ULTIMATE KCET

CRASH COURSE 2026

(Zoology) | Lecture - 01

Breathing and Exchange of Gases Body Fluids and Circulation Excretory Products and Their Elimination

By – Raghunath Sir

Recap *of previous lecture*

1. Animal Kingdom
2. Structural Organisation in Animals - Frog
3. Biomolecules
4. Most Important MCQs

Topics *to be covered*

1. Breathing and Exchange of Gases
2. Body Fluids and Circulation
3. Excretory Products and Their Elimination
4. Most Important MCQs

3 qns

Breathing and Exchange of Gases

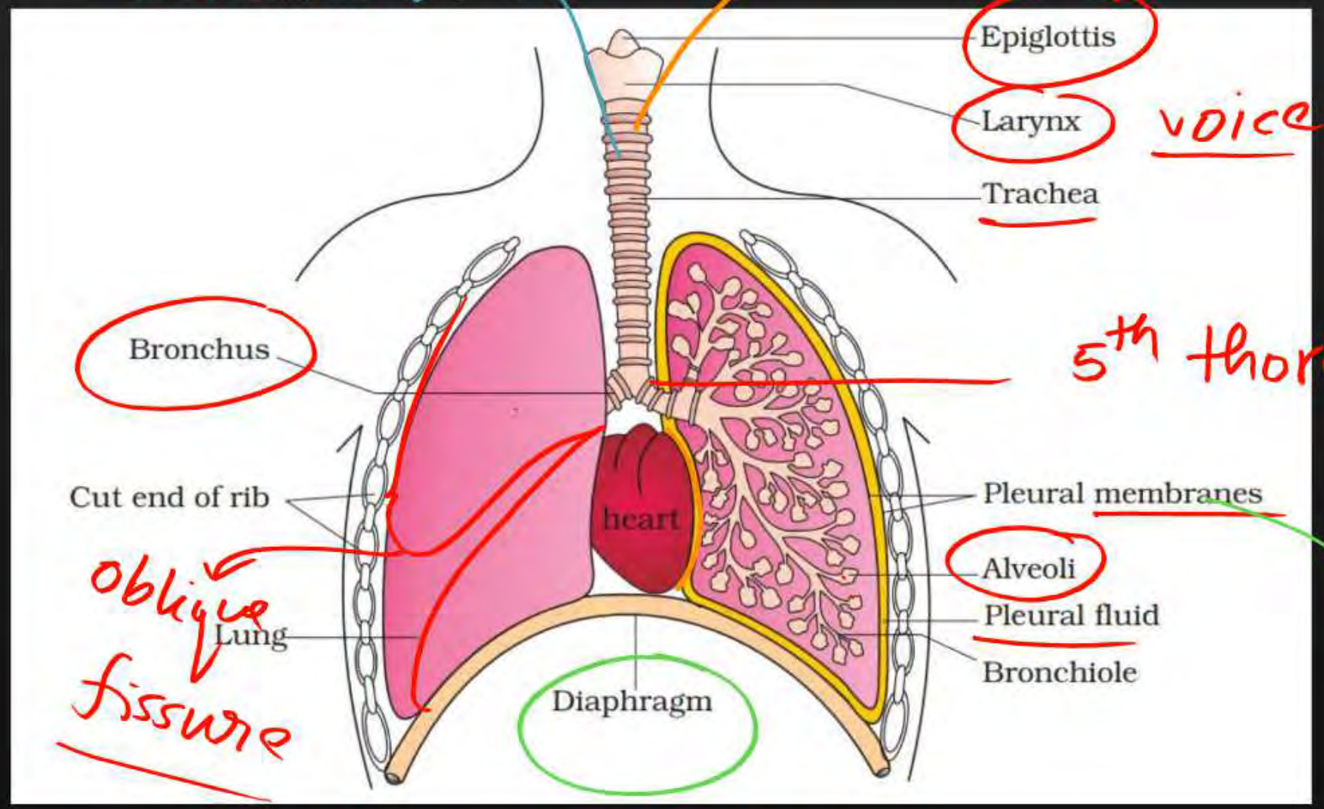
1	*Pulmonary Ventilation*
2	*External Respiration*
3	*Transport of Gases*
4	*Internal Respiration.*
5	*Cellular Respiration*

1. Breathing or pulmonary ventilation by which atmospheric air is drawn in and CO_2 rich alveolar air is released out.
2. Diffusion of gases (O_2 and CO_2) across alveolar membrane.
3. Transport of gases by the blood.
4. Diffusion of O_2 and CO_2 between blood and tissues.
5. Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.

Breathing and Exchange of Gases

pseudostratified ciliated columnar

C-shaped cartilaginous ring



voice

5th thoracic vertebrae

oblique fissure

Somatic

Visceral

Gap – Mediastenum

Nose / Nasal chamber
↓
Pharynx
↓
Larynx
↓
Trachea
↓
Bronchi
↓
Bronchioles
↓
Alveoli

