins and blood cells.

The filtrate is ultrafiltrate or glomerular filtrate or primary urine.

The glomerular filtration rate in a healthy individual is 125ml/ minute.

**2) Selective reabsorption:** Nearly 99% of primary urine and essential substances are reabsorbed by renal tubules called selective reabsorption. About 85% of primary urine is reabsorbed in a constant unregulated manner called obligatory reabsorption.

**3) Tubular secretion:** During the formation of urine, the tubular cells secrete substances such as  $H^+$ ,  $K^+$  and  $NH_3$  into the filtrate. Tubular secretion is also an important step in the formation of urine, as it helps in the maintenance of ionic and acid base balance of the body fluids.

### II) Mechanism of selective reabsorption- Secretion in different parts of nephrons

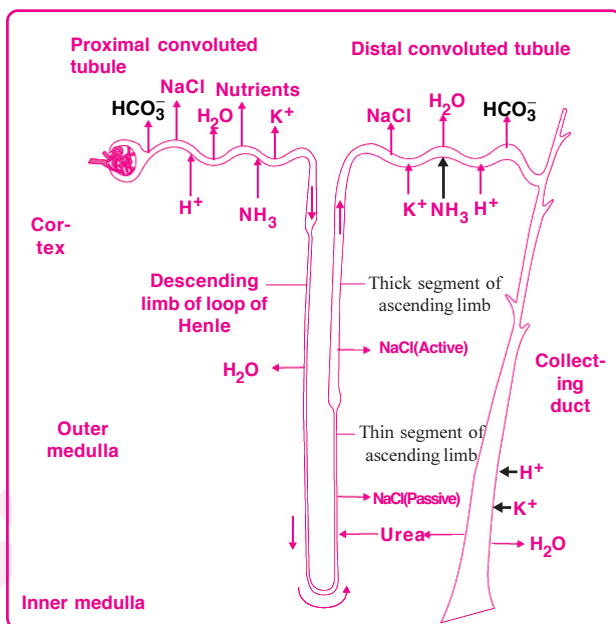
**1) Proximal convoluted tubule:** It is lined by cuboidal epithelium with brush border. About 80% electrolytes and water are reabsorbed. Water is absorbed by passive diffusion (osmosis) and  $Na^+$ , glucose, amino acids and other essential substances by active transport.  $H^+$  and  $NH_3$  are secreted.  $HCO_3^-$  is absorbed to maintain pH.

**2) Henle's loop:** Water reabsorbed in descending limb by diffusion. Ascending limb has a thin segment and thick segment.  $NaCl$  is reabsorbed passively in thin part and actively in thick part. In Henle's loop, low osmolarity (300) is maintained **towards cortex** and **high osmolarity** (1200) at the **tip in medulla**.

The counter flow of blood through vasa recta removes water,  $NaCl$  and reabsorbed substances continuously.

**3) Distal Convoluted Tubule(DCT):** Water is reabsorbed by the action of ADH (Anti diuretic hormone).  $HCO_3^-$  is absorbed.  $H^+$ ,  $K^+$  and  $NH_3$  are secreted to maintain pH.

**4) Collecting Ducts(CD):** This segment allows the passage of small amount of urea to keep up its osmolarity. Concentrated urine is released into pelvis. It is **hypertonic** to the plasma of blood.



**REABSORPTION AND SECRETION  
OF MAJOR SUBSTANCES**

20. Describe male reproductive system of a man. Draw a labelled diagram of it.

A: MALE REPRODUCTIVE SYSTEM

[AP 16,17,18,20][TS 16,17,18,19,22]

**Male Reproductive system consists of 6 parts:**

I) Testes II) Epididymis III) Vasa deferentia IV) Urethra V) Penis VI) Accessory glands

**I) Testes:**

- 1) Testes or testicles are a pair of oval pinkish **male primary sex organs**.
- 2) They are suspended outside the abdominal cavity within a **pouch** called **scrotum**.
- 3) Sperms do not develop at body (abdominal) temperature. So they go into scrotum.
- 4) The scrotum is connected to abdominal cavity through inguinal canal.
- 5) Inside the scrotum, testis is held by gubernaculum.
- 6) Spermatic cord is formed by the blood vessels, nerve and vas deferens. This cord runs from abdomen to each testis through inguinal canal.
- 7) Tunica albuginea project inside the testis as septa. There are about 250 testicular lobules in each testis. Each lobule contains 2 or 3 highly coiled seminiferous tubules.
- 8) Each seminiferous tubules consists of germinal epithelium and sertoli cells.
- 9) Germinal epithelium produces sperms.
- 10) Sertoli cells nourish the sperms.
- 11) The regions outside the seminiferous tubules called interstitial spaces contain Leydig cells.
- 12) They produce male hormone testosterone called androgens.
- 13) Testosterone controls the development of secondary sexual characters and spermatogenesis.
- 14) Seminiferous tubules open in rete testis. Rete testis opens into vasa efferentia. Vasa efferentia open into a highly coiled epididymis.

