Question bank-Paper No.14

Drugs acting on urinary system

I. Name the following:

1.A non diuretic congener of thiazide.-(Diazoxide)

2.A sulphonamide derivative diuretic without any anti bacterial activity.-(Acetazolamide)

3.A carbonic anhydrase inhibitor.-(acetazolamide)

4.A xanthine diuretic .-(Theophylline/ Theobromine)

5.Aldosterone antagonist.-(Spironolactone)

6.A uracil diuretic.-(Aminometradine)

7.An osmotic diuretic.-(Mannitol, urea)

8.An anthranilic acid derivative diuretic.-(Furosemide)

9.An antiepileptic drug which stimulate antidiuretic hormone secretion.-(Carbamazepine)

10.A hypolipidemic agent which stimulate antidiuretic hormone secretion.-(Clofibrate)

11.An enzyme inhibited by ethacrynic acid .-(Na+ K+ ATP ase)

12.An enzyme inhibited by Diamox-(Carbonic anhydrase)

13.A phenoxy acetic acid derivative.-(Ethacrynic acid)

14.A potassium sparing diuretic.-(Spironolactone, Triamterene)

15. A Long acting thiazides.-(Bendoflumithiazide, Poly thiazide)

16.A non aldosterone antagonist , with potassium sparing diuretic action –(Triamterene, Amiloride)

17.One potassium excreting diuretic.-(chlorothiazide)

18.One beta unsaturated ketone derivative having diuretic action.-(Ethacrynic acid)

19.One mercurial diuretic.-(Mersalyl)

20.One alkalinising salt having diuretic property.-(Sodium bicarbonate)

21.One antidiuretic drug other than ADH.-(Chlorpropamide)

22.Organic amine used as urinary alkaliniser.-(Tromethamine)

23.One urinary tract antispasmodic.-(Flavoxate hydrochloride)

24.Other name for methenamine mandalate.-(Hexamine)

25.One synthetic choline ester that inhibits micturition .-(Bethanechol)

26.Three urinary antiseptics.- (nalidixic acid, nitrofurantoin, methenamine)

27.Three urinary acidifiers –(Ammonium chloride, Ammonium biphosphate, sodium acid phosphate, potassium acid phosphate)

28.The only diuretic which does not require access to the tubular lumen to induce dieresis .-(Spironolactone)

29.The metabolite of spironolactone which is the actual aldosterone antagonist.-(Canrenone)

30.Two ammonium salts having diuretic action.-(Ammonium chloride and ammonium nitrate)

31.Two aldosterone antagonist .-(spironolactone and eplerenone, pot. canrenoate)

32.Urinary tract sedative.-(Tr.Belladona, Tr.Hyocyamas)

33.Urinary tract analgesic.-(Phenazopyridine hydrochloride)

34.Urinary tract antispasmodic.-(Flavoxate hydrochloride)

II.write the active ingredients of

1.Aldactone.-(Spironolactone)

2.Bumex.-(Bumetamide)

3.Diapid .-(L-vasopressin)

4.Diamox -(Adetazolamide)

5.Diuril, Saluril-(Chlorothiazide),

6.Edecrin .-(Ethacrynic acid)

7.Esidrex.-(Hydrochlorothiazide)

8.Gramoneg –(nalidixic acid)

9.Lasix.-(Furosemide)

10.Lypressin.-(Lysin-vasopressin)

11.Osmitrol .-(Mannitol)

12. Renese –(polythiazide)

13. Ticrynafen-(Tienilic aid)

III. Fill up the blanks with most appropriate words:

1.Acid citric, Citrate and Dextrose solution (ACD solution) is added to blood as anticoagulant at the rate of ……ml/100 ml of blood -(15 ml)

2.Acetazolamide is available as ……..-(Diamox)

3.Active ingredient of Salyrgan is ……..-(Mersalyl)

4.Active ingredient of Thiomerin is ……._(Mercaptomerin)

5.ADH is used for the treatment of diabetes insipides and it is of ……origin.-(Pituitary)

6.Administration of insulin is the treatment of choice in …… keto acidosis.-(diabetes)

7.Aldosterone secretion is controlled by the electrolytes in the blood reaching the ……—(hypothalamus)

8.Among xanthenes ……..is the most effective diuretic.-(theophylline)

9.Ammonium chloride injection ……the pH of the blood.-(decrease)

10.Ammonium chloride is a urinary ……(acidifier)

11.Angiotensin II ……. the aldosterone secretion by zona glomerulosa .-(stimulate)

12.Antidiuretic hormone is otherwise known as……..(vasopressin)

13.Atrial naturiuretic polypeptide (ANP) is synthesised by myocytes of ……..(Rt.and Lt.atria)