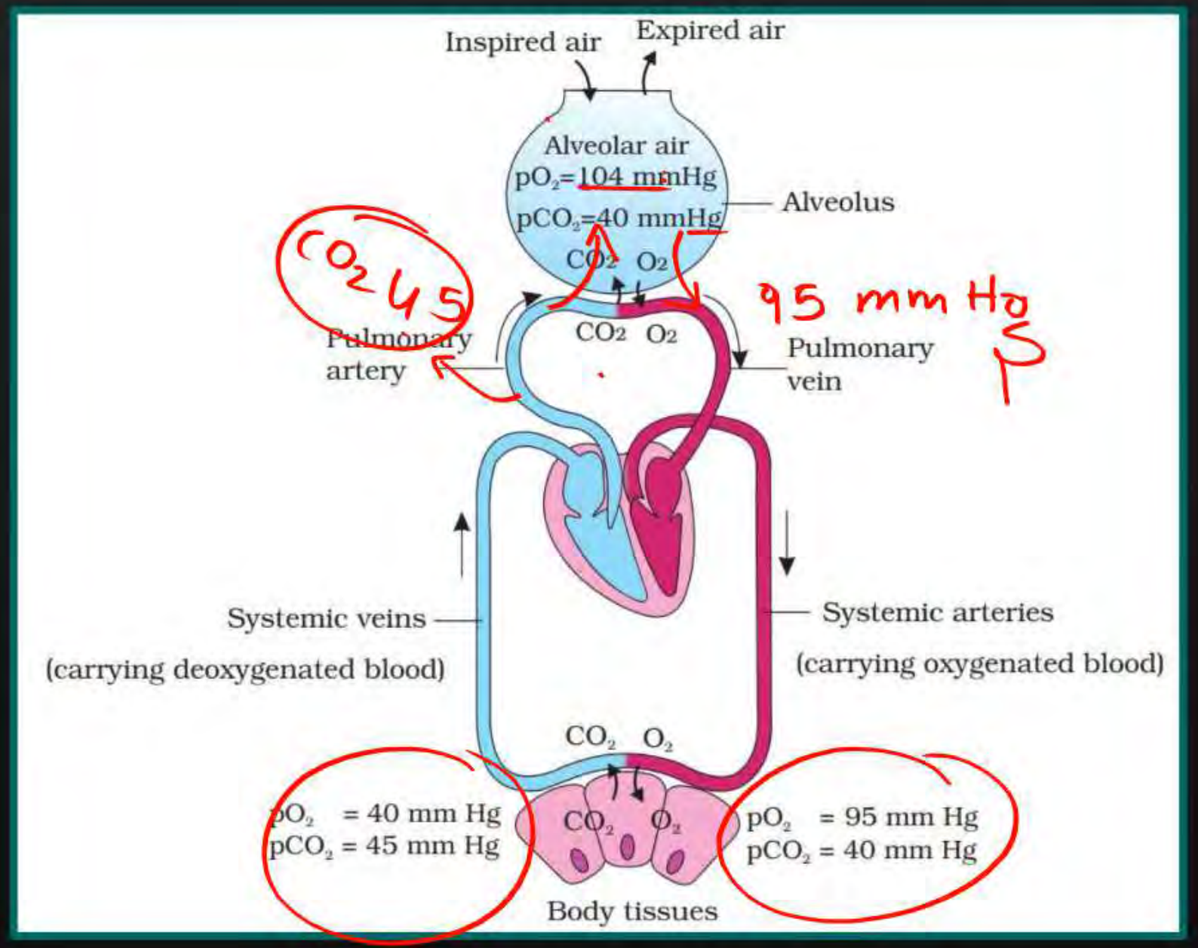
Respiratory Volumes and Capacities

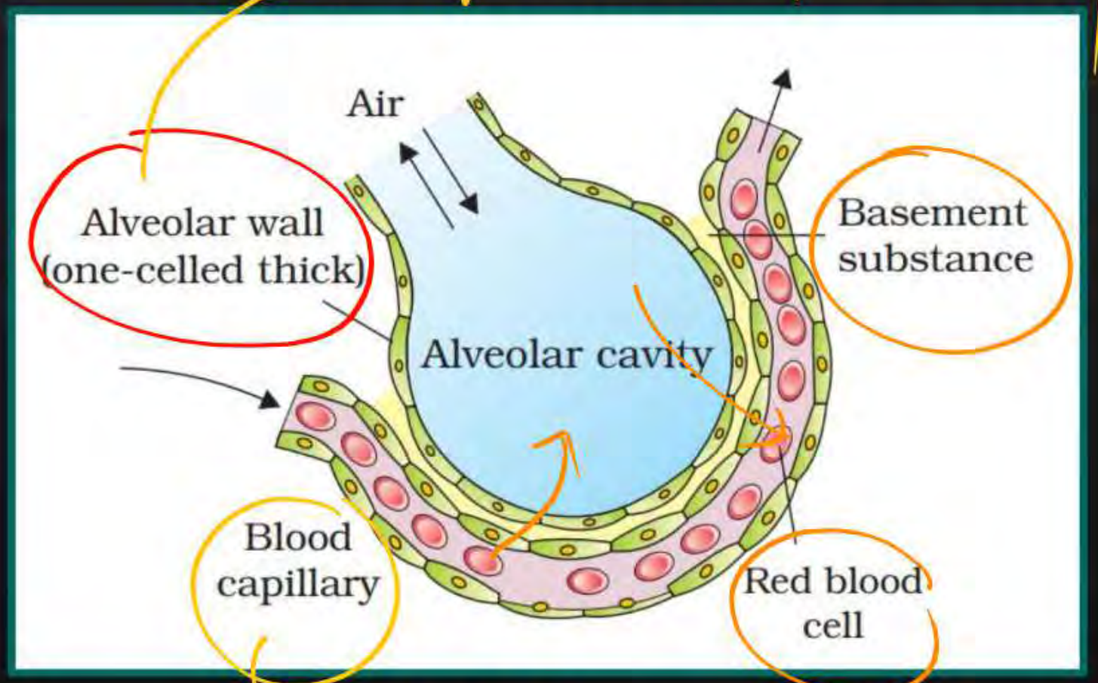
Volumes and Capacities	Features
Tidal Volume (TV) 500 mL	Volume of air inspired or expired during a normal respiration.
Inspiratory Reserve Volume (IRV) 2500 - 3000 mL	Additional volume of air, a person can inspire by a forcible inspiration.
Expiratory Reserve Volume (ERV) 1000 - 1100 mL	Additional volume of air, a person can expire by a forcible expiration.
Residual Volume (RV) 1100 - 1200 mL	Volume of air remaining in the lungs even after a forcible expiration.
Inspiratory Capacity (IC) IRV+TV	Total volume of air a person can inspire after a normal expiration. (TV+IRV).

Respiratory Volumes and Capacities

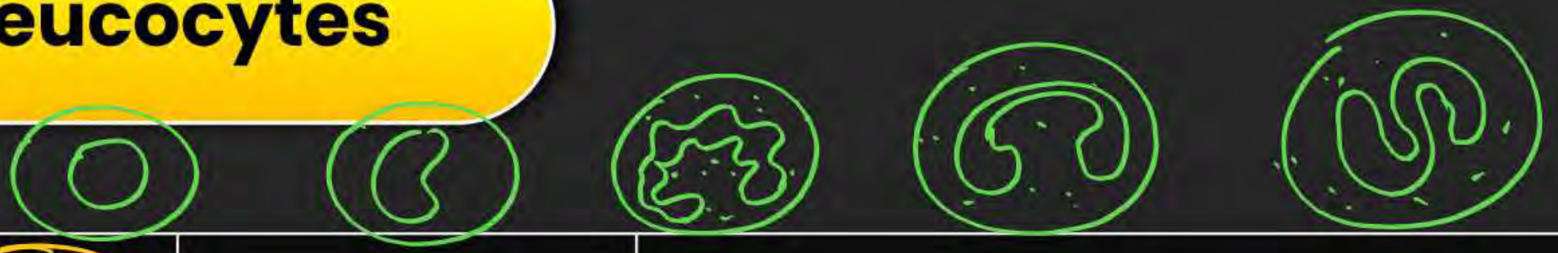
Volumes and Capacities	Features
Expiratory Capacity (EC) ERV + TV	Total volume of air a person can expire after a normal inspiration. (TV+ERV).
Functional Residual Capacity (FRC)	Volume of air that will remain in the lungs after a normal expiration. (ERV+RV).
Vital Capacity (VC) IRV+TV+ERV	The maximum volume of air a person can breathe in after a forced expiration.
Total Lung Capacity IRV+TV+ERV+RV	Total volume of air accommodated in the lungs at the end of a forced inspiration.

Respiratory Gas	Atmospheric Air	Alveoli	Deoxygenated Blood	Oxygenated Blood	Tissues
pO2	159 ↑	104 ↑	40 ↓	95 ↑	40 ↓
pCO2	0.3 ↓	40 ↓	45 ↑	40 ↓	45 ↑

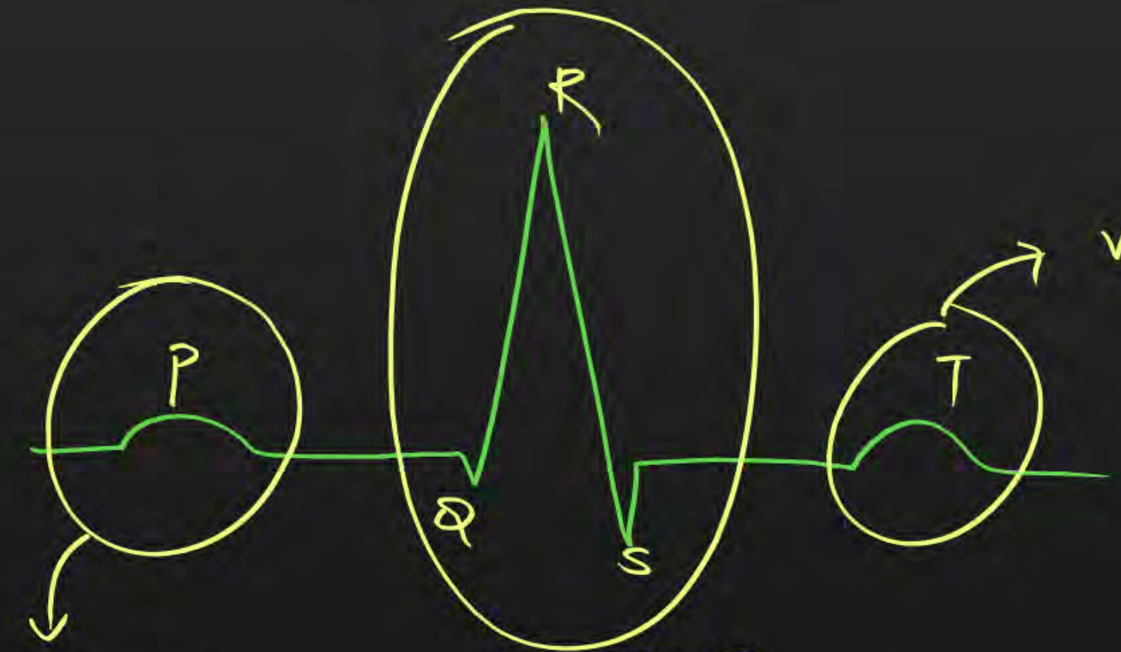




Types of Leucocytes



Type of Leucocytes	Shape of Nucleus	Percentage	Functions
Lymphocytes	Large-spherical	20-25 %	Produce immune responses
Monocytes	Kidney shaped	6-8 %	Phagocytic cells which destroy foreign organisms entering the body.
Neutrophils	Multi-lobed	60-65 %	
Eosinophils	Bi-lobed	2-3 %	Resist infections and are also associated with allergic reactions.
Basophils	S-shaped	0.5-1 %	Secrete histamine, serotonin, heparin, etc., and are involved in inflammatory reactions.



