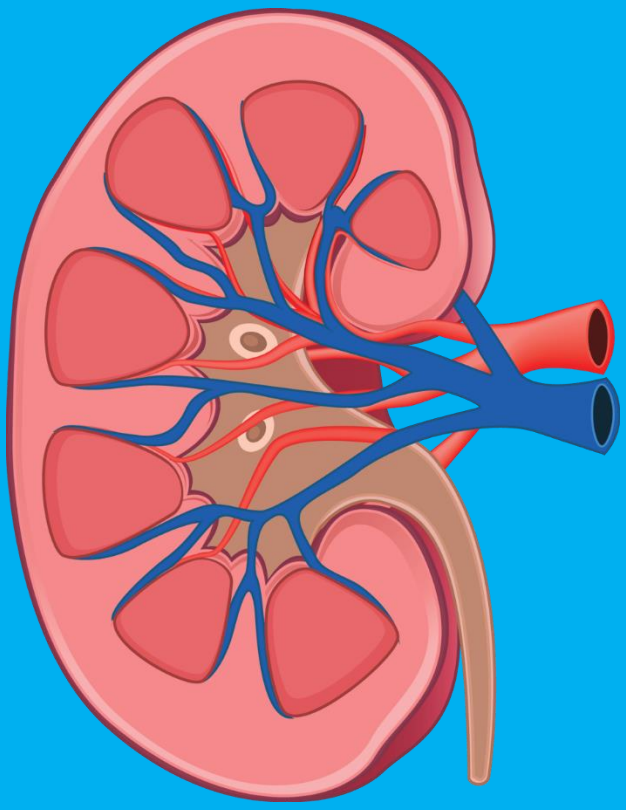
19. EXCRETORY PRODUCTS AND THEIR ELIMINATION



Biology Smart Booklet

Theory + NCERT MCQs + NEET PYQs

EXCRETORY PRODUCTS AND THEIR ELIMINATION

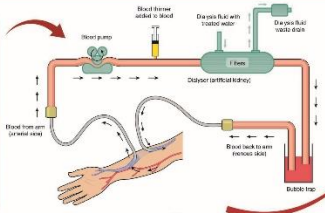
DISORDER OF EXCRETORY SYSTEM

- Glomerulonephritis → inflammatn of glomerulus
- Renal failure → Kidney failure.
- Uremia → accumulation of urea in blood: hemodialysis is done

MODES OF EXCRETION

- Ureotelism →excretory product is urea : mammals
- Ammonotelism →excretory product is ammonia : bony fishes. aquatic amphibians.
- Uricotelism → excretory product is uric acid : Birds

HAEMODIALYSIS



MICTURITION

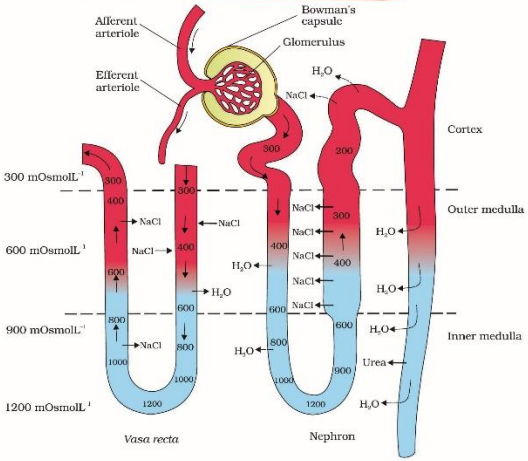
Process of expulsion of urine from bladder

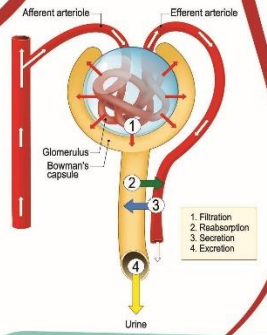
REGULATION OF KIDNEY

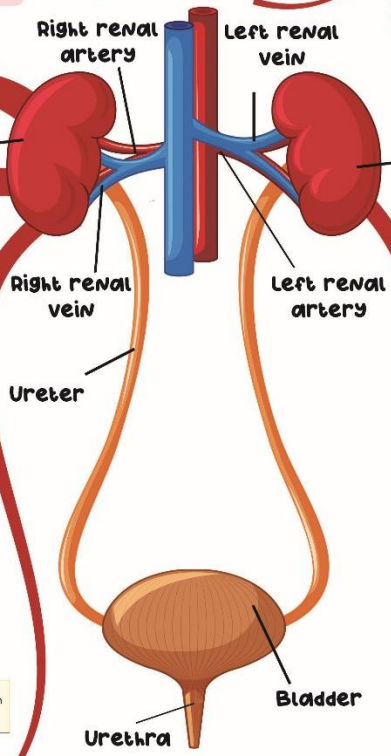
- By ADH (Vasopressin): ADH prevents diuresis
- By JGA (Juxtaglomerular Apparatus) : RAAS mechanism
- By ANF (Atrial Natriuretic factor

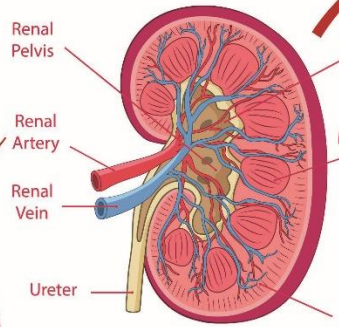
CONCENTRATION OF URINE

1) Counter – current mechanism
2) Henle's loop and Vasa recta play a crucial role in concentration of urine
3) Osmolority increases from 300- 1200 mOsmolL^{-1}
4) Nacl and urea are responsible for this









KIDNEY

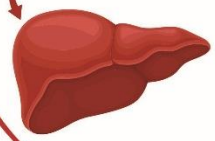
1) Reddish-brown, bean-shaped
2) Location →between last thoracic & third lumbar vertebra
3) Two zones →
   Outer : Cortex :
   Inner : Medulla
4) Kidney has nephrons (in millions)

FUNCTIONS OF THE TUBULES

- PCT → 70-80% of electrolytes & water are reabsorbed.
- Henle's loop → help to maintain high osmolarity of interstitial fluid.
- DCT → Reabsorption of Sodium ions & water
- Collecting Duct → large amount of water is reabsorbed leads to concentrated Urine

OTHER ORGANS IN EXCRETION

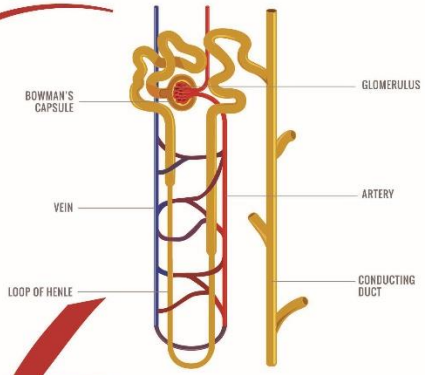
1) Liver
2) Lungs
3) Skin



URINE FORMATION STEPS

1) Glomerular filtration
2) Reabsorption
3) Secretion

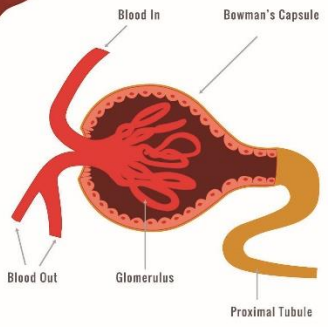
Nephron structure



STRUCTURAL & FUNCTIONAL UNIT OF KIDNEY.