14.Basic aluminium carbonate reduces the formation of ……stones in the urinary tract.-(phosphate)

15.Carbonic anhydrase is an enzyme containing ……metal , present in RBC, Kidney, CNS and Eyes-(Zinc)

16.Carbonic anhydrase inhibitors causes the development of metabolic……-(acidosis)

17.Chlorothiazide act at ……convoluted tubule of nephron.-(distal

18.Deficiency of ADH causes Diabetes ……-(Insipides)

19.Diarrhoea causes metabolic ……(acidosis)

20.Ethanol ……ADH production (reduce)

21.Ethacrynic acid is ……potent than Bumetamide .(less)

22.Furosemide causes excretion of …… % of the filtered sodium.-(15 to 20)

23.Furosemide interfere with the .....system in the kidney tubule and causes diuresis.-(countercurrent multiplier)

24.Furosemide and ethacrynic acid act at ……limb of loop of Henle-(medullary thick acending)

25.Furosemide causes metabolic .....-(Alkalosis)

26.Furosemide reduces the excretion of ..... acid in the urine.-(uric)

27.Furosemide is additive with other diuretics but not with .....-(Ethacrynic acid)

28.Hexamine release .....in presence of water at a pH 5.-(Formaldehyde)

29.Mercurials with theophylline is available as .....-(mercurophylline)

30.Quinidine, is an isomer of quinine an antimalarial drug.—(quinine)

31.Short acting sulfonamide for urinary tract is more active in .....urine.-(Alkaline)

32.The dose of sodium acid phosphate in dog is .....gm.TID. orally-(1)

33.The main transducer mechanism in AT1 receptor is .....in vascular smooth muscle.-(C-IP3/ DAG)

34.Tienilic acid cause more loss of ..... acid than electrolytes.-(Uric)

35.The metabolite of spironolactone ,.....is the actual antagonist of aldosterone.-(Canrenone)

36.Thiazides exert an antidiabetic effect in .....patients-(Diabetes insipides)

37.Triamterene and spironolactone act at ……collecting tubule.-(distal)

38.Urinary acidifiers .....the antibacterial action of methenamine.-(increases)

39.Verapamil is used in .....because of its prolongation of A-V node ERP.-(cardiac arrhythmia)

40.When metabolic .....develops Carbonic anhydrase become refractive.-(acidosis)

41.....is the true physiological diuretic act by inhibiting ADH.-(Water)

42.....is a competitive antagonist and inverse agonist of AT 1.-(Losartan)

IV.State true or false :

1. Absorption of mercurials are stimulated by theophylline.-(T)

2. Acetazolamide ,Triamterene and Spironolactone cause acidosis when used as diuretics.-(T)

3. Acetazolamide is having anticonvulsant effect.-(T)

4. Acetazolamide acts at proximal tubule of nephron.-(T)

5. Acute attack of gout is a side effect of chlorothiazide.-(T)

6.ADH is used as a local haemostatic.-(T)

7.All bacteria is sensitive to formaldehyde at a concentration of 20 microgram /ml.-(T)

8.Alkalinisation of urine will minimise uric acid crystalisation.(T)

9.Alkalinisers increase the antimicrobial action of aminoglycosides and increase the solubility of sulphonamides.-(T)

10.Ammonium chloride is an urinary acidifier.-(T)

11.Ammonium chloride can be used as a diuretic in ascitis.-(F)

12.Among xanthenes theobromine is having the least diuretic effect.—(F)

13.Angiotensin II is a potent vasoconstrictor (T)

14.Angiotensin I is converted in to angiotensin II in lungs and endothelial cells by angiotensin converting enzyme(ACE) (T)

15.Ascorbic acid reduces the urine pH.-(T)

16.Atropine is useful in the control of Noctural enuresis.-(T)

17.Bacteria will not develop resistance to formaldehyde .-(T)

18.Bethanechol can be recommended in non-obstructive urinary retention.-(T)

19.Bumetamide is several times active than Furosemide.-(T)

20.Canine kidney can concentrate urine to as much as double compared to human.-(T)

21.Carbamazepine is an antiepileptic drug which stimulate antidiuretic secretion.-(T)

22.Clofibrate a hypolipidemic agent which stimulates antidiuretic hormone.-(T)

23.Carbonic anhydrase inhibitors can be recommended in mercurial diuretic refractivenes.-(T)

24.Chlorothiazides aggravate diabetes -(T)

25.Chlorothiazide inhibits reabsorption of Na+ and Cl_ in the distal tubule which results in enhanced renal excretion of Na+ and Cl- and HCo3 and K+. –(T)

26.Chlorothiazide and other thiazide should not be used in renal failure with anurea.-(T)