ventricular repolarization

Atrial depolarization

QRS

ventricular depolarization

Coagulation of Blood

prothrombin $\xrightarrow[\text{kinase}]{\text{Thrombo}}$ Thrombin

Fibrinogen $\xrightarrow{\text{Thrombin}}$ Fibrin

- A dark reddish-brown scum formed at the site of a cut or an injury over a period of time. It is a clot or coagulum formed mainly of a network of threads called fibrins in which dead and damaged formed elements of blood are trapped.
- Fibrins are formed by the conversion of inactive fibrinogens in the plasma by the enzyme thrombin.
- Thrombin, in turn are formed from another inactive substance present in the plasma called prothrombin. An enzyme complex, thrombokinase, is required for the above reaction.

Excretory Products

Organisms	Excretory organs
Protozoans, porifera, coelenterates	Body surface
Platyhelminthes, Rotifers, Cephalochordates	Protonephridia
Annelids	Nephridia
Molluscs	Metanephridia / Organ of Bojanus
Crustaceans	Green glands
Arachnids	Coxal glands
Insects	Malpighian tubules
Echinoderms	Nephrocytes

→ Ammonotelic

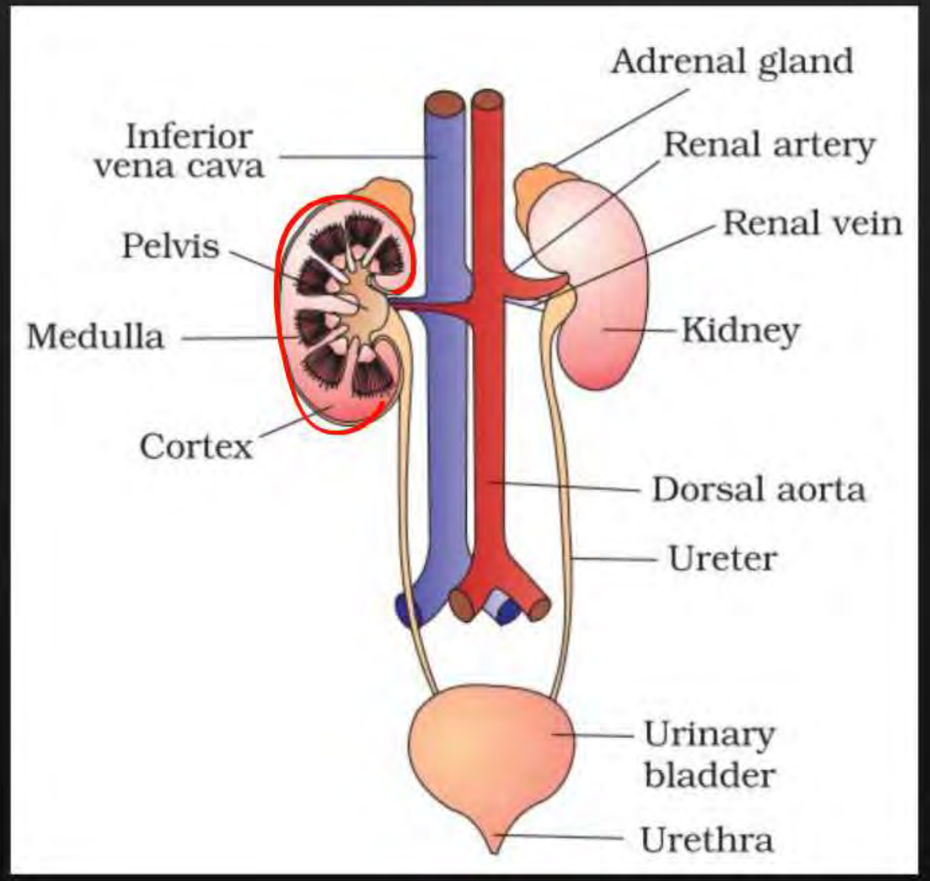
Nitrogenous wastes	Examples
Ammonia — Most toxic	Aquatic animals
Urea — Ureotelic	All mammals, Cartilaginous fishes
Uric acid — least toxic	Insects, land snails, lizards and birds
Allantoin	Non-primates
Hippuric acid	All mammals
Ornithuric acid	Birds
Trimethylamine oxide (TMO)	Marine bony fishes
Guanine	Spiders
Creatinine	Mammals
Bile pigments - bilirubin	Mammals