- Two parts → Glomerules & Renal Tubule.
- Glomerulus → tuft of capillaries enclosed by Bowmans's capsule.
- Renal tubule begins with Bowman's capsule. Proceed as PCT. Henle's loop and DCT.
- DCT's open into a collecting duct
- Vasa recta is a minute network of blood vessels parallel to Henle's loop.

Bowman's Capsule

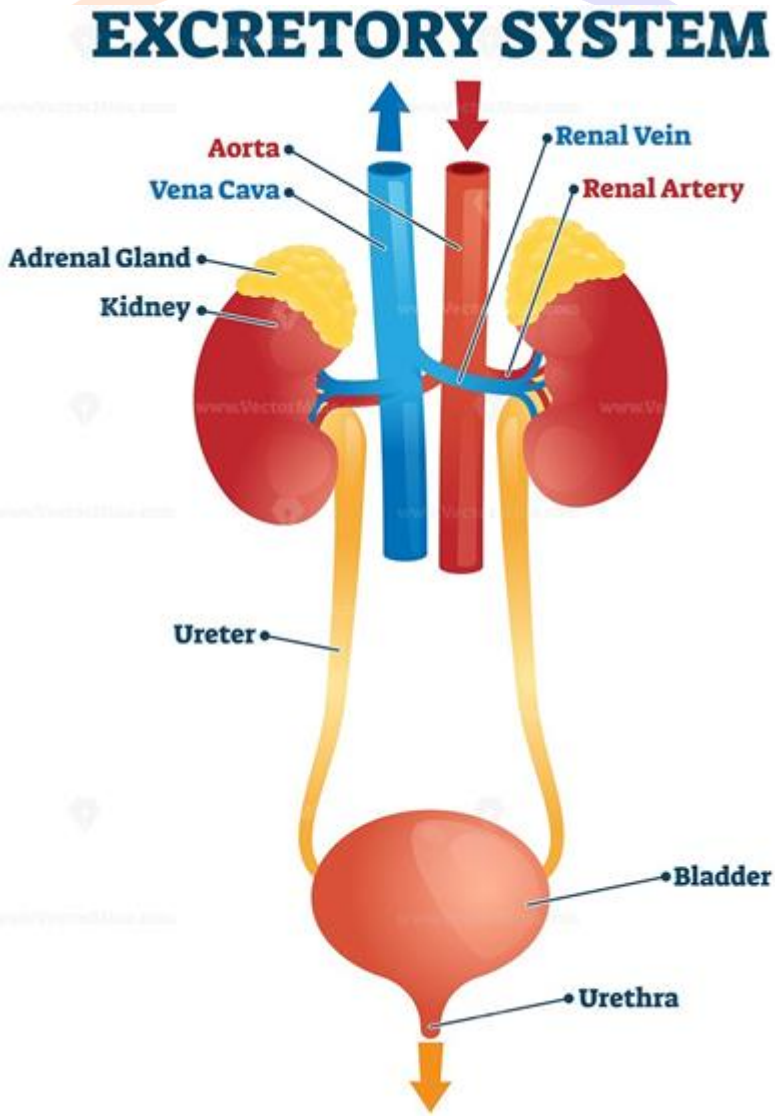


BOWMANNS CAPSULE + GLOMERULUS = MALPHIGIAN BODY

EXCRETORY PRODUCTS AND THEIR ELIMINATION

Human Excretory System

Anatomically, the human excretory system consists of a pair of kidneys, a pair of ureters, urinary bladder and the urethra. The kidneys contain tiny, numerous structures called nephrons. These are termed as the functional unit of the kidneys and are responsible for the separation of water, filter toxins and replenish necessary elements back into the bloodstream.



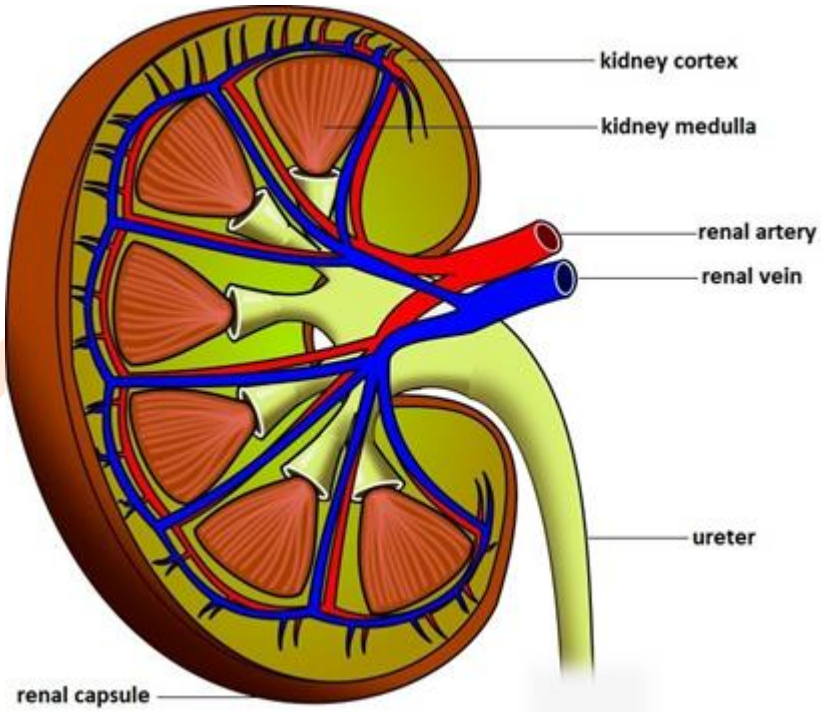
Ammonotelism: The animals which excrete ammonia are called ammonotelic and excretion of ammonia is known as ammonotelism eg. Amoeba, sycon, hydra, liver fluke, tapeworm, Leech, Prawn, bony fishes etc.

Ureotelism: Excretion of urea is known as ureotelism and the animals which excrete urea are ureotelic animals eg. mammals, many terrertrial amphibians and marine fishes and sting rays etc.

Uricotelism: Excretion of uric-acid is known as uricotelism and the animals are called uricotelic eg. most insects, land snails, lizards, snakes and birds.