27.Conivapan is a vasopressin receptor (V2) antagonist.-(T

28.Diamox will be more active in an acidic urine.-(F)

29.Diuretic effect of acetazolamide is a self limiting process .-(T)

30.Diuresis with thiazides are not depended on acid base balance.-(T)

31.Eplerenone is an example for aldosterone antagonist.-(T)

32.Ethacrynic acid acts for a longer period than furosemide.-(F)

33.Ethacrynic acid causes more chloride loss than furosemide.-(T)

34.Ethacrynic acid is irritant orally and may cause vomition and bleeding.-(T)

35.EDECRIN is the trade name of ethacrynic acid.-(T)

36.Ephedrine sulphate allow urinary bladder to retain its content.-(T)

37.Ethacrynic acid will act even in chronic renal failure.-(T)

38.Ethacrynic acid inhibits ATP synthesis and Na+ K+ATPase activity.-(T)

39.Ethacrynic acid can be recommended in hypercalcemia as it increases the excretion of calcium and magnesium.-(T)

40.Ethacrynic acid is not a potent diuretic in rats.-(T)

41.Furosemide is an anthranilic acid derivative.-(T)

42.Furosemide is a carboxylic acid derivative.-(T)

43.Furosemide enhances the production ofPGE2 which in turn inhibit chloride and sodium reabsorption in the thick acending limb.-(T)

44.Furosemide is effective in patients with impaired renal function.-(T)

45.Furosemide, Ethacrynic acid and Chlorothiazide causes alkalosis on use as a diuretic.-(T)

46.Hearing loss is a side effect of ethacrynic acid and that reduces the popularity of it.-(T)

47.Hexamine decompose to formaldehyde at a pH 7.4-(F)

48.Hexamine decompose in gastric juice.-(T)

49.Hexamine will have more action in an alkaline urine.-(F)

50.Hexamine must be protected from gastric juice in enteric coated pills / capsules to get good action in urinary tract.-(T)

51.In diabetes insipides patients Thiazides significantly reduce the volume of urine.-(T)

52.In humanbeings arginine vasopressin and in pigs lysine vasopressin is seen.-(T)

53.It is better to administer methenamine in an enteric coated form .-(T)

54.LASIX is the trade name of furosemide.-(T)

55.Loop diuretics like furosemide stimulate calcium excretion.-(T)

56.Mefruside is a congener of furosemide-(T)

57.Mercurials combine with SH group of enzymes associated with transport system in kidney tubule.-(T)

58.Mercurial diuretics cause hypochloremic alkalosis.-(T)

59.Mercurials will act in acidosis.-(T)

60.Mercurials cause the development of acidosis.-(F)

61.Mercurials will not interfere with sodium hydrogen exchange.-(T)

62.Mercurials inhibit active sodium reabsorption.-(T)

63.Methylene blue induces haemolysis in glucose 6-phosphate dehydrogenous deficiency.-(T)

64.Methenamine has no antibacterial activity in presence of blood or tissues.-(T)

65.Mercurials causes the retention of HCO_3 to counteract chloride loss, resulting in alkalosis.-(T)

66.Mental confusion is one of the side effects of ethacrynic acid.-(T)

67.Mineralocorticoids cause retention of potassium in the body.—(F)

68.Mineralocorticoids cause retention of sodium in the body.-(T)

69 Nalidixic acid is ineffective against systemic infection because of its reduced action in presence of proteins.-(T)

70.Non diuretic mercurials can block the action of the diuretic mercurials.-(T)

71.NSAIDs inhibit the diuretic , natriuretic and chloruretic response of furosemide.-(T)

72.NSAIDs block the PG E2 production and block the furosemide induced diuresis.-(T)

73.Nitrofurantoin is effective in urinary tract infection.-(T)

74.Oxybutynin chloride is an urinary tract antispasmodics.-(T)

75.Osmitrol is metabolised by liver.-(F)

76.phenazopyridine is a urinary analgesic.-(T)

77.Plasma can be stored for several months in frozen stage without damage.-(T)

78.Proximal convoluted tubule absorb almost all of glucose, bicarbonate, aminoacids and other metabolite -(T)

79.Pseudomonas is resistant to Quinolones.-(T)

80.Pseudomonas in urinary tract is susceptible to Nitrofurantoin .-(F)

81.Reduction urine pH enhances the excretion of basic drugs..-(T)

82.Refractiveness will not develops for mercurials.-(F)

83.Rifractiveness to mercury can overcome by acidifying salt.-(T)

84.Spironolactone acts on distal nephron (collecting tubule)-(T)

85.The diuretic response of furosemide is not significantly altered by acid base balance.-(T)

86.The primary action of acetazolamide is in the proximal tubule.-(T)