**II) Epididymis :**

- 1) It is a **narrow tightly coiled tube** located along **posterior** surface of each testis.
- 2) Vasa deferentia leave the testis and open into epididymis .
- 3) **Epididymis** provides space for **maturation** and **storage of sperms**.
- 4) Epididymis is divided into 3 regions  
(i) caput epididymis (ii) corpus epididymis and (iii) cauda epididymis.
- 5) Caput epididymis receives the sperms from the testis through vasa efferentia.

**III) Vasa deferentia:**

- 1) The Vasa deferentia is a long, narrow, muscular tube.
- 2) It starts from the tail of the epididymis, passes through the inguinal canal into the abdomen and loops over the urinary bladder.
- 3) The two ducts open into urethra at the centre of the prostate gland.

**IV) Urethra:**

- 1) The **urethra originates from the urinary bladder** and extends through the penis to its external opening called urethral meatus.
- 2) The **urethra** provides an **exit for urine** as well as for semen during ejaculation.
- 3) Urethra is shared terminal duct of the reproductive and urinary systems.
- 4) Urethra is the urinogenital duct of man passes through penis to open outside.

**V) Penis:**

- 1) The penis serves as a **urinal duct**.
- 2) It is the **intromittent organ** that transfers spermatozoa to the vagina of a female.
- 3) It has **3 columns of tissue**. Two upper **corpora cavernosa** and **one ventral corpus spongiosum**.
- 4) The terminal enlarge part is glans penis covered by loose skin (fore skin) called **prepuce**.
- 5) Skin and a subcutaneous layer enclose all three columns, which consist of special tissue that helps in erection of the penis to facilitate insemination.

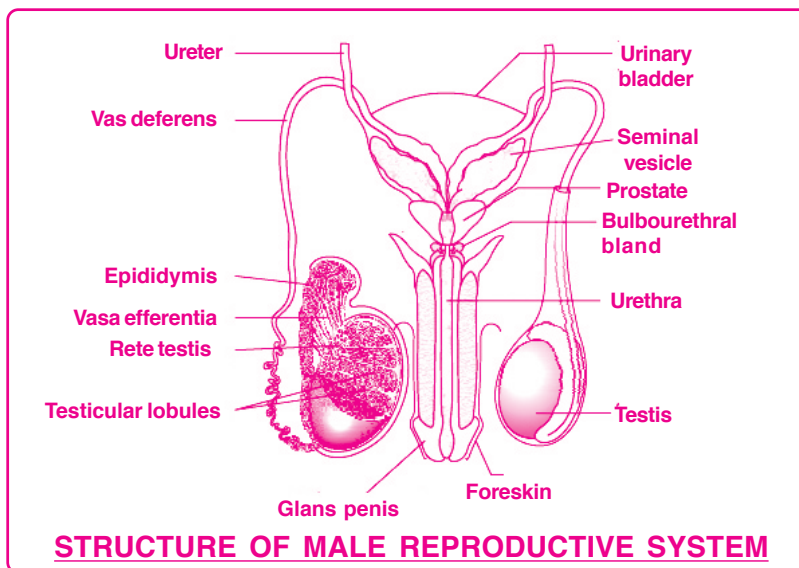
**VI) Male accessory genital glands:****(1) Seminal vesicles:**

- 1) A pair of simple tubular glands is present below the urinary bladder. Each seminal vesicle opens into the corresponding vas deference.
- 2) Its secretion constitutes 60% of total seminal fluid. It is alkaline and viscous fluid.
- 3) **Fructose acts as the main energy source of the sperm.**

**(2) Prostate gland:** (i) It is present below the urinary bladder. Its contribution to seminal fluid is 15-30%. (ii) Its secretion is **slightly acid**. It **activates the sperms** and provides nutrition.