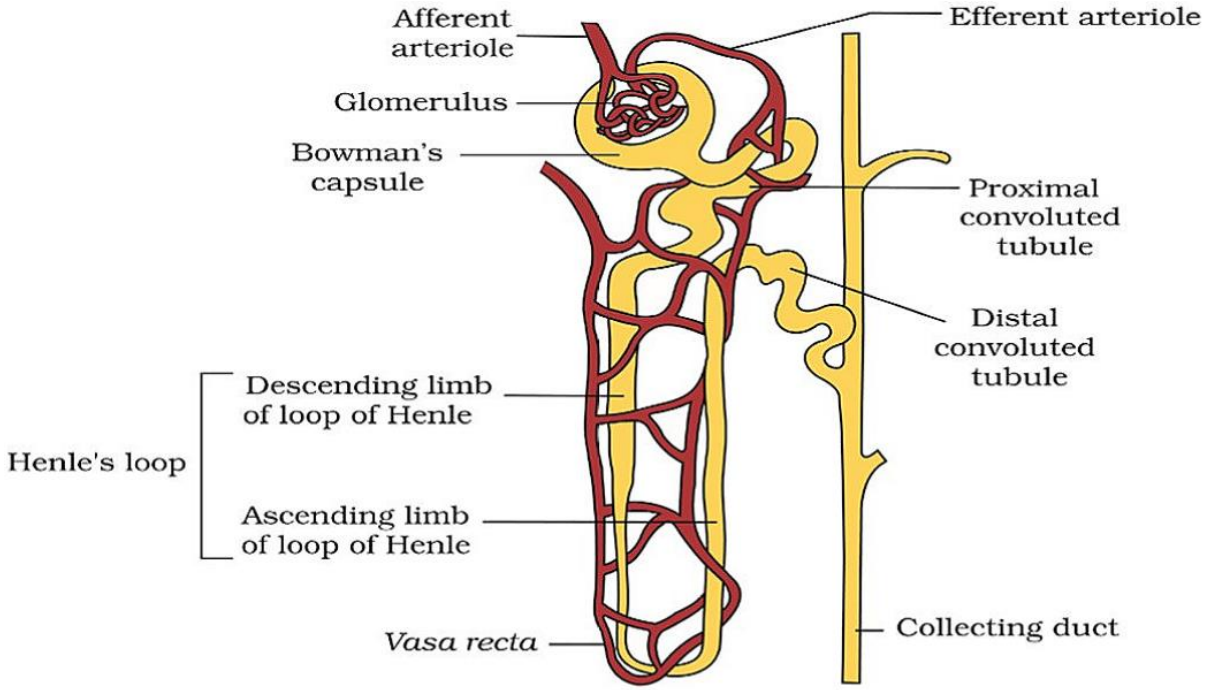
Kidneys

Kidneys are reddish brown bean shaped structure situated between last thoracic and lumber vertebra. Each kidney has a notch on its inner side called hilum through which ureter, blood vessels and nerves enter.



- Inside the hilum has broad funnel shaped space called renal pelvis with projection called calyces.
- Inside the kidney are two zone- outer cortex and inner medulla. Medulla is divided into medullary pyramids projecting into calyx.
- Cortex extends between medullary pyramids as renal column called Columns of Bertini.
- The functional unit of kidney is nephron. Each kidney contains about one million nephrons.
- Each nephron has two parts- the glomerulus and renal tubules. Glomerulus is the tuft of capillaries formed by afferent arteriole. Blood from glomerulus is carried away by efferent arteriole.
- Renal tubules starts with Bowman's capsule continue with tubular parts divided into Proximal Convoluted tubules, Henle's loop and Distal Convoluted tubule.
- The malpighian tubules, PCT and DCT of nephron are situated in cortical region where as loops of Henle's into medulla.

Types of Nephrons



Juxtamedullary Nephron: About 15% of total nephrons, Glomeruli are found in inner region of cortex, large in size, long loop of Henle and found deep in medulla, associated with vasa recta control plasma volume when water supply is short.

Cortical Nephron: About 85% of total nephron mainly lie in renal cortex, glomeruli found in outer cortex, short loop of Henle, extends very little in medulla. They do not have vasa recta or vasa recta is highly reduced.

Urine formation

- Glomerular Filtration (Filtration of blood by glomerulus).
- Reabsorption (Reabsorption by renal tubules).
- Secretion (Tubular cells secretes H+, K+ ammonia into filtrate).

Glomerular capillaries: Glomerular capillaries blood pressure cause filtration of blood through 3 layers (endothelium of glomerular blood vessels, epithelium of Bowman's capsule and basement layer between two membranes as ultra-filtration.

glomerular filtration rate (GFR): The amount of filtrate formed by kidneys per minute is called glomerular filtration rate (GFR) which is 125 ml/minute.

Glomerular Filtration rate: Glomerular Filtration rate is controlled by Juxta glomerular apparatus (JGA).

Reabsorption: 99% of filtrate has to be reabsorbed by renal tubules called reabsorption.

Function of Tubules

- **Proximal Convoluted Tubules (PCT):** All the important nutrients, 70-80% electrolytes and water are reabsorbed.
- **Henle's Loop:** Maintains high osmolarity of medullary interstitial fluid.

- **Distal Convoluted Tubules (DCT):** Conditional reabsorption of Na+ and water. Maintains pH and sodium- potassium balance.
- **Collecting Duct:** Large amount of water is reabsorbed to produce concentrated urine.

Mechanism of concentration of urine: The flow of filtrate in two limbs of Henle's loop is in opposite direction to form counter current. The flow of blood in two limbs of vasa recta increase the osmolarity towards the inner medullary interstitium in the inner medulla.

The transport of substance facilitated by special arrangement of Henle's loop and vasa recta is called counter current mechanism.

Regulation of kidney function

- Functioning of kidney is monitored by hormonal feedback mechanism of hypothalamus and JGA. Change in blood volume, body fluid and ion concentration activates the osmoreceptors in the body that stimulate the hypothalamus to release ADH or vasopressin hormones. The ADH facilitates water absorption in tubules.

- Decrease in glomerular blood pressure activate JG cells to release renin which converts angiotensinogen to angiotensin I and II that increase the glomerular blood pressure and release of aldosterone that increase absorption of Na+ ions and water.

Micturition

- The process of expulsion of urine from the urinary bladder is called micturition. The neural mechanism that causes it is called micturition reflex. Urine formed in nephron is stored in urinary bladder till a voluntary signal is given by CNS. This initiates the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

- Lungs, liver and skin also play important role in process of excretion. Lungs remove CO_2 and water, liver eliminates bile containing substances like bilirubin, biliverdin. Sweat glands remove NaCl, small amount of urea and lactic acid. Sebaceous glands excrete sterol, hydrocarbons and waxes.

Disorders of Excretory System

Uremia: There is high concentration of non-protein nitrogen (urea, uric acid, creatinine). Urea can be removed by hemodialysis.

Renal failure: Also known as kidney failure where glomerular filtration is ceased and both kidney stops working. Kidney transplant is the ultimate method in correction of acute kidney failure.

Renal Calculi: Formation of stone or insoluble mass of crystallized salts formed within the kidney.

Glomerulonephritis (Bright's Disease): Inflammation of glomeruli of kidney due to entry of protein or red blood corpuscles in to filtrate due to injury.

NCERT LINE BY LINE QUESTIONS

Introduction

1. Ammonia and urea are waste products derived from the metabolic breakdown of- **[Pg- 290,E]**
   A) Lipids B) Carbohydrates C) Proteins D) Sugars
2. Which of the following molecules is the most toxic to the cells? **[Pg- 290,E]**
   A) NaCl B) Urea C) Uric acid D) Ammonia
3. The terms "ammonotelic", "Ureotelic", and "Uricotelic" are used to describe- **[Pg- 290,M]**
   A) Modes of excretory system development
   B) The actions of hormones on the excretory systems
   C) The types of nitrogenous waste produced by various classes of vertebrates
   D) Modification of kidney tubules to enhance excretion
4. Which of the following statements is correct? **[Pg- 290,H]**
   A) Many bony fishes, aquatic amphibian and aquatic insects are ammoniotelic
   B) Ammonia is readily soluble
   C) NH_3 is generally excreted by the body surface or through gills (in fishes) as NH_4^+
   D) All
5. Which of the following statements is wrong? **[Pg- 290,H]**
   A) Kidney does not play any significant role in the removal of ammonia
   B) Ureotelic animals excrete most of the nitrogenous waste as urea
   C) Ammonia and urea are the waste products derived from the metabolic breakdown of proteins
   D) None of the above is wrong
6. Urea and uric acid are – **[Pg- 290,E]**
   A) More toxic than NH_3 B) Less toxic than NH_3
   C) Equally toxic to NH_3 D) Non-toxic
7. Which of the following group of animals is ureotelic? **[Pg- 290,E]**
   A) many terrestrial amphibians B) Mammals
   C) Marine fishes D) All
8. NH_3 is converted into urea in – **[Pg- 290,M]**
   A) Kidney B) Liver C) Spleen D) Intestine
9. Which of the following groups of animals is uricotelic? **[Pg- 290,E]**
   A) Reptiles B) Insects C) Birds and land snail D) All
10. Excretion of nitrogenous products in semisolid forms by - **[Pg- 290,E]**
    A) Uricotelic animals B) Ureotelic animals
    C) Ammoniotelic animals D) Amniotes
11. Least toxic nitrogenous waste is – **[Pg- 290,E]**
    A) NH_3 B) Urea C) Uric acid D) NH_3 and urea
12. Which of following in small amount is retained in kidney matrix of some animals to maintain a desired osmolarity? **[Pg- 290,M]**
    A) NH_3 B) Urea C) Uric acid D) NH_3 and uric acid
13. Terrestrial organisms must conserve water. The least amount of water is lost with the excretion of which nitrogenous waste product? **[Pg- 290,M]**
    A) NH_3 B) Uric acid C) Urea D) CO_2
14. The less amount of water is lost with the excretion of which nitrogenous product? **[Pg- 290,E]**
    A) NH_3 and urea B) NH_3 and uric acid C) NH_3 D) Urea and uric acid
15. Which of the following is correct about protonephridia/flame cells? **[Pg- 291,H]**
    A) Protonephridia are the excretory structures in Platyhelminthes (e.g. Planaria), rotifers and some annelids
    B) Protonephridia are the excretory structures in the cephalochordates e.g. Amphioxus
    C) Protonephridia are primarily concerned with ionic and fluid volume regulation i.e. osmoregulation
    D) All