87.The diuretic action of theophylline is not much affected by acid base balance.-(T)

88.Theophylline inhibits tubular reabsorption of sodium.-(T)

89.The diuretic action of Ammonium chloride lasts for few days.-(T)

90.The most potent form of thyroxin is triiodothyronine. —(T)

91.The most important side effect of ammonium chloride as a urinary acidifier is development of metabolic acidosis.-(T)

92.The peak action of mercurial diuretic is for 6—9 hours.-(T)

93.The ratio of intracellular to extracellular K+ ion con. is the major determinant of the resting membrane potential (-70 to – 90mv) –(T)

94.The tubular epithelium of the thick portion of the ascending loop of Henle is highly permeable to water.-(F)

95.Theophylline prevent the attachment of mercury to tissue protein.-(T)

96.The thick ascending limb of loop of Henle and the distal convoluted tubule are relatively impermeable to water but actively reabsorb solute.-(T)

97.The thick ascending limb of loop of Henle and the distal convoluted tubule are relatively impermeable to water but actively reabsorb solute.-(T)

98.Thiazides produce neither alkalosis nor acidosis.-(T)

99.Tienilic acid causes more loss of uric acid in urine and relieve gout.-(T)

100.Tolvapan is a selective vasopressin V2 receptor blocker.-(T)

101.Two third of the Na+ is reabsorbed in the proximal convoluted tubule.-(T)

102.Torsemide is a loop diuretic.-(T)

103.Tripamide is a loop diuretic.-(T)

104.Thiazides are having diabetogenic effect in subclinical diabetes mellitus.-(T)

105.Thiazides inhibit carbonic anhydrase but not causes metabolic acidosis.-(T)

106.106.The primary site of action of thiazide is the distal convoluted tubule.-(T)

107.The effect of spironolactone largely depends on the activity of aldosterone.-(T)

108.The diuretic effect of spironolactone reaches the maximum immediately.-(F)

109.Urine must be alkalinised while administering Methenamine.-(F)

110.Urinary acidifiers eliminate the odour and turbidity of urine.-(T)

111.Urinary acidifiers prevent the precipitation of calcium deposits in urinary tract or rubber articles placed in the urinary tract.-(T)

112.Urinary acidifiers are contra indicated in renal and hepatic disease.-(T)

113.Vasopressin can be administered orally in dogs.-(F)

114.When carbonic anhydrase is blocked, there will be less hydrogen for sodium exchange.-(T)

115.When refractivenes is developed to ammonium chloride it is excreted in the urine.-(T)

116.When potassium is injected acidifying effect will be produced.-(T)

IV. Mark the Odd one out.

1.Ammonium chloride , sod. bisulphate , sod. acid phosphate, sod. acetate.-(sodium acetate- only urinary alkaliniser, others are urinary acidifier)

2.Anthranilic acid derivative, phenoxy acetic acid derivative, mercurials, xanthenes-(Xanthines-all are loop diureticsexcept xanthenes)

3.Ammonium chloride,sod. acid phosphate , ammonium biphosphate, sodium bicarbonate.-(Sod. bicarbonate-systemic alkaliniser)

4.Blood, Plasma, despeciated serum, dextran -(dextran- synthetic plasma volume expander others are natural.)

5.Carbonic anhydrase inhibitors, xanthenes, uracil diuretics, mercurials.-(Mercurials- only loop acting diuretic)

6.Flavoxatehydrochloride, ephedrine sulphate, atropine, oxybutynium chloride, Bethanechol-(U.tractantispasmodic anti spasmodic except bethanechol)

7.Polythiazide, quinethazone, chlorthalidone, spironolactone.-(spironolactone-only potassium sparing diuretic)

8.Sodium bicarbonate, sodium citrate, sod. acetate, sod. biphosphate-(sod.biphosphate-only acidifier)

V. Match each one in A to those in B andC.

A	B	C
1. Sodium sulphate	urinary acidifier--2	urinary tract antispasmodics-4
2.Sod. acid phosphate	disurea —4	enhance hypocalcemia--3
3. Sod. bicarbonate	metabolise to bicarbonate-5	increase calcium solubility —2
4.Flavoxate	stimulate calcium absorption-6	initiate micturition-7
5. Sod. acetate	increase bladder tone-7	increase serum phosphorus-6
6.Calcitriol	systemic alkaliniser-3	hyper calcemia.-1
7.Bethanechol	Glaubers salt-1	urinary alkaliniser-5