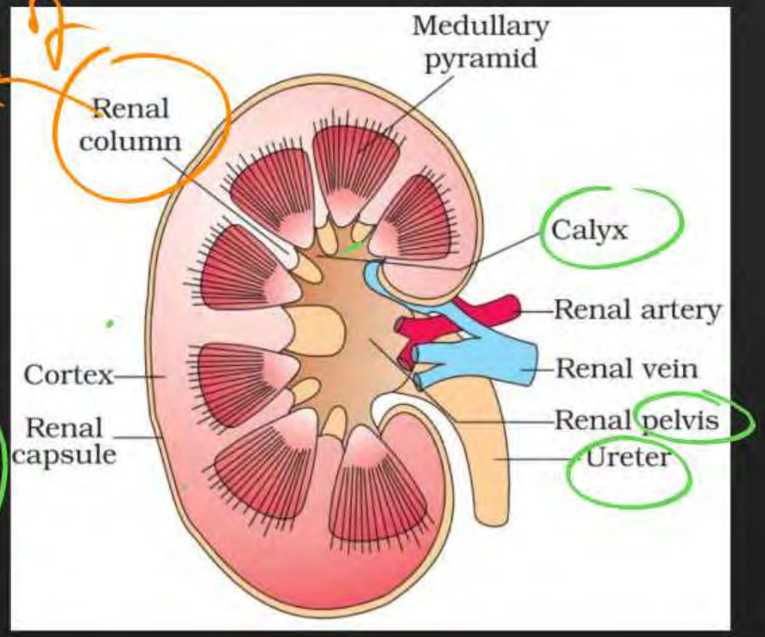
Excretory System

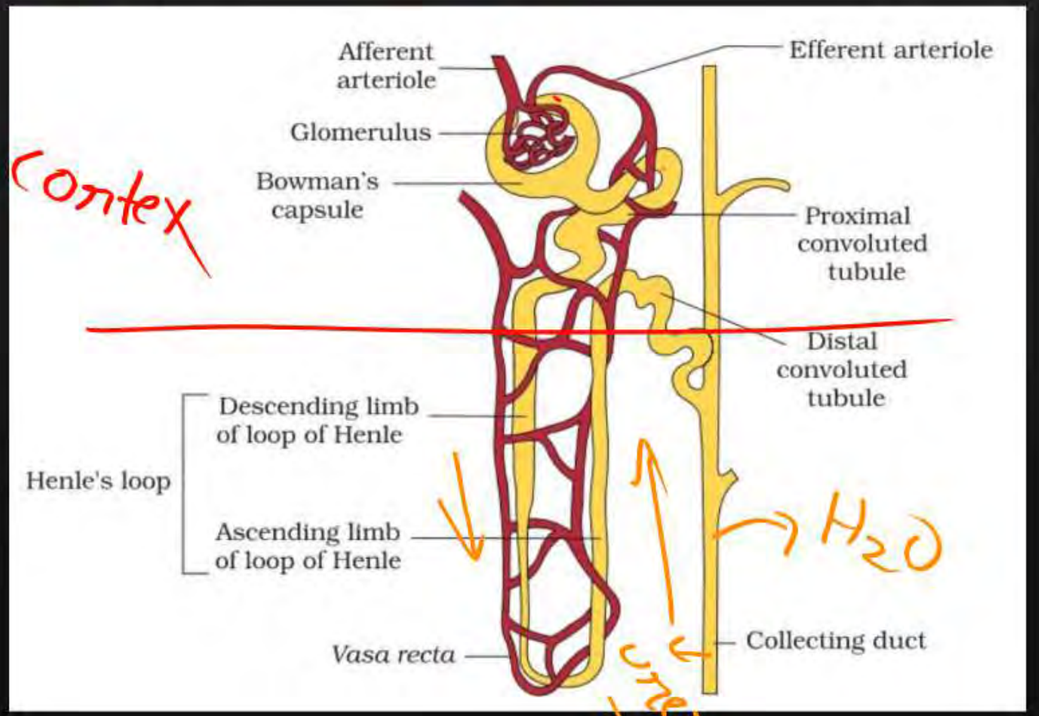
column of Berteni

corticol

juxta-medullary nephrony







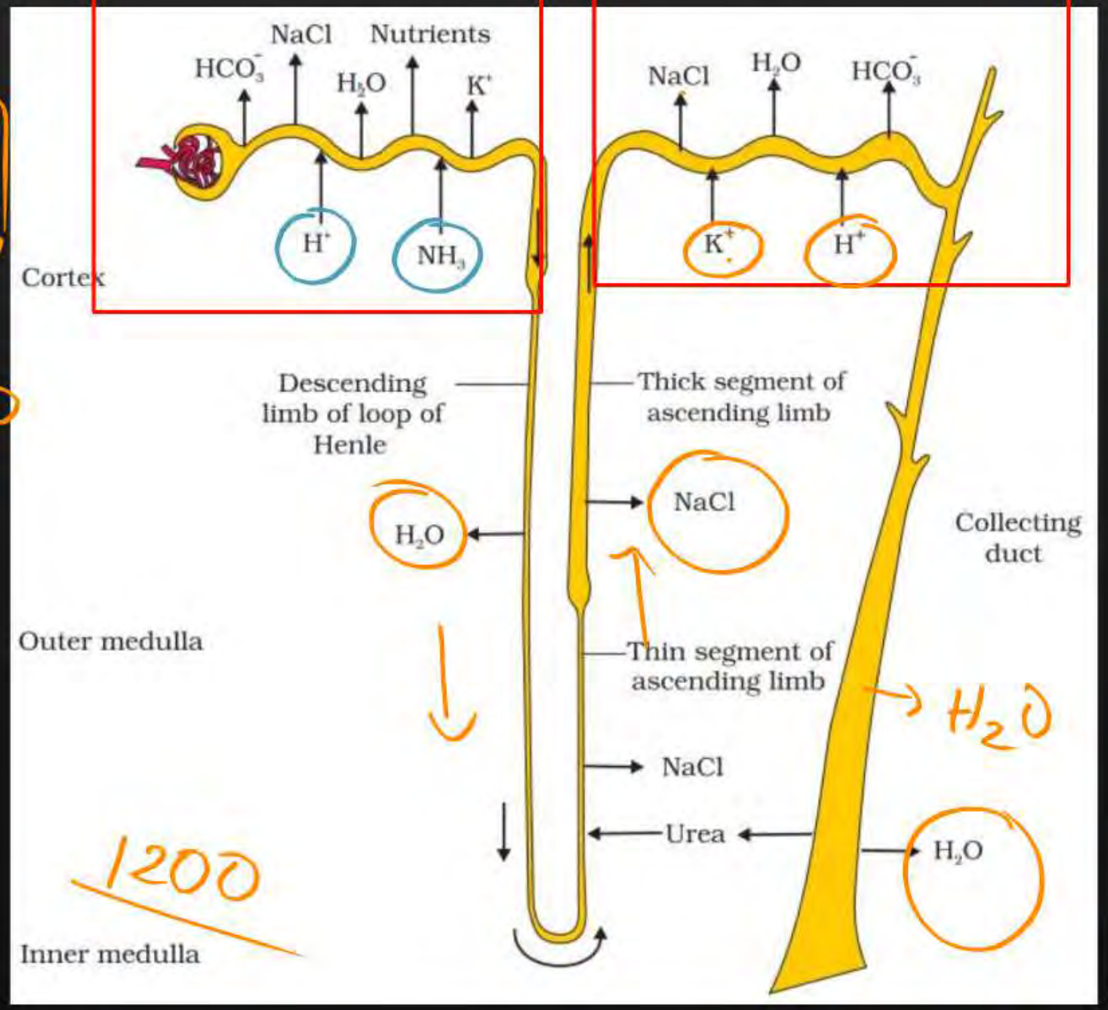
Functions of Tubules

PCT

DCT

Selective reabsorption

Tubular secretion



600

900

1200

Regulation of Kidney Function

Excessive loss of body fluids

↓

Activation of receptors in the body

↓

Stimulates Hypothalamus

↓

ADH (Antidiuretic Hormone) Vasopressin

- Renal Tubules - DCT and Collecting Duct
  - ↓
  - Absorption of water by renal tubules
  - ↓
  - Prevents Diuresis
- Constriction of blood vessels in Kidney
  - ↓
  - Increases the blood pressure
  - ↓
  - Increases GFR

Filtrate

180 ltrs

Fall in GFR

↓ 99%

1 - 1.5 ltrs

Glomerular filtration rate :

125 ml/min

Renin-Angiotensin mechanism

JGA - JG Cells

↓

Renin

↓

Angiotensinogen → Angiotensin I → Angiotensin II

↓

Angiotensin II - Powerful Vasoconstrictor

- ↓
- Increases Blood Pressure
- ↓
- Increases GFR

- Stimulates Adrenal Cortex to release Aldosterone
- ↓
- Absorption of Na^+ and H_2O from DCT

Question

Which is the correct sequence of the air passage in man?

A. Nasal cavity → pharynx → trachea → larynx → bronchi → bronchioles → alveoli

B. Nasal cavity → pharynx → larynx → trachea → bronchi → bronchioles → alveoli

C. Nasal cavity → larynx → pharynx → trachea → bronchi → bronchioles → alveoli

D. Nasal cavity → larynx → bronchi → pharynx → trachea → bronchioles → alveoli

Question

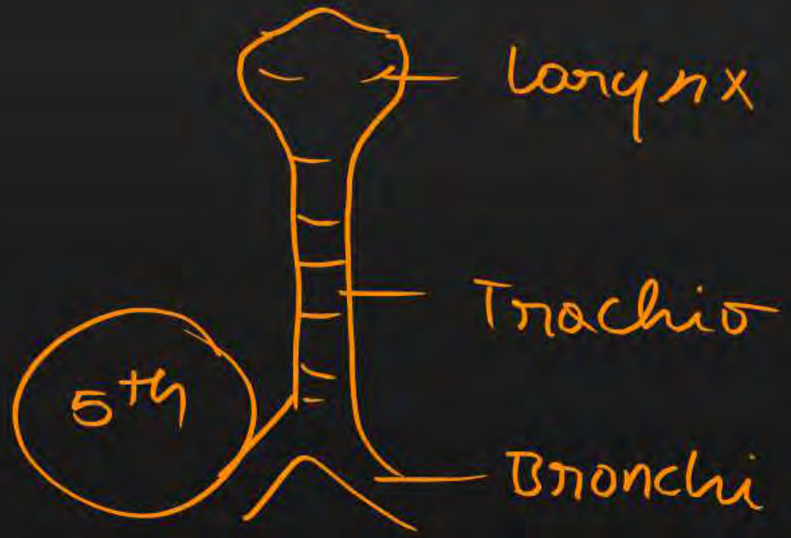
Trachea divides into right and left primary bronchi at