**(3) Bulbourethral glands:**

- (i) These are present below the prostate gland. They add an alkaline fluid to semen during the process of ejaculation.
- (ii) The fluid secreted by these glands **lubricates the urethra**.



**21. What are multiple alleles? Describe multiple alleles with the help of ABO blood groups in man.** [AP 16, 18, 20, 22, 24] [TS 18, 22, 24]

**A: I) Multiple alleles:** Generally a gene has two alleles, one dominant and other recessive. Sometimes a gene may have more than two alleles which are called multiple alleles. The **number of Genotypes** for multiple alleles can be known by the formula  $\frac{n(n+1)}{2}$ , where n is the number alleles.

**Ex:** ABO blood groups.

There are 3 alleles for a single gene.  $\therefore$  No. of genotypes =  $\frac{n(n+1)}{2} = \frac{3(3+1)}{2} = \frac{3(4)}{2} = 6$

**II) ABO Blood Groups:**

The **four Blood groups A, B, AB, O** types are characterized by the presence or absence of antigens on the plasma membrane of RBCs.

The Antigens are sugar polymers. These are bound to lipid molecules.

**Blood group A** persons have antigen 'A' on their RBCs and anti-B antibodies in the plasma.

**Blood group B** persons have antigen 'B' on their RBCs and anti-A antibodies in the plasma.

**Blood group AB** persons have antigens 'A' and 'B' on the RBCs and 'no anti-A and anti-B antibodies' in the plasma.

**Blood group O** persons have 'no antigens' on their RBCs and both 'anti-A' and 'anti-B' antibodies in the plasma

**III) Genetic basis:**

- Karl Land Steiner** proposed the ABO system of blood groups.
- Genetic basis of ABO Blood group is mainly dependent on **3 alleles I<sup>A</sup>, I<sup>B</sup> and I<sup>O</sup>** (or i) of the gene I located on **chromosome 9**.
- Alleles I<sup>A</sup> and I<sup>B</sup> produce antigen A and antigen B respectively.
- Allele I<sup>O</sup> does not produce any antigens.
- Allele I<sup>A</sup> and I<sup>B</sup> are dominant over I<sup>O</sup> but codominant to each other
- A child receives one of the three alleles from each parent, giving rise to six possible genotypes and four possible blood types.
- The 6 genotypes are as follows:
 

(i) I <sup>A</sup> I <sup>A</sup>	(ii) I <sup>A</sup> I <sup>O</sup>	(iii) I <sup>B</sup> I <sup>B</sup>	(iv) I <sup>B</sup> I <sup>O</sup>	(v) I <sup>A</sup> I <sup>B</sup>	(vi) I <sup>O</sup> I <sup>O</sup>
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- The four Phenotypes are as follows:
 

(i) I <sup>A</sup> I <sup>A</sup> and I <sup>A</sup> I <sup>O</sup> are A group blood	(ii) I <sup>B</sup> I <sup>B</sup> and I <sup>B</sup> I <sup>O</sup> are B group blood
(iii) I <sup>A</sup> I <sup>B</sup> are AB group blood	(iv) I <sup>O</sup> I <sup>O</sup> are O group blood

**IV) Compatibility:**

- 1.1) A<sup>+</sup> group can receive blood from A<sup>+</sup>, A<sup>-</sup> and O<sup>-</sup> groups.
- 1.2) A<sup>-</sup> group can receive blood from A<sup>-</sup> and O<sup>-</sup> groups.
- 2.1) B<sup>+</sup> group can receive blood from B<sup>+</sup>, B<sup>-</sup> and O<sup>-</sup> group.
- 2.2) B<sup>-</sup> group can receive blood from B<sup>-</sup> and O<sup>-</sup> groups.
- 3.1) AB<sup>+</sup> can receive from all other groups. Hence **AB<sup>+</sup> is called universal recipient.**
- 3.2) AB<sup>-</sup> can receive from A<sup>-</sup>, B<sup>-</sup>, AB<sup>-</sup> and O<sup>-</sup> groups.
- 4.1) O<sup>+</sup> can receive blood only from O<sup>+</sup> and O<sup>-</sup> groups.
- 4.2) O<sup>-</sup> can receive blood only from O<sup>-</sup> but not from any other group.  
O<sup>-</sup> can be transfused to any other group. Hence **O<sup>-</sup> is called universal donor.**