A	B	C
1.Mefruside	normal animals-6	interfere blood grouping-7
2.Furosemide	osmotic diuretic -7	65 ml/kg/day-6
3.Ethacrynic acid	ECF 5 meq/lit-5	improve micro circulation-7
4.Sodium	Tam horsefal protein-1	130 ml/kg/day-8
5.Potassium	ECF cation-4	ICF 10 meq/lit –4
6.Water turn over	diuresis for 4 hours-3	Lasix--2
7.Dextran	lactating animals-8	loop diuretics-1,2,3
8. Higher water turn over	diuresis for 6 hours-2	ICF 150 meq/lit —5

A	B	C
1.Acetazolamide	Edecrine-5	loop diuretic—4,5
2.Spironolactone	urinary acidifier—7	reduce urine in diabetes insipides-6
3.Mersalyl	aldosterone antagonist-2	urolithiasis-7
4.Furosemide	UT Antispasmodic-9	Refractoriness-3
5.Ethacrynic acid	inhibit by ethanol-8	carbonic anhydrase inhibitor-1
6.Chlorothiazide	acts on proximal tubule-1	interfere with testosterone-2
7.Ammonium chloride	organic mercurial-3	not active in rats-5
8.Anti diuretic hormone	lasix-4	urinary tract analgesic-9
9.Flavoxate hydrochloride	saluril-6	vasopressin-8

A	B	C
1. Ammonium chloride	increase bladder tone --3	DNA gyrase—4
2. Aldactone	fluroquinolone—4	carbonic anhydrase inhibitor—5
3. Bethanechol	loop diuretic—6	urinary tract analgesis—7
4. Ciprofloxacin	Alkalosis—8	generate formaldehyde—9
5.Diamox	dysurea—7	novasurol—8
6. Ethacrynic acid	urinary antiseptic—9	initiate micturition—3
7. Flavoxate	increase action of methenamine—1	potassium sparing diuretic—2
8. Mercurials	acidosis—5	urinary acidifiers—1
9. Methenamine	aldosterone antagonist—2	counder current multiplier System-6

VI.Choose the correct answers from the given ones:

1.An anti-mineralocorticoid used as diuretic is a) spiranolactone b) aldosterone c) deoxycortico sterone d) corticosterone -(a)

2.A urinary acidifier a) ammonium sulphate b) sodium acid phosphate c) ammonium hydroxide d) all the above. —(b)

3.Bicarbonate can be recommended in a) hyper ventilation b) un controlled diabetes c) ethacrynic acid toxicity d) all the above. —(b)

4.During diuretic therapy refractiveness is seen when alkalosis develops a) for mercurials b) for xanthenes c) for acetazolamide d) none of the above .—(a)

5.Ethacrynic acid is a loop diuretic a) it is a powerful diuretic in cats b) it is a powerful diuretic in dogs c)it is not a potent diuretic in rats d) it is a mild diuretic in cattle.—(c)

6.Ethacrynic acid causes the development a) acidosis b) alkalosis c) hepatitis d) nephritis --(b)

7.Eventhough chlorothiazide is having a sulfonamide moiety a) it causes metabolic acidosis b) causes metabolic alkalosis c) will not cause metabolic acidosis d) will not interfere with acid base balance –(c)

8.Ethanol is having influence on urinary system a) it enhances ADH b) irritate urinary tract c) it inhibits ADH d) decreases uric acid excretion.—(c)

9.Flavoxate is used to counteract spasm of urinary tract a) it is having anti cholinergic action b)anti bacterial action c) anti inflammatory action d) all the above --(a)

10.For better action of methenamine urine must be a) acidified b) alkalinized c) neutralized d)increase the volume .—(a)

11.Following drugs have their primary action in the proximal kidney tubule. a) acetazolamide b) theobromine c) urea d) all the above. —(d)

12.Following drug shave their primary action in the distal convoluted tubule a) chlorothiazide b) mercaptomerine c) theobromine d) none of the above.-(a)

13.Furosemide is a powerful diuretic a) interfere countercurrent multiplier system b) causes the development of metabolic acidosis c) additive with ethacrynic acid d) none of the above.—(a)

14.Furosemide is a diuretic a) it is an anthranilic acid derivative b) loop diuretic c) effective even in impaired renal function d) all the above –(d)

15.Furosemide is a very powerful diuretic a) causes temporary deafness b) causes mental confusion c) severe imbalance of electrolytes d) all the above --(d)

16.Furozemide is a) an anthranilic acid derivative b) loop diuretic c) effective in patients with impaired renal function d) all the above.-(d)

17.Hexamine is a urinary antiseptic a) act by releasing formaldehyde in the urinary tract b) effective in acidic medium c) inhibits the action by urea splitting bacteria d) all the above are correct.—(d)

18.In refractiveness to mercurial diuretics alternate drug of choice is a) xanthenes b) furosemide c) acetazolamide d) none of the above.-(c)