A. 4th thoracic vertebra

B. 5th thoracic vertebra

C. 6th thoracic vertebra

D. 6th cervical vertebra



Question

Lining of trachea is made of

pseudostratified ciliated columnar epithelial tissue

A Simple squamous epithelium — Exchanging

B Simple cuboidal epithelium — secretion

C Pseudostratified epithelium ✓

D Pseudostratified epithelium ✓

Question

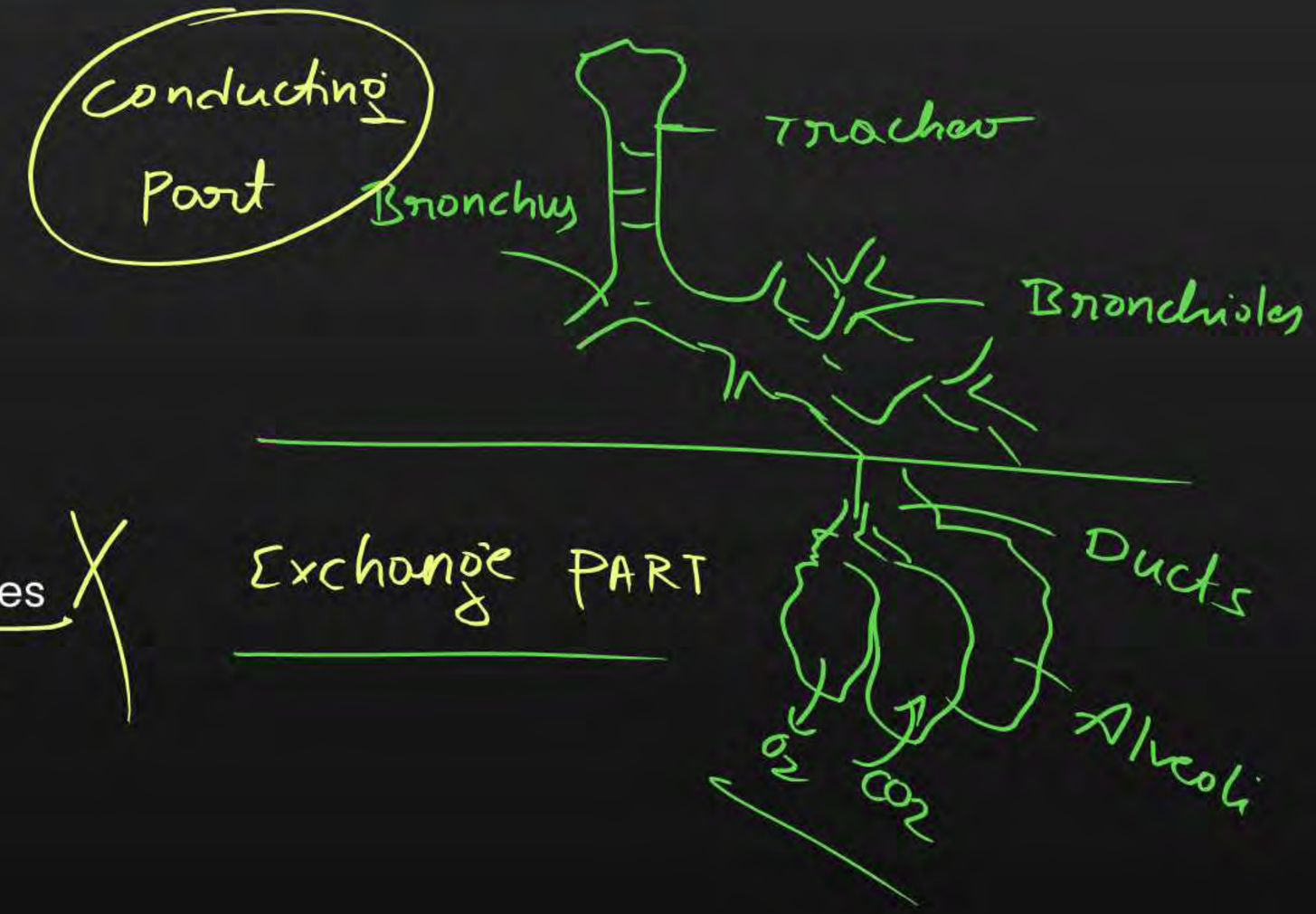
Respiratory or exchange part of the respiratory system consists of

A. All bronchi

B. All bronchioles

C. All bronchi and terminal bronchioles

D. Alveoli and their ducts



Question

Which of the following are functions of conducting part of the respiratory system?

A. Removal of foreign particles from incoming air

B. Humidifies incoming air

C. Bring the temperature of incoming air to body temperature

D. All the above

Question

Assertion: Trachea, primary, secondary and tertiary bronchi and terminal bronchioles are non-collapsible.

Reason: They all are supported by incomplete cartilaginous ring

A. Both (A) and (R) are true and (R) is the correct explanation of (A).

B. Both (A) and (R) are true but (R) is not the correct explanation of (A).

C. (A) is true but (R) is false.

D. Both (A) and (R) are false.

Question

During inspiration

A. Diaphragm and external intercostals muscle relax

B. Diaphragm and internal intercostals muscles relax

C. Diaphragm and external intercostals muscles contract

D. Diaphragm and internal intercostals muscles contract

Question

During inspiration, the diaphragm

A. Relaxes to become dome-shaped

B. Contracts and flattens

C. Expands

D. Shows no change

Question

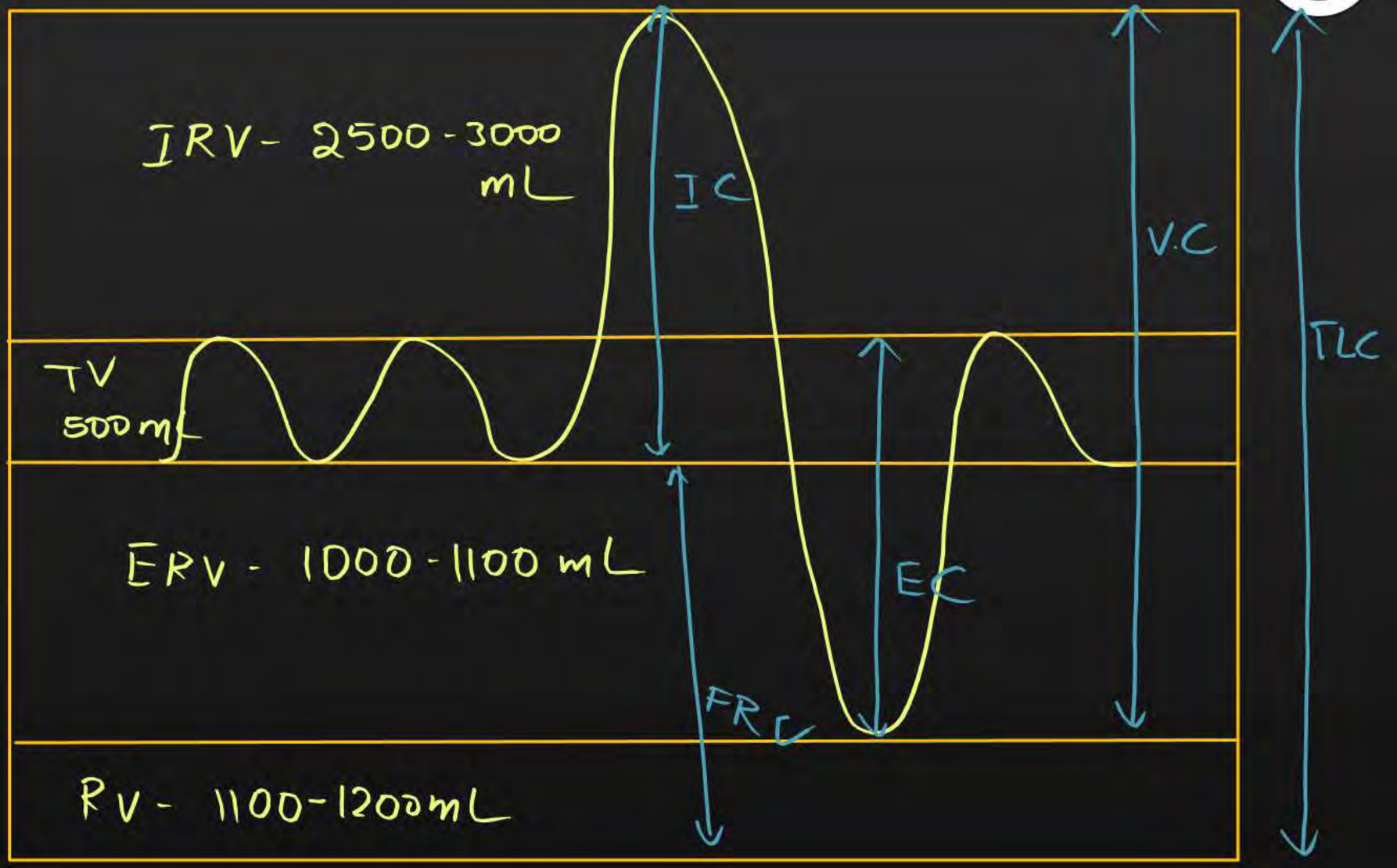
Vital capacity is equal to

A ERV + TV

B IRV + TV

C VC + RV

D ERV + TV + IRV



Question (KCET - 2021)