16. Match the column I with column II. **[Pg- 291,M]**

	Coulumn I		Column II
A	Nephridia	I	Crustaceans(Prawn)
B	Malphigian tubules	II	Annelids(Earthworm)
C	Anteenal Gland or Green Glands	III	Insects (Cockroach)

A) A-I, B-II, C-III B) A-III, B - II, C – I C) A-II, B - III, C-I D) A-II, B- I, C-III

Human Excretory System

17. Which of the following statements is wrong about the human excretory system? **[Pg- 291,H]**
A) Excretory system consists of one pair of bean shaped kidneys, one pair of ureter, a urinary bladder and a urethra.
B) Kidneys are situated between the 12th thoracic and 3rd lumbar vertebrae close to the dorsal wall in abdominal cavity.
C) Right kidney is a little higher level than the left one.
D) All

18. Each kidney of adult human measures- **[Pg- 291,E]**

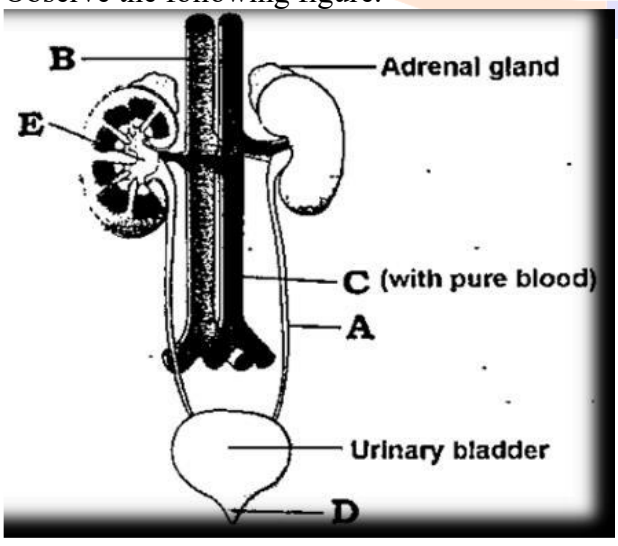
	Le ngth	**Width**	**Thickness**	**Weight**
A	10 - 12 Cm	5 - 7cm	2 – 3 cm	120-170 g
B	10 – 20 Cm	10 - 12 Cm	6 - 12 cm	40-50 gm
C	2 – 6 cm	10 - 12 Cm	6 - 12 cm	40-50 gm
D	10 - 12 Mm	5 - 7 Mm	2 – 3 mm	120-170 mg

19. The part of kidney, gateway for ureter, nerves and blood vessels is- **[Pg- 291,E]**
A) Hilum B) Renal pore C) Minor calyx D) Major calyx

20. Inner to the hilum of kidney is a broad funnel shaped space called- **[Pg- 291,E]**
A) Cortex B) Medulla C) Pelvis D) Calyx

21. Which of the following statements is false? **[Pg- 291,292,H]**
I. Outer cortex and inner medulla are the two zones in kidney
II. Medulla is divided into about 8 to 18 renal pyramids
III. Pyramid projects into calyx
IV. Inwards extension of cortex between the pyramids is called renal column of Bertini
A) I and IV B) II and IV C) IV D) None

22. Observe the following figure. **[Pg- 291,E]**



Identify A to E structure.

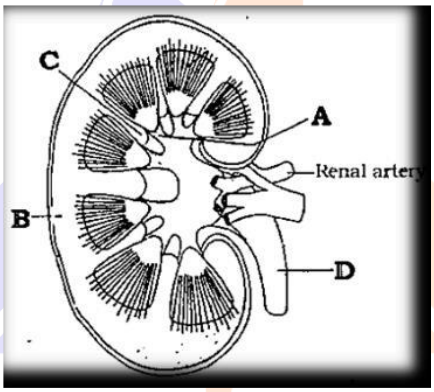
	A	B	C	D	E
A)	Superior vena cava	Inferior vena cava	Dorsal Aorta	Urethra	Pelvis
B)	Inferior vena cava	Superior vena cava	Dorsal Aorta	Urethra	Pelvis
C)	Urethra	Inferior vena cava	Dorsal Aorta	Urethra	Pelvis
D)	Dorsal Aorta	Inferior vena cava	Urethra	Cortex	Pelvis

23. Which one of the following is the structural and functional unit of kidney? **[Pg- 292,E]**
A) Urethra B) Urinary bladder C) Renal column D) Nephron

24. Renal corpuscle or Malpighian body is- **[Pg- 291,E]**
A) Glomerulus only B) Glomerulus along with Bowman's capsule
C) Bowman's capsule D) Glomerulus with afferent arteriole

25. Which one of the following is a tube that carries urine from kidney to the urinary bladder? **[Pg- 291,E]**
A) Loop of Henle B) Ureter C) Urethra D) Uvula

26. Go through the following figure- **[Pg- 292,E]**



Identify A to D

	A	B	C	D
A)	Cortex	Calyx	Renal Column	Ureter
B)	Calyx	Cortex	Renal Column	Ureter
C)	Medulla	Cortex	Renal Column	Urethra
D)	Calyx	Cortex	Renal Column	Urethra

27. Each kidney has how many nephrons? **[Pg- 292,E]**
A) About 2 million B) About 1 million
C) About 5000 D) About 50000

28. The bed of capillaries in the vertebrate kidney where water, urea and salts are filtered out of the blood is the – **[Pg- 292,E]**
A) Bowman's capsule B) Collecting duct
C) Glomerulus D) Loop of Henle

29. All of the following structures are situated in the renal cortex except – **[Pg- 293,M]**
A) Loop of Henle B) Malpighian corpuscle
C) PCT D) DCT

30. The DCTs of many nephrons open into a straight tube called – **[Pg-293,M]**
A) PCT B) Loop of Henle C) Collecting duct D) Bowman's capsule

31. Which of the following statements is false? **[Pg-292,293,H]**
A) Renal tubule starts with a double walled cup like structure called Bowman's capsule
B) In majority of nephrons, the loop of Henle is too short and such nephrons are cortical nephrons
C) Juxta medullary nephron has long loop of Henle
D) None

32. Which is the correct pathway for passage of urine in humans? **[Pg-292,293,M]**
A) Collecting tubule → ureter → bladder → urethra
B) Renal vein → renal ureter → bladder → urethra
C) Pelvis → Medulla → bladder → urethra
D) Cortex → Medulla → bladder → ureter