19.Mersalyl act as a diuretic by a) inhibiting the action of sod. re absorption without interfering with Na + H+ exchange b) interfering with Na + H+ exchange c) inhibiting ADH secretion d) none of the above mechanism.-(a)

20.Mercurial diuretics will produce a) metabolic alkalosis b) refractivenes c) interfere active sodium reabsorption d) all the above.-(d)

21.Nalidixic acid is not effective in systemic infection because a) it is destroyed by the bacteria b) its activity is reduced in presence of protein c) neutralized in the body pH d) all the above --(b)

22.Normal sodium filtration via kidney tubule is…….m.eq/min. a) 30---40 b) 13---20 c) 50---60 d) 5—10 .—(b)

23.One of the following is an osmotic diuretic. a) xanthenes b) mercurials c) mannitol d) none of the above .—(c)

24.One of the following is a potassium sparing diuretic a) spironolactone b) quinethazone c) furosemide d) theobromine --(a)

25.One of the following is a loop diuretic a) Ethacrynic acid b) spironolactone c) acetazolamide d) urea --(a)

26.One of the following is an urinary acidifier .-a) ammonium sulphate b) sodium acid phosphate c) ammonium hydroxide d) all the above. –(b)

27.One of the following is an anti diuretic drug in diabetes insipidus a)thiazides b) mercurials c)carbonic anhydrase inhibitors d) all the above. –(a)

28.One of the following is an uricosuric drug a) tienilic acid b)torsemide c)bumetamide d) none of he above.-(a)

29.One of the following is a xanthine diuretic a) theobromine b) theophylline c) caffeine d) all the above .—(d)

30.Out of the total body water content the inaccessible bone water is about a) 2.5 % b) 7.5 % c) 20 % d) 1%--(b)

31.Osmotic diuretics have the following qualities a) pharmacologically very active b) freely filtered at glomeruli c) metabolized slowly d) all the above –(b)

32.Osmotic diuretic can be recommended in a) oligurea due to burns b) cerebral oedema c) ocular pressure d) all the above --(d)

33.Out of the total water excretion kidney contribute about a) 70—80% b) 50—60% c) 20---30% d) 40% --(b)

34.Refractivenes to mercurial diuretics can be overcome by a) ammonium chloride b) potassium chloride c) sodium citrate d) sodium bicarbonate.—(a)

35.Spironolactone is used as a diuretic and it a) inhibits aldosterone b) inhibits testosterone activity c) it retain potassium d) all the above. —(d)

36.Sodium acid phosphate can be used as a a) urinary acidifier b) urinary alkaliniser c) as a diuretic d) none of the above --(a)

37.The following drugs are having their primary site of action in the proximal convoluted tubule.-a) Acetazolamide b) Theobromine c) Urea d) all the above. —(d)

38.The following drugs have vasodilator action a) sodium nitrite, b)amylnitrate c)nitroglycerine d) all the above -(d)

39.The richest natural source of heparin is from a)lung b)liver c) kidney d) blood.-(a)

40. The sulfonamide without antibacterial action is a) sulfacetamide b) silver sulphadiazine c) acetazolamide d) none of the above.-(c)

41.Aldosterone produces in response to a) stimulation by angiotensin I b) Hyperkalaemia c) decrease in dietary sodium intake d) Hyponatremia e) all the above.-(e)

VII. Select the correct answers from the given ones and substantiate your answer.

1-Which of the following blood transfusion practice in cats may pose the most serious haemagglutination problem? A) The type A donor donate blood to the type B recipient. B) The type **B** donor donate blood to the type A recipient. C) Type A donor donate blood to the type A B recipient. D) Type AB donor donate blood to the type A receipiant,

The answer is B—cats with type B blood have strong anti A antibody. One ml. Of type A blood given to type B cat can be fatal even without prior sensitization .type A kitten bone to and allowed to nurse from type B queens suffer from neonatal iso erythrolysis. Cats with type A blood have weak anti-B antibody, which does not cause a serious hemagglutination problem. Cats with type AB blood have no isoantibody against either A or B antigen, and thus they do not cause any hemagglittination problem when serving as a donor.

2. If you decide to perform a blood transfusion in a dog with severe blood loss, the appropriate dosage should be A) 4-5 mL/kg. B) 10-20 mL/kg. C) 40-50 mL/kg. D) 60-70mL/kg.E) 90-100 mL/kg.

The answer is B. The recommended dosage for blood transfusion is 10-20 ml/kg.

3. Which of the following is a correct statement regarding blood collection and storage? A) Heparin is a potent anticoagulant , and thus is good for blood storage. B) Forty percent of blood volume can be safely collected from a healthy donor every 2-4 weeks. C) the blood that is collected using CPDA-1 can be stored longer than the one that is collected using CPD. D)the blood that is collected with 3.5% sodium citrate can be stored at 4 degree Centigrade for 3 weeks.