Arrange the following in the order of increasing volume

1. Tidal volume 500
2. Residual volume 1100 - 1200
3. Expiratory reserve volume 1000 - 1100
4. Inspiratory reserve volume 2500 - 3000

1 < 3 < 2 < 4

A 1 < 2 < 3 < 4

B 1 < 4 < 3 < 2

C 1 < 3 < 2 < 4

D 1 < 4 < 2 < 3

Question

A spirometer cannot be used to measure

A. IC ✗

B. RV ✓ Residual volume

C. ERV ✗

D. IRV ✗

Question

Assertion: During inspiration, the volume of thorax increases.

Reason: This happens due to the relaxation of diaphragm and inspiratory muscles

contraction

External intercostal

A. Both (A) and (R) are true and (R) is the correct explanation of (A).

B. Both (A) and (R) are true but (R) is not the correct explanation of (A).

C. (A) is true but (R) is false.

D. Both (A) and (R) are false.

Question

The most characteristic feature of haemoglobin is

A. Its red colour

B. Presence of iron

C. Its ability to combine reversibly with oxygen

D. Presence of basic protein globin

Question

Factors at tissue level favours the dissociation of oxygen from oxyhaemoglobin

$pCO_2 \uparrow$ 45

$pO_2 \downarrow$ 40

$HbO_2 \longrightarrow Hb + O_2$

A. Low pO_2, low pCO_2, high H^+, low temperature

B. High pO_2, high pCO_2, low H^+, high temperature

C. Low pO_2, high pCO_2, high H^+, high temperature

D. Low pO_2, high pCO_2, high H^+, low temperature

$pO_2 \downarrow$

$pCO_2 \uparrow$

H^+ conc. $\uparrow$

Temp $\uparrow$

Question

Oxygen binding to haemoglobin is

A. Directly proportional to CO_2 concentration

B. Directly proportional to CO concentration

C. Inversely proportional to CO_2 concentration

D. Independent of CO concentration

Question

The majority of CO_2 is transported as

A. Carbonates

B. Bicarbonates

C. Carbaminohaemoglobin (23%)

D. Dissolved state in blood (7%)

70% CO_2 → Bicarbonate

20-25% → RBC

7% → plasma

Question

H.W

Diffusion membrane is made up of

A. Thin squamous epithelium of alveoli

B. Endothelium of alveolar capillaries

C. Basement membrane between the two layers

D. All the above

Question

H.W

How O_2 and CO_2 gets transported through blood?

A. With the help of RBCs and blood plasma

B. With the help of RBCs and WBCs

C. With the help of WBCs and blood serum

D. With the help of platelets and corpuscles

Question

H-W

The partial pressure of oxygen in the alveoli of the lungs is

A More than that in the blood

B Less than that in the blood

C Less than that of carbon dioxide

D Equal to that in the blood

Question

Wheezing sound is produced in

A Asthma

B Emphysema

C Silicosis

D Pneumonia

Question

H.W

Which of the following is incorrect about occupational respiratory disorder?

A. It occur in some industries, especially those involving grinding or stone-breaking.

B. Long exposure in such industries leading to fibrosis (proliferation of fibrous tissues).

C. It is an allergic disease always.

D. Workers in such industries can be protected from these disorders by wearing protective masks.

Question

Match the following columns and select the correct option.

Column - I		Column - II	
a	Eosinophils (iii)	p (i)	Immune response
b	Basophils (iv)	q (ii)	Phagocytosis
c	Neutrophils (ii)	r (iii)	Associated with allergic reactions
d	Lymphocytes (i)	s (iv)	Release granules containing histamine

(A) a-(iii) b-(iv) c-(ii) d-(i)

(B) a-(iv) b-(i) c-(ii) d-(iii)

(C) a-(i) b-(ii) c-(iv) d-(iii)

(D) a-(ii) b-(i) c-(iii) d-(iv)

Question

The most active phagocytic white blood cells are

→ Destroy foreign bodies

A. Eosinophils and lymphocytes

B. Neutrophils and monocytes

C. Neutrophils and eosinophils

D. Lymphocytes and macrophages

Question

The haemoglobin content per 100 mL of blood of a normal healthy human adult is

A. 5 - 11 gm

B. 25 - 30 gm

C. 17 - 20 gm

D. 12 - 16 gm

Question

Which one of the following plasma proteins is involved in the coagulation of blood?

plasma — Matrix

90-92% of water

6-8% of proteins.

Albumin. Globulin. Fibrinogen

A. Albumin - osmotic balance

B. Serum amylase

C. Globulin - Defense mechanism

D. Fibrinogen ✓

↳ clotting of blood.

Question

Serum differs from blood in

→ without clotting factor - Fibrinogen

A. Lacking globulins ✗

B. Lacking albumins ✗

C. Lacking clotting factors ✓

D. Lacking antibodies ✗

Question

Which one of the following is correct?

A. Plasma = Blood − Lymphocytes

B. Serum = Blood + Fibrinogen

C. Lymph = Plasma + RBC + WBC

D. Blood = Plasma + RBC + WBC + Platelets

Question

ABO grouping is based on how many antigens present or absent on WBCs

RBCs

A 1

B 2

C 3

D None of these

Question

What is the correct order of these events?

1. Conversion of fibrinogen to fibrin
2. Clot retraction and leakage of serum
3. Thromboplastin formation
4. Conversion of prothrombin to thrombin

A. 3, 2, 1, 4

B. 3, 4, 2, 1

C. 3, 4, 1, 2

D. 4, 1, 3, 2

Question

Systolic pressure of heart is higher than diastolic pressure, because

(A) Blood is forcefully pumped into arteries by the heart during systole and not during diastole.