33. Match the column I with column II. **[Pg-292,293,H]**

	Column I		Column II
A	Delivers blood to glomerulus	I	Ascending and descending limb
B	Carries urine to pelvis, also acts in water reabsorption	II	Renal artery
C	Collects filtrate from Bowman's capsule	III	Collecting duct
D	Loop of Henle	IV	PCT

A) A - II, B - III, C - IV, D – I B) A-I, B - III, C-II, D- IV
C) A - II, B - IV, C - I, D – III D) A- IV, B - III, C - II, D – I

34. Which of the following is correct about Juxta medullary nephrons? **[Pg-293,E]**
A) Vasa recta is prominent B) Loop of Henle is long
C) NaCl is returned to the interstitium by ascending limb of vasa recta
D) All

35. Which of the following places the region of nephron in their correct sequence with respect to flow of tubular fluid? **[Pg-293,M]**
A) PCT→ Descending limb of Henle (DLH) → Ascending limb of Henle (ALH) → DCT→ Collecting duct(CD)
B) PCT→ALH →DLH →OCT→CD
C) ALH →DLH →PCT→OCT→CD D) OCT→ALH →DLH →PCT→CD

36. Vasa recta is – **[Pg-293,E]**
A) shaped B) S-shaped C) U-shaped D) J-shaped

37. In glomerulus, afferent arteriole – **[Pg-292,E]**
A) Is wider than efferent arteriole B) And efferent arteriole has similar diameter
C) Is narrower than efferent arteriole D) Is narrow than efferent capillaries

38. Which of the following is incorrect? **[Pg-292,M]**
A) Blood vessel leading to glomerulus is called efferent arteriole
B) Vasa recta, peritubular capillaries, Glomerulus all have blood
C) Cortical nephron has no or highly reduced vasa recta
D) Vasa recta runs parallel to the Henle's loop in juxtamedullary nephrons

Paragraph- 19.2 Urine Formation

39. Urine formation involves- **[Pg-293,M]**
A) Ultra filtration and reabsorption occurring in different parts of nephron
B) Ultrafiltration and reabsorption occurring in same part of nephron
C) Ultrafiltration, reabsorption and secretion occurring in different parts of nephron
D) Ultrafiltration, reabsorption and secretion occurring in same part of nephron

40. Match the column I with column II. **[Pg-293,294,M]**

	Coulumn I		Column II
a	PCT	I	Concentrated urine formation
b	DCT	II	Filtration of blood
c	Loop of Henle	III	Reabsorption of 70 - 80% electrolytes
d	Countercurrent mechanism	IV	Ionic balance
e	Renal corpuscle	V	Maintenance of conc. gradient in medulla

	a	b	c	d	e
A)	III	IV	I	V	II
B)	III	V	IV	II	I
C)	I	III	II	V	IV
D)	III	I	IV	V	II

41. Which of the following statements is correct? **[Pg-293,M]**
I. Renal vein take blood away from kidney
II. Loop of Henle conserves water
III. Podocytes occur in inner wall of Bowman's capsule
IV. Ultrafiltrate *I* nephric filtrate is plasma minus proteins.
A) I and II B) I and Ill C) III and IV D) I, II, III, IV

42. The glomerular capillaries cause filtration of blood through ____ layers – **[Pg-293,E]**
A) 1 B) 2 C) 3 D) 6

43. The layers between the blood in glomerular blood Bowman's space are – **[Pg-293,E]**
A) Tunica media + Cuboidal epithelium+Basement's membrane
B) Endothelium + Epithelium of Bowman's capsule + Basement membrane between the 2 layers
C) Endothelium of glomerular blood vessel + Endothelium of Bowman's capsule + Parietal layer of Bowman's capsule
D) Tunica media + Epithelium of Bowman's capsule + Endothelium of Bowman's capsule

44. On average, _____ mL of blood is filtrated by the kidney per minute which constitute roughly __ of the blood pumped out by each ventricle of heart in a minute. – **[Pg-293,E]**
A) 125 ml, $1/6^{th}$ B) 100 -125 ml, $1/6^{th}$ C) 1100 -1200 ml, $1/5^{th}$ D) 5 L, $1/10^{th}$

45. The amount of the filtrate formed by the kidney / minute is called GFR (Glomerular Filtration Rate). The GFR of a healthy adult is- – **[Pg-294,E]**
A) 80 mL/min B) 125 mL/min C) 300 mL/min D) 20 mL/min

46. The GFR/day in a healthy adult is – **[Pg-294,E]**
A) 5 L B) 180 L C) 200 L D) 20 L

47. Juxtaglomerular apparatus, a special sensitive cellular region is formed in – **[Pg-29,E4]**
A) PCT and DCT
B) PCT and DCT at the location of their contact
C) PCT and loop of Henle at the location their contact
D) DCT and afferent arteriole at the location of their contact

48. Of the filtrate, nearly how many of it is reabsorbed by the renal tubules? **[Pg-294,E]**
A) 5% B) 99% C) 50% D) 25%

Paragraph- 19.3 Function of the Tubules

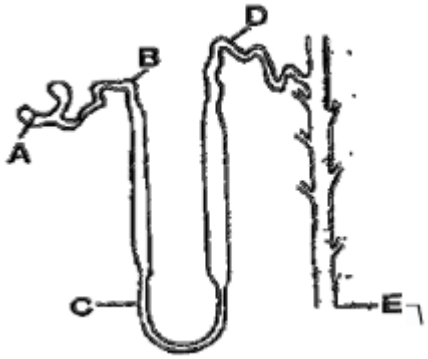
49. Which of following statements is false? **[Pg-294,H]**
A) The kidney has built in mechanism for regulation of GFR
B) Tubular secretion does not play any significant role in urine formation
C) The amount of urine output per day in normal adult is about 1.5 L
D) During urine formation tubular cells secrete H+, K+ and NH3 in the filtrate

50. Which of the following statements about proximal convoluted tubule (PCT) is false? **[Pg-294,H]**
A) It is lined by simple cuboidal brush border epithelium which increases the surface area
B) Nearly all the essential nutrients, 70 - 80% electrolytes, 70% H2O are reabsorbed by PCT
C) PCT is not the site of selective secretion
D) PCT helps to maintain the pH and ionic balance of body fluids

51. PCT helps to maintain the pH and ionic balance of body fluids by - **[Pg-294,M]**
A) Selective secretion of H^+, NH_3 and K^+ ions in filtrate
B) Reabsorption of HCO_3^- from filtrate
C) Both a and b
D) Secreting regulatory hormone like renin and angiotensinogen

52. If Loop of Henle were absent from mammalian nephrons, which of the following is to be expected? **[Pg-294,H]**
A) The urine will be more dilute
B) There will be no urine formation
C) The urine will be more concentrated
D) There will be hardly any change in quality and quantity of urine formed

53. Use following diagram to complete the statements about the human nephron – **[Pg-295,M]**



I. The composition of the filtrate would be most like plasma in the tubule next to the letter.
II. The urine would be most concentrated in the collecting duct next to letter
III. Most of the glomerular filtrate is reabsorbed into peritubular capillary next to the letter
IV. Conducting of urine to pelvis of the kidney from the structure next to the letter
V. Most water is reabsorbed by the structure next to the litter