The answer is C. The blood collected with CPDA-1 (citrate-phosphate-dextrose-adenine)can be stored for 7 weeks, while with CPD can be stored for 3 weeks. Heparin is not good anticoagulant for blood collected for storage. It is inactivated in the blood in 48 hours, as it activate platelets,

rendering them non-functional. A total of 20% of blood volume can be safely collected from a healthy donor every 2-4 weeks. The blood that is collected using 3.5% sodium citrate should be used for transfusion soon after collection, as this does not contain phosphate buffer, glucose, or adenine.

4. In the presence of renal disease, hyperkalemia may occur after the administration of A) mannitol. B) triamterene. C) furosemide D) chlorothiazide.

The answer is B. Triamterene is a potassium sparing diuretic that inhibits active sodium reabsorption in the distal tubule and collecting duct. Potassium retention may produce hyperkalemia in the presence of renal disease. mannitol, furosemide, and chlorothiazides are not potassium sparing diuretics.

5. Which of the following statements concerning furosemide is not true? A) It tends to produce a metabolic alkalosis via urinary loss of hydrogen , potassium and chloride. B) It decreases calcium reabsorption in the loop of Henle and increases urinary calcium loss. C) it may increase capacitance of pulmonary blood vessels and reduce epistaxis in race horses. D) It blocks Na+ -K+-2Cl- coupled transport in the ascending loop of Henle. E) It is less potent than agents which act at the proximal convoluted tubule.

The answer is E.furosemide increases the hydrogen, potassium and chloride ion excretion rate which produce metabolic alkalosis. Calcium reabsorption in the loop of Henle is decreased because of the loss of transcellular potential produced by blockade of Na+ K+ 2Cl- co transport. Blood vessel capacitance is increased and this may prevent exercise induced pulmonary haemorrhage in horse. Loop diuretics are more potent than agents which act at the proximal tubules because compensatory mechanisms for sodium reabsorption are limited beyond the loop of henle.

6.An alkaline urine and a decreased rate of aqueous humor formation in glaucoma is produced by A) ethacrynic acid B) dichlorphenamide C) mannitol D) triamterene.

The answer is B. Dichlorphenamide is a CA inhibitor which reduces Na+ H+ exchange in the proximal convoluted tubule and thus HCO3 ion is excreted and the urine becomes alkaline. CA activity is required for aqueous humor formation and thus the inhibition of this enzyme by dichlorphenamide reduces intraocular pressure in glaucoma . Ethacrynic acid, mannitol, and triamterene do not inhibit CA.

7. A veterinarian is presented with a dog exhibiting signs of diabetes insipidus which does not respond to desmopressin (synthetic analog of pituitary ADH) . paradoxically , urine output may decrease following treatment with A) amiloride. B) aminophylline. C) chlorothiazide D) acetazolamide E) ammonium chloride.

The answer is C. The thiazide diuretic decrease urine volume in nephrogenic diabetic insipidus. The mechanism is not completely known but sodium depletion, increase sodium and chloride absorption in the proximal tubules and reduced volume delivered to the distal nephron, may enhance the action of ADH. This effect is not observed with other classes of diuretics.

8. A high ceiling or loop diuretics such as furosemide , ethacrynic acid, or bumetamide A) have a slow onset of action since they are bound to plasma albumin. B) are the diuretics of choice in acute pulmonary oedema. C) are useful in treating aminoglycoside antibiotic toxicity since they increase renal excretion of this class of antimicrobials. D) are potentiated by CA inhibitor such as acetazolamide or dichlorphenamide because they require an alkaline urine for their diuretic action.

The answer is B. Loop diuretics may potentiate the oto-toxicity of the aminoglycoside antibiotics and should not be used with this class of antimicrobials. They have a rapid onset of action and produce peak diuresis which is greater than other classes of diuretics they are useful in rapid mobilization of oedema fluid in life –threatening conditions such as pulmonary edema. Their action is independent of urinary PH.

9. Excessive sodium retention and potassium excretion resulting from aldosterone secreting adrenal gland tumors may be treated with A) furosemide B) chlorothiazide C) triamterene D) spironolactone.

The answer is D. Mineralocorticoids such as aldosterone is secreted in large amounts by adrenal gland tumors and produce excessive sodium retension and potassium excretion by the kidney. Spironolactone is a competitive antagonist of aldosterone and ameliorates the effect of the hormone . Furosemide, chlorothiazide, or triamterene do not affect aldosterone actions.