(B) Arteries offer resistance to the flowing of blood during systole only

(C) Arteries contract during systole only

(D) Volume of blood in heart is greater during systole than during diastole

Question

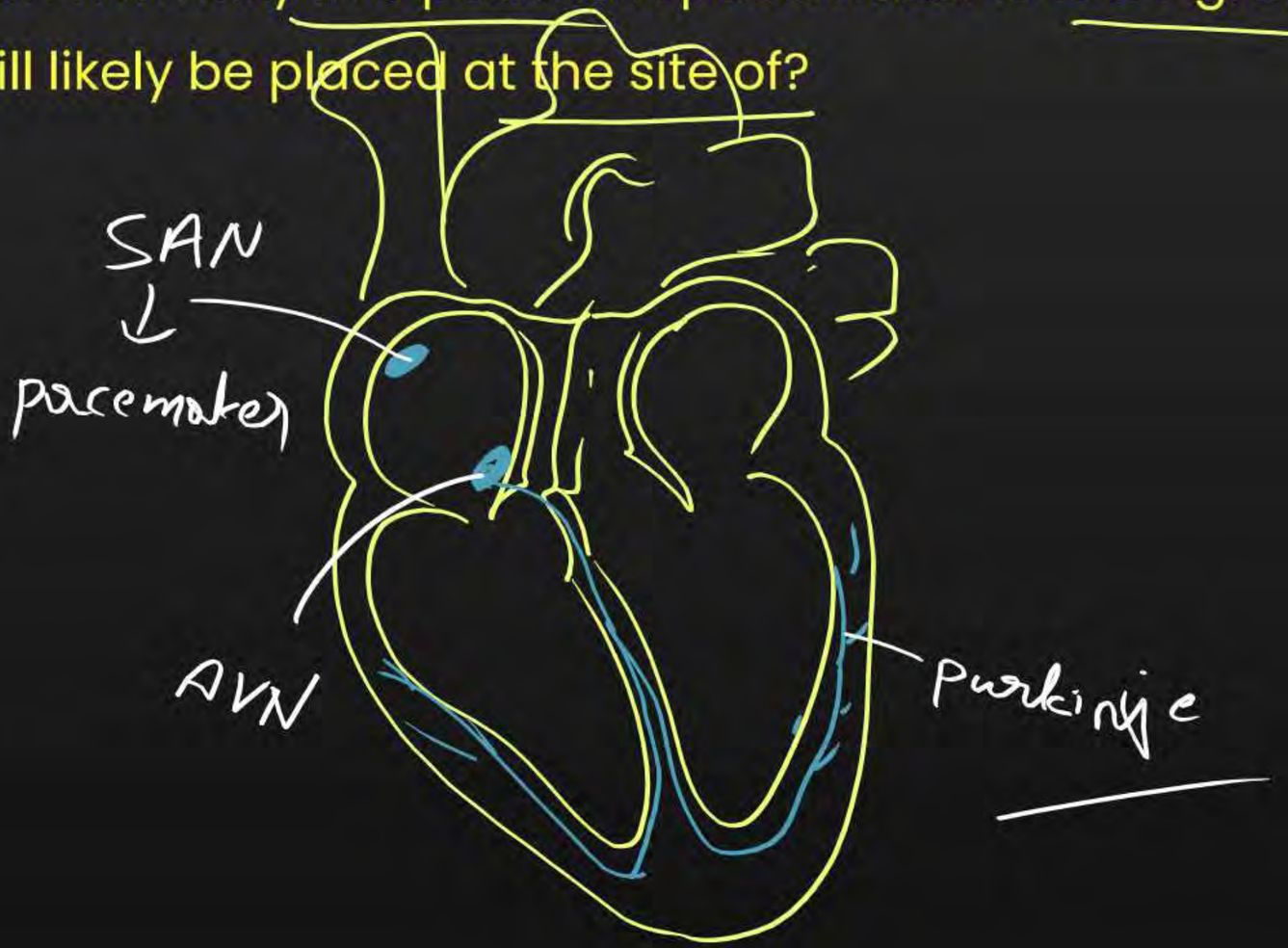
A cardiac pacemaker fails to function normally in a patient. A pacemaker is to be grafted into him by the doctors. The graft will likely be placed at the site of?

A. Atrioventricular bundle

B. Purkinje system

C. Sinoatrial node

D. Atrioventricular node

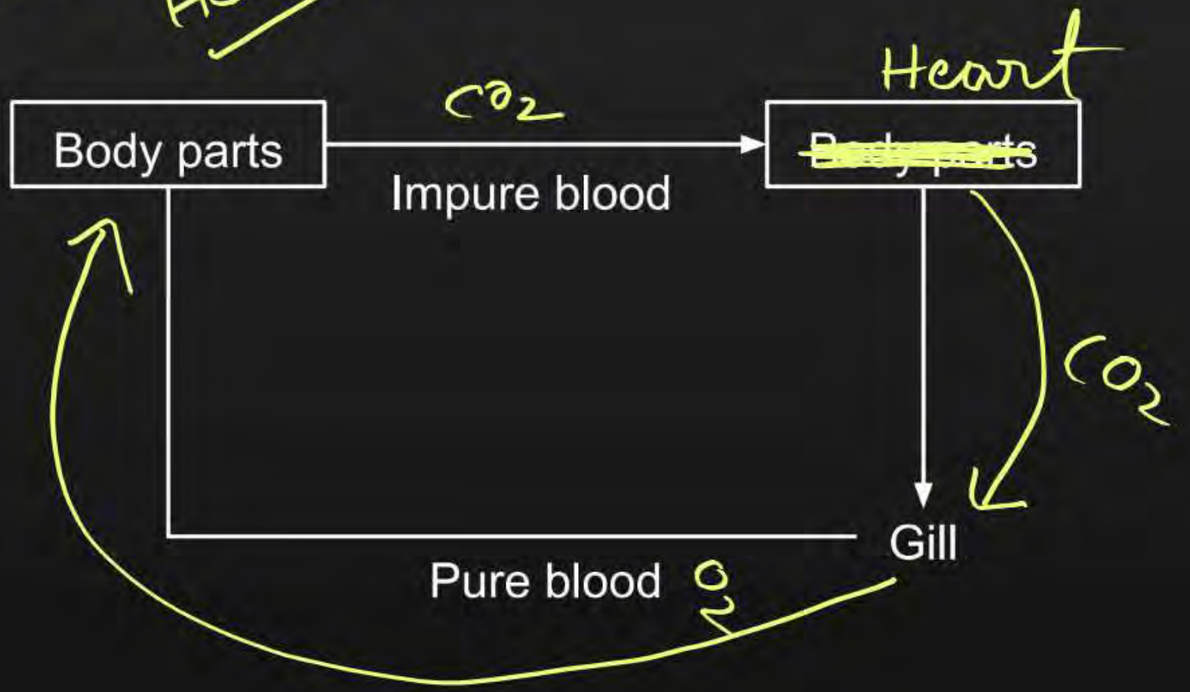


Question

In fishes, the blood circulation is represented as The given flow of blood indicates that it is a

Fishes

2-chambered Heart.