	I	II	III	IV	V
A)	A	C	B	E	D
B)	A	E	B	C	D
C)	A	B	E	C	D
D)	A	E	B	E	B

54. I. Reabsorption in this region is minimum.
II. This region plays a significant role in the maintenance of high osmolarity of intestinal fluid
III. Its descending limb is permeable to water but almost impermeable to electrolytes
IV. Its ascending limb is impermeable to water but allows transport of electrolyte actively or passively
V. In descending limb filtrate is hypertonic while in ascending limb filtrate is hypotonic
The above characteristics are associated with - **[Pg-294,H]**
A) PCT B) Loop of Henle C) DCT D) Bowman's capsule

55. Which of the following statements is correct? **[Pg-294,H]**
I. Reabsorption of water occurs passively in the initial segment of nephron
II. Nitrogenous waste are absorbed by passive transport
III. Conditional reabsorption of Na+ and water takes place in DCT
IV. DCT reabsorbs HCO_3 –V. DCT is capable of selective secretion of H+, K+ and NH3 to maintain pH and Na+ - K+ balance in blood
VI. Substances like glucose, amino acids, Na+, etc in the filtrate are reabsorbed actively
A) I and II B) II and III C) IV and V D) All

56. Tubular secretion helps to maintain a proper acid-base balance by removing one of the following from blood – **[Pg-294,E]**
A) H+ and NH3 B) Uric acid C) H+ and urea D) NH3 and creatinine

57. Which of the following statements is false regarding the collecting duct? **[Pg-295,M]**
I. Collecting duct is a straight duct
II. It extends from the cortex to medulla
III. Large amount of water could be reabsorbed from it to produce concentrated urine·
IV. Small amount of urea diffuses out from it into the medulla to keep up the osmolarity
V. It plays a role to maintain pH and ionic balance of blood by the selective secretion of H+ and K+ ions
A) Only I B) Only III C) IV and V D) None

Paragraph- 19.4 Mechanism of Concentration of the Filtrate

58. Mammals have the ability to produce _____ urine- **[Pg-295,E]**
A) Hypotonic B) Hypertonic C) Isotonic D) Alkaline

59. Which one plays an important role in counter current mechanism? **[Pg-295,E]**
A) Vasa recta B) PCT C) Loop of Henle D) A and C

60. In which of the following counter current operates- **[Pg-29,E5]**
A) In ascending limb of loop of Henle
B) In descending limb of loop of Henle
C) In ascending limb or descending limb of vasa recta

D) Between the 2 limb of Henle's loop and those of vasa recta

61. Medullary gradient is developed by all the following except - **[Pg-296,M]**
A) Reabsorption of Na+ from ascending limb of Henle's loop into medullary interstitium
B) Reabsorption of Na+ from descending limb of Henle's loop
C) Diffusion of small amount of urea from collecting duct into medullary interstitium
D) Proximity between Henle's loop and vasa recta as well as the counter current in them

62. The medullary gradient is mainly caused by - **[Pg-296,E]**
A) Urea & K+ B) H+ and K+ C) NaCl and Urea D) Urea and H+

63. The counter current mechanism helps to maintain a concentration gradient. This gradient helps in – **[Pg-297,M]**
A) Easy passage of water from medulla to collecting tubule and thereby concentrating urine
B) Easy passage of water from collecting tubule and thereby concentrating urine
C) Easy passage of water from medullary interstitial fluid to collecting tubule and thereby diluting urine
D) Inhibition of passage of water between the collecting tubule and medulla and so isotonic urine is formed

64. NaCl is transported by the ascending limb of Henle's loop which is exchanged with - **[Pg-296,E]**
A) DCT B) PCT C) Ascending limb of vasa recta D) Descending limb of vasa recta

65. NaCl is returned to the by the ascending limb of vasa recta - **[Pg-296,E]**
A) Ascending limb of Henle's loop B) DCT C) PCT D) Interstitial fluid of medulla

66. Human kidney can produce urine nearly how many times concentrated than the initial filtrate formed? **[Pg-297,E]**
A) 4 B) 2 C) 10 D) 100

67. The high osmolarity of the renal medulla is maintained by all of the following except - **[Pg-296,M]**
I. Diffusion of salt from the ascending limb of the loop of Henle
II. Active transport of salt from the upper region of the ascending limb
III. The spatial arrangement of juxtamedullary nephrons
IV. Diffusion of urea from the collecting duct
V. Diffusion of salt from the descending limb of the loop of Henle
A) Only I B) Only V C) III and IV D) I and V

Paragraph- 19.5 Regulation of Kidney Function

68. Which one of the following is produced in the kidneys? **[Pg-297,E]**
A) Rennin B) Renin C) Uricase D)Arginase

69. Reabsorption of Na+ is controlled by – **[Pg-297,E]**
A) Vasopressin or ADH B) Aldosterone C) Renin D) Rennin

70. The reabsorption of water in the kidneys is under the control of a hormone – **[Pg-297,E]**
A) STH B) ACTH C) LH D) ADH/Vasopressin

71. Antidiuretic hormone secretion increases when the hypothalamus is stimulated by – **[Pg-297,E]**
A) Angiotensin receptors B) Glucose receptors
C) Osmoreceptors D) Renin receptors

72. The kidneys help regulate acid-base balance by controlling the level of ____ in the blood- **[Pg-297,E]**
A) CO_2 B) H^+ C) HCO_3^- D) B and C

73. The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms involving - **[Pg-297,E]**
A) Hypothalamus only B) JGA only
C) The heart only D) Hypothalamus, JGA and heart (to certain extent)

74. Osmoreceptors in the body are activated by changes in - **[Pg-297,M]**
A) Blood volume but not body fluid volume
B) Body fluid volume but not blood volume
C) Blood volume and body fluid volume
D) Blood volume, body fluid volume and ionic concentration

75. Which of the following sequences is correct for regulation of kidney function? **[Pg-297,H]**
A) An excess loss of water from body→Stimulates hypothalamus→Osmoreceptors→ eurohypophysis→ADH→ Increases water permeability of DCT and CT→ Prevention of diuresis

B) An excess loss of fluid from body→Osmoreceptors→ Hypothalamus→Neurohypophysis→ ADH→ Increases water permeability of DCT and CT→Prevention of diuresis.
C) An excess loss of fluid from body→ Osmoreceptors→ Hypothalamus→ Neurohypophysis→Aldosterone→ Water permeability of DCT and CT increases→ Prevention of diuresis
D) An excess loss of fluid from body→ osmoreceptor→ Hypothalamus→ Adenohypophysis→ ADH→ Increases water permeability of DCT and CT→ Prevention of diuresis

76. Osmoregulation is the function of- **[Pg-297,E]**
A) Oxytocin B) Prolactin C) Vasopressin (ADH) D) None of the above

77. ADH is synthesised by, _____ released by _____ and acts on _____. **[Pg-297,M]**
A) Hypothalamus, Neurohypophysis, DCT and CT
B) Hypothalamus, Neurohypophysis, Loop of Henle
C) Hypothalamus, Adenohypophysis, DCT and CT
D) Hypothalamus, Adenohypophysis, Loop of Henle

78. Which of the following sequence is correct? **[Pg-297,M]**
A) An increase in body fluid volume → switch off the Osmoreceptors → suppresses the ADH release
B) ADH → Constricting effect on blood vessel→ B. P. high~ Glomerular blood flow more → GFR more
C) Angiotensinogen→ Angiotensin I→ Angiotensin II→ Adrenal cortex →Aldosterone
D) All

79. Which of the following factors can active the JG cells to release renin? **[Pg-297,E]**
A) A fall in glomerular blood pressure (GBP)
B) A fall in glomerular blood flow (GBF)
C) A fall in GFR
D) A fall in GFR I GBP I GBF