A. Double circulation ✗

B. Single circulation ✓

C. Incomplete single circulation ✗

D. Incomplete double circulation ✗

Question

H.W

Electrocardiogram is a measure of

A Heart rate

B Ventricular contraction

C Volume of blood pumped

D Electrical activity of heart

Question

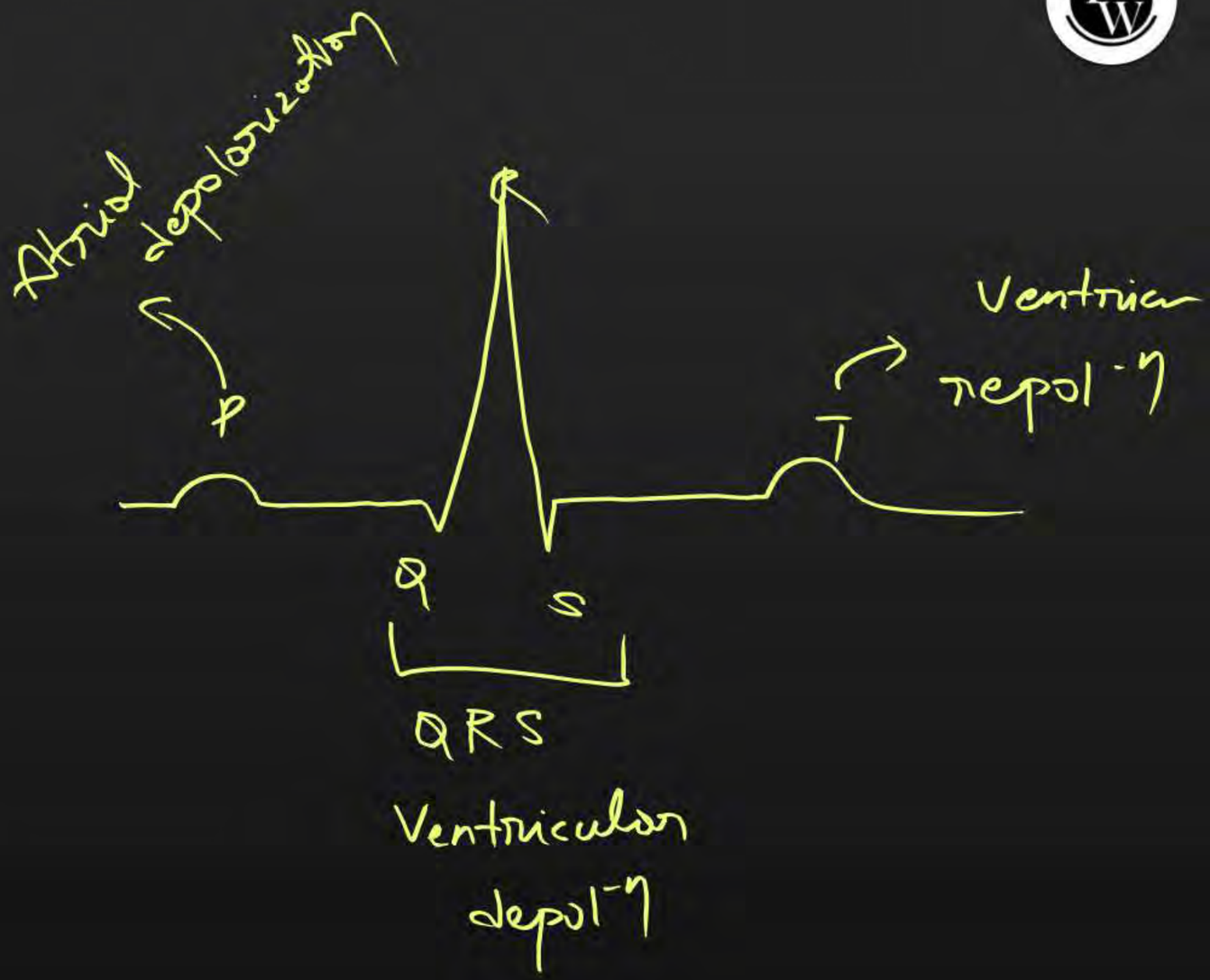
P-wave represents

A. Depolarization of ventricles

B. Repolarization of ventricle

C. Repolarization of atria

D. Depolarization of atria



Question

A unique vascular connection that exist between the digestive tract and liver is called

Intestine

Kidney & lower parts of the body

A. Renal portal system ✗

B. Hypothalamic–Hypophyseal portal system ✗

C. Hepatic portal system ✓

D. All the above ✗

Question

H·W

Normal BP = 120/80 mmHg in an adult. In this measurement 120 mmHg is the _____ pressure and 80 mmHg is _____ pressure.

A. Diastolic, systolic

B. Systolic, diastolic

C. Pulse, diastolic

D. Pulse, systolic

Question

The least toxic nitrogenous waste is

A Ammonia – most toxic

B Urea

C Uric acid – least toxic

D Both (A) & (B)

Question

Which of the following is not ureotelic?

A. Most of terrestrial amphibians ✗ ureo

B. Mammals ✗ ureo

C. Land snails - uricotelic ✓

D. Marine fishes ✗ ureo

Question

Statement-I: Aquatic animals are generally ammonotelic.

Statement-II: Ammonia is the least toxic nitrogenous waste.

A. Statement I and Statement II both are correct.

B. Statement I is correct, but Statement II is incorrect.

C. Statement I is incorrect, but Statement II is correct.

D. Statement I and Statement II both are incorrect.

Question

Which one of the following is not normally excreted in urine?

A. Uric acid

B. Haemoglobin

C. Ketone bodies

D. Hippuric acid

Question

Choose the incorrect statement w.r.t excretory system.

A. Skin and lungs help in excretion

B. Nearly 99% of filtrate is reabsorbed through renal tubules.

C. Kidneys are situated close to the dorsal inner wall of the abdominal cavity.

D. Antennal gland performs excretion in earthworms.

Nephredia

Question

Consider the following statements.

I. Flame cells are excretory structures in flatworms.

II. Dermal branchiae are the excretory organs of Hemichordata.

A Statement I is true, but II is false

B Statement I is false, but II is true

C Both statements I and II are true

D Both statements I and II are false

Question

In which one of the following organism its excretory organs are correctly stated?

A. Humans - Kidneys, sebaceous glands and tear glands

B. Earthworm - Pharyngeal, integumentary and septal nephridia

C. Cockroach - Malpighian tubules and enteric caeca

D. Frog - Kidneys, skin and buccal epithelium

Question

H.W

The layers between the glomerular blood and Bowman's space are:

A. Cuboidal epithelium + basement membrane only

B. Endothelium + epithelium of Bowman's capsule + basement membrane between the 2 layers

C. Endothelium of glomerular blood vessel + endothelium of Bowman's capsule + Compound layer of Bowman's capsule

D. Epithelium of Bowman's capsule + endothelium of Bowman's capsule only

Question

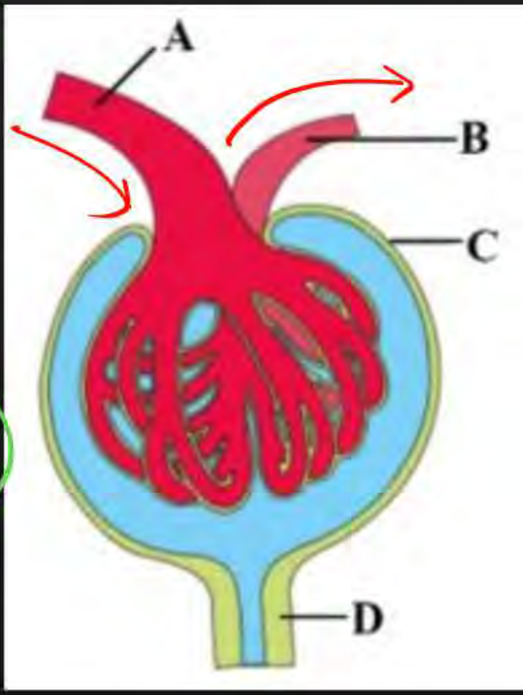
Identify A-D in the following structure and the correct option for A, B, C and D.

A A - Afferent arteriole, B - Efferent arteriole, C - Bowman's capsule, D - PCT

B A - Efferent arteriole, B - Afferent arteriole, C - Bowman's capsule, D - DCT

C A - Afferent arteriole, B - Efferent arteriole, C - Bowman's capsule, D - DCT

D A - Efferent arteriole, B - Bowman's capsule, C - Afferent arteriole, D - DCT



Question

H.W

What is the primary characteristic of the glomerular filtration process?

A. It allows all plasma constituents to pass through.

B. It is a process of selective absorption.

C. It is considered as a process of ultrafiltration.

D. It takes place in the collecting duct.

Question (KCET - 2021)

H.W

The increase in osmolarity from outer to inner medullary interstitium is maintained due to:

I. close proximity between Henle's loop and vasa recta.

II. Counter current mechanism.

III. selective secretion of HCO_3^- and hydrogen ions in PCT.

IV. Higher blood pressure in glomerular capillaries.

A (III) and (IV)

B (I), (II) and (III)

C (I) and (II)

D Only (II)

Question

H.W

Given below are two statements:

Statement I: Nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules.

Statement II: The endothelium of glomerular blood vessels has podocytes.

In the light of the above statements, choose the most appropriate answer from the options given below:

A Statement I is correct but Statement II is incorrect.

B Statement I is incorrect but Statement II is correct.

C Both Statement I and Statement II are correct.

D Both Statement I and Statement II are incorrect.

Question

H.W

Given below are two statements:

Statement I: The ascending limb of loop of Henle is permeable to water but almost impermeable to electrolytes.

Statement II: Both kidneys have nearly one million of complex tubular structure called nephron.

In the light of the above statements, choose the most appropriate answer from the options given below:

A Statement I is correct but Statement II is incorrect.

B Statement I is incorrect but Statement II is correct.

C Both Statement I and Statement II are correct.

D Both Statement I and Statement II are incorrect.

Question

Proximal convoluted tubule (PCT) is lined with;

Selective reabsorption.

A. Cuboidal epithelium ✗

B. Compound brush border epithelium

C. Simple cuboidal brush border epithelium ✓

D. Columnar epithelium

Increase → Surface area for absorption

Question

Which of the following organs or glands is correctly paired with the type of waste it eliminates?

A. Lungs → Bilirubin and biliverdin

B. Liver → CO_2 and lactic acid

C. Sweat glands → NaCl and small amounts of urea

D. Sebaceous glands → Large amounts of water and cholesterol

Thank You