80. Which of the following statements is false? **[Pg-297,M]**
A) Angiotensin II, being a powerful vasoconstrictor, increases glomerular pressure and thereby GFR
B) Angiotensin II activates the adrenal cortex to release aldosterone
C) Aldosterone promotes reabsorption of Na+ and water from the DCT and CT leading to an increase in B.P. and GFR
D) ANF causes vasoconstriction

81. RAAS (Renin -Angiotensinogen - Aldosterone System)- **[Pg-297,M]**
A) Is triggered when the juxtaglomerular cells of JGA releases renin in response to various stimuli
B) Is responsible for regulation of kidney function
C) Are stimulated when ANF is more in blood
D) A and B are correct

82. Which of the following is true about Atrial Natriuretic factor (ANF)? **[Pg-297,M]**
A) An increase in blood volume and B. P. stimulates cardiac atria to release ANF
B) ANF promotes vasoconstriction and thereby decrease B.P.
C) ANF acts as a check on RAAS
D) A and C

83. Renin-angiotensin pathway controls – **[Pg-297,E]**
A) Ultrafiltration B) Blood pressure C) Glucose reabsorption D) Cardia output

84. RAAS secretes which of the following hormones? **[Pg-297,E]**
A) Glucocorticoids B) Renin C) Mineralocorticoids D) All

Paragraph- 19.6 Micturition

85. The expulsion of urine from the urinary bladder is called - **[Pg-298,E]**
A) Uricolysis B) Micturition C) Uremia D) Anuria

86. In micturition - **[Pg-298,E]**
A) Urethra relaxes B) Ureter relaxes C) Ureter contracts D) Urethra contracts

87. The outline of principal event of urination is given below in unordered manner- **[Pg-297-299,H]**
I. Stretch receptors on the wall of urinary bladder send signal to the CNS
II. The bladder fills with urine and becomes distended

III. Micturition
IV. CNS passes on motor messages to initiate the contraction of smooth muscles of bladder and simultaneous relaxation of urethral Sphincter
The correct order of steps for urination is -
A) I→ II→ III→ IV B) IV→ III→ II→I
C) II→I→ IV→ III D) III→ II →I → IV

88. The neural mechanisms causing urination is called - **[Pg-298,E]**
A) Scarth reflex B) Withdrawal reflex C) Micturition reflex D) None

89. Average pH of human urine is – **[Pg-298,E]**
A) 6 B) 9 C) 3 D) 7

90. Match the column I with column II. **[Pg-298,M]**

	Coulumn I		Column II
A)	Uremia	I)	Henle's loop
B)	Ketonuria	II)	Ketone bodies in urine
C)	Glycosuria	III)	Artificial kidney
D)	Blood dialyser	IV)	Glucose in urine
E)	Concentration of urine	V)	Accumulation of urea in blood

A) A - V, B - II, C - IV, D – III, E – I B) A- Ill, B - II, C - IV, D - I, E - V
C) A-I, B - II, C - IV, D - Ill, E – V D) A- I, B - II, C - IV, D - V, E – III

91. Diabetes mellitus is characterized by- **[Pg-298,E]**
A) Oilgonuria B) Ketonuria and glycosuria
C) Anuria D) Haematuria

92. How much urea is excreted per day by a normal adult? **[Pg-298,E]**
A) 0 gm B) 25 – 30 gm C) 50 gm D) 1 – 2 gm

Paragraph- 19.7 Role of other Organs in Excretion

93. Other than kidneys, which of the following also helps in the elimination of excretory wastes? **[Pg-298,E]**
A) Skin B) Liver C) Lungs D) All

94. How much CO_2 is removed per minute by our lungs- **[Pg-298,E]**
A) 18 Ml B) 200 Ml C) 1L D) 8 L

95. Which of the following statements is false? **[Pg-298,M]**
A) Micturition is carried out by a reflex
B) Cholesterol is excreted in the bile and waxes are excreted in the sebum
C) 8 L urine is excreted per day
D) The primary function of sweat is excretion

96. Liver (largest gland) is both secretory and excretory organ. It secretes bile. Which of the following are major excretory products of bile? **[Pg-298,E]**
A) Degraded and steroid hormones B) Vitamins and drugs
C) Bilirubin and Biliverdin D) Cholesterol

97. Most of excretory products of bile ultimately pass out along with- **[Pg-298,E]**
A) Urine B) Digestive wastes C) Urea D) Sweat

98. I. The human skin possesses sweat and sebaceous glands which eliminate some wastes in their secretion.
II. Sweat is waxy protective secretion having sterols, hydrocarbons and fatty acid
III. Sebum is an aqueous fluid having NaCl, lactic acid, urea, amino acids, glucose
Which one of the above statement is correct? **[Pg-298,H]**
A) Only I B) II and III C) Only II D) I and II

Paragraph- 19.8 Disorder of the excretory system

99. In uremia, artificial kidney is used for removing accumulated waste products like urea by the process called- **[Pg-298,E]**
A) Micturition B) Haemolysis C) Ureotelism D) Hemodialysis

100. In artificial kidney dialysing fluid contains all the constituents as in plasma expect- **[Pg-298,E]**
A) Na+ B) Water C) Glucose D) Nitrogenous wastes

101. Kidney stone is produced by- **[Pg-299,E]**
A) Deposition of sand particles B) Crystallization of Ca- oxalate
C) Precipitation of protein D) KCI or NaCl

102. Bright's disease/Glomerulonephritis is- **[Pg-299,E]**
A) Glycosuria B) Cystitis C) Inflammation of glomeruli D) Ketonuria

103. Following are the steps of dialysis- **[Pg-298,299,M]**
A. Blood is passed into a vein. B. Blood is mixed with heparin.
C. Blood is mixed with anti-heparin. D. Blood is drained from convenient artery.
E. Blood is passed through a coiled and porous cellophane tube bathing in dialysis fluid.
F. Removal of nitrogenous wastes from blood.
The correct sequence of steps is-
A) A → B → C → D → E → F B) F → C → E → B → A → D
C) D → B → E → F → C → A D) D → C → E → F → B → A

NEET PREVIOUS YEARS QUESTIONS

01. Match the excretory disorder given in column I with their description given in column II and select the correct option given below. **[2018]**

Column – I	**Column – II**
A. Glycosuria	I. Accumulation of uric in joints
B. Gout	II. Mass of crystallised salts within the kidney
C. Renal calculi	III. Inflammation in glomeruli
D. Glomerula nephrits	IV. Presence of glucose in urine

(a) A-III; B-II; C-IV; D-I (b) A-I; B-II; C-III; D-IV
(c) A-IV; B-I; C-II; D-III (d) A-II; B-III; C-I; D-IV

02. Match the function given in column I with their respective structure given in column II and select the correct option given below: **[2018]**

Column I (Function)	**Column II (Part of Excretory system)**
A. Ultrafiltration	I. Henle's loopB.
B. Concentration of urine	II. Ureter
C. Transport of urine	III. Urinary bladder
D. Storage of urine	IV. Malpighian corpuscle
	V. Proximal convoluted tubule

(a) A-IV; B-V; C-II; D-III (b) A-IV; B-I; C-II; D-III
(c) A-V; B-IV; C-I; D-III (d) A-V; B-IV; C-I; D-II

03. Which of the following statements is **correct**? **[2017]**
(a) The descending limb of loop of Henle is impermeable to water.
(b) The ascending limb of loop of Henle is permeable to water.
(c) The descending limb of loop of Henle is permeable to electrolytes.
(d) The ascending limb of loop of Henle is impermeable to water

04. A decrease in blood pressure / volume will not cause the release of : **[2017]**
(a) Atrial natriuretic factor (b) Aldosterone (c) ADH (d) Renin

05. In mammals, which blood vessel would normally carry largest amount of urea? **[2016]**
(a) Renal vein (b) Dorsal aorta (c) Hepatic vein (d) Hepatic portal vein

06. Human urine is usually acidic because **[2015]**
(a) excreted plasma proteins are acidic.
(b) potassium and sodium exchange generates acidity.

(c) hydrogen ions are actively secreted into the filtrate.
(d) the sodium transporter exchanges one hydrogen ion for each sodium ion in peritubular capillaries.

07. Which of the following does not favour the formation of large quantities of dilute urine? **[2015]**
(a) Caffeine (b) Renin (c) Atrial-natriuretic factor (d) Alcohol

08. Removal of proximal convoluted tubule from the nephron will result in **[2015]**
(a) more concentrated urine. (b) no change in quality and quantity of urine.
(c) no urine formation. (d) more diluted urine.

09. Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule? **[2014]**
(a) Increase in aldosterone levels. (b) Increase in antidiuretic hormone levels.
(c) Decrease in aldosterone levels. (d) Decrease in antidiuretic hormone levels.

10. Use of an artificial kidney during haemodialysis may result in : **(NEET-2019)**

(a) Nitrogenous waste build-up in the body

(b) Non-elimination of excess potassium ions

(c) Reduced absorption of calcium ions from gastro-intestinal tract

(d) Reduced RBC production

Which of the following options is the most appropriate?

(1) (a) and (b) are correct (2) (b) and (c) are correct

(3) (c) and (d) are correct (4) (a) and (d) are correct

11. Match the following parts of a nephron with their function: **(NEET-2019 ODISSA)**

(a) Descending limb of Henle's loop (i) Reabsorption of salts only

(b) Proximal convoluted tubule (ii) Reabsorption of water only

(c) Ascending limb of Henle's loop (iii) Conditional reabsorption of sodium ion and water

(d) Distal convoluted (iv) Reabsorption of tubule ion, water and organic nutrients.

Select the correct option from the following:

(1) (a)-(i), (b)-(iii), (c)-(ii), d-(iv) (2) (a)-(ii), (b)-(iv), (c)-(i), d-(iii)

(3) (a)-(i), (b)-(iv), (c)-(ii), d-(iii) (4) (a)-(iv), (b)-(i), (c)-(iii), d-(ii)

12. Match the items in Column-I with those in Column-II: **(NEET-2019 ODISSA)**

Column-I	**Column-II**
(a) Podocytes	(i) Crystallised oxalates
(b) Protonephridia	(ii) Annelids
(c) Nephridia	(iii) Amphioxus
(d) Renal calculi	(iv) Filtration slits

Select the correct option from the following :

(1) (a)-(iii), (b)-(iv), (c)-(ii), d-(i) (2) (a)-(iii), (b)-(ii), (c)-(iv), d-(i)

(3) (a)-(iv), (b)-(iii), (c)-(ii), d-(i) (4) (a)-(iv), (b)-(ii), (c)-(iii), d-(i)

13. The increase in osmolarity from outer to inner medullary interstitium is maintained due to : **(NEET-2020 COVID)**

(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

(1) Only(ii) (2) (iii) and (iv) (3) (i), (ii) and (iii) (4) (i) and (ii)

14. Select the correct statement : **(NEET-2020 COVID)**

(1) Atrial Natriuretic Factor increases the blood pressure.

(2) Angiotensin II is a powerful vasodilator.

(3) Counter current pattern of blood flow is not observed in vasa recta.

(4) Reduction in Glomerular Filtration Rate activates JG cells to release renin.

15. Which of the following would help in prevention of diuresis? **(NEET-2020)**

1) Decrease in secretion of renin by JG cells

2) More water reabsorption due to under secretion of ADH

3) Reabsorption of Na+ and water from renal tubules due to aldosterone

4) Atrial natriuretic factor causes vasoconstriction

16. Presence of which of the following conditions in urine are indicative of Diabetes Mellitus? **(NEET-2020)**

1) Renal calculi and Hyperglycaemia 2) Uremia and Ketonuria

3) Uremia and Renal calculi 4) Ketonuria and Glycosuria

17. Nitrogenous waste is excreted in the form of pellet or paste by: **[NEET-2022]**

1) *Ornithorhynchus* 2) *Salamandra*

3) *Hippocampus* 4) *Pavo*

NCERT LINE BY LINE QUESTIONS – ANSWERS

Q	1	2	3	4	5	6	7	8	9	10
Ans	C	D	C	D	D	B	D	B	D	C
Q	11	12	13	14	15	16	17	18	19	20
Ans	C	B	B	D	D	C	D	A	A	C
Q	21	22	23	24	25	26	27	28	29	30
Ans	D	C	D	B	B	B	B	C	B	C
Q	31	32	33	34	35	36	37	38	39	40
Ans	D	A	A	D	A	C	A	A	C	A
Q	41	42	43	44	45	46	47	48	49	50
Ans	D	C	B	C	B	B	D	B	B	C
Q	51	52	53	54	55	56	57	58	59	60
Ans	C	A	D	B	D	A	D	B	D	D
Q	61	62	63	64	65	66	67	68	69	70
Ans	B	C	B	D	D	A	B	B	B	D
Q	71	72	73	74	75	76	77	78	79	80
Ans	C	D	D	D	B	C	A	D	D	D
Q	81	82	83	84	85	86	87	88	89	90
Ans	D	D	B	C	B	A	C	C	A	A
Q	91	92	93	94	95	96	97	98	99	100
Ans	B	B	D	B	C	C	B	A	D	D
Q	101	102	103							
Ans	B	C	C							

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1 (c) **2** (b) **3** (d) **4** (a) **5** (c) **6** (c) **7** (b) **8** (d) **9** (a) **10** (3)

11 (2) **12** (3) **13** (4) **14** (4) **15** (3) **16** (4) **17** (4)

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. **(c)** Glycosuria denotes presence of glucose in the urine. Gout occurs due to deposition of uric acid crystals in the joint. Renal calculi are precipitates of calcium phosphate produced in the pelvis of the kidney. Glomerular nephritis is the inflammatory condition of glomerulus, characterised by proteinuria and haematuria.

2. **(b)**

3. **(d)** Descending limb of loop of Henle is permeable to water but impermeable to electrolytes whereas ascending limb is impermeable to water but permeable to electrolytes.

4. **(a)** A decrease in blood pressure / volume stimulates the release of renin, aldosterone and ADH while increase in blood pressure / volume stimulates the release of Atrial Natriuretic Factor (ANF) secreted by atria of heart, which causes vasodilation and also inhibits RAAS (Renin Angiotensin Aldosterone System) mechanism that decreases the blood volume/pressure.

5. **(c)**

6. **(c)** Urine has acidic nature because hydrogen ions (H+) are components of an acid which are secreted into the filtrate.

7. **(b)** Renin is an enzyme released by the kidneys. It causean increase in blood preasure leading to restoration of perfusion pressure in the kidneys. The secretion of renin is induced by decrease in blood pressure and blood volume. It has no role in the formation of large quantities of urine.

8. **(d)** Generally all of the essential nutrients and 70% to 80% of electrolytes and water are reabsorbed by PCT. Removal of proximal convoluted tubule from the nephron will result in dilution of urine.

9. **(a)**

15. Adrenal cortex secretes mineralocorticoids like aldosterone which increase the reabsorption of Na^+ and water from renal tubule that prevent diuresis and increases water holding capacity

16. Presence of Ketone bodies in urine is called Ketonuria and presence of glucose in urine is called Glycosuria. The above are indications of Diabetes mellitus.

17. *Pavo*-uricotelic-excreting product –pellet/paste