10. A diuretic which decreases calcium excretion via increased absorption in the distal tubule and is thus used to prevent calcium oxalate bladder stone is A) hydrochloro thiazide B)ethacrynic acid C) urea D) spironolactone E) triamterene

The answer is A. The thiazide diuretics stimulate Ca ++ reabsorption in the early distal tubule and reduce urinary calcium concentrations. this action may aid in preventing the formation of calcium oxalate uroliths. Loop diuretics increase calcium excretion. Spironolactone, triamterene, or urea does not affect calcium excretion.

11. Hyperglycemia via inhibition of the conversion of proinsulin to insulin may occur with A) thiazides B) loop diuretics C) CA inhibitors D) methyl xanthenes.

The answer is A. Thiazide may produce hyperglycemia by slowing the conversion of proinsulin to insulin. This effect is most prominent in the diabetic or prediabetic state. This effect does not occur with loop diuretics, CA inhibitors or the methylxanthines.

12. Which of the following is contraindicated in patients with liver disease because of the danger of precipitating hepatic coma? A) hydrochlorothiazide B) acetazolamide C) furosemide d) spironolactone.

The answer is B. CA inhibitors, such as acetazolamide increase urinary bicarbonate excretion and produce an alkaline urine.

VIII. Answer the following:

1.Classify diuretics depending on their diuretic potency, give examples.

A.High efficacy diuretics a) high ceiling diuretics- furocemide and etacrynic acid. b) Organic mercurials – mersalyl.

B. Moderate efficacy diuretics: a)Thiazides-chlorothiazide,polythiazide b) thiazide like diuretic-chlorthalidone, xipamide.

C.Low efficacy or adjunctive diuretics a) Osmotic diuretics-Mannitol, Glycerine b) Carbonic anhydrase inhibitors- acetazolamide, dichlorphenamide. c) Potassium sparing diuretics-triamterene, spironolactone

D. Miscellaneous diuretics- acidifying salt like- ammonium chloride, alkalinising salt like potassium citrate, methyl xanthenes like aminophylline.

E. Newer drugs. Vasopressin receptor antagonists like conivaptan, Dopamine receptor agonist like fenoldopam.

2.Clasify diuretics with examples depending on the site of action:

A.Primary action in the proximal convoluted tubule a) Carbonic anhydrase inhibitors-acetazolamide. b) Xanthines- Theophylline. c) Urea derivatives-aminimetradine . d) Osmotic –mannitol.

B. Primary action in the loop of Henley. a)Anthranilic acid derivatives-furosemide. B) phenoxy acetic acid derivatives-ethacrynic acid c) Mercurial diuretics-mersalyl.

C. Primary action in the distal tubule. 1) potassium excreting diuretics-a) Thiazides-chlorothiazide b) Quinazoline derivatives-quinethazone c) Phthalimidine derivatives-chlorthalidone 2) potassium sparing diuretics.a) Aldosterone antagonist –spironolactone b) non aldosterone antagonist-triamterene.

3.Prolonged spironolactone treatment will not produce hyperkalemia ,How? Spironolactone is a potassium retaining diuretic, increase serum potassium stimulate the release of aldosterone which stimulate potassium excretion. This is how hyperkalemia is avoided.

4.This is the rate limiting step in the rennin- angiotensin system. What? Convertion of angiotensinogen to angiotensin I by rennin from J.G apparatus is the step

5.What are the indications of diuretics? –(congestive heart failure, liver disease, hypertension, oedema, glaucoma, poisoning, epilepsy.)

6. What is the goal of diuretic therapy? –The goal is to move extracellular fluid out of the body by promoting the excretion of sodium and water at the same time to maintain the electrolyte balance.

7.Why few diuretics are rotating alternatively for long term therapy? Some of the diuretics on long term use produce acidosis then that diuretic become inactive, then shift to another diuretic which is

active in acidosis and slowly produce alkalosis. When alkalosis develops this will become inactive then we shift to the initial one - rotate like this for getting prolonged action.

8. What are the characteristic of an ideal osmotic diuretic? Give their indications: They must be freely filtered at the glomeruli, undergoes limited reabsoption, pharmacologically inert, non metabolised, contribute to osmolality of plasma. Indications: cerebral oedema, oligurea due to surgery, to reduce intra ocular pressure, to increase toxin excretion, as a preoperative medication in some type of surgery.

9.Hexamine is not effective in presence of urea splitting bacteria Why? Urea splitting bacteria split urea and tends to increase the pH of urine. At higher pH hexamine will not release formaldehyde to act, that is why it is not effective.

IX.Write short notes on

1. ALDOSTERONE ANTAGONIST: Aldosterone antagonists are group of diuretics act by inhibiting Na+ active re absorption which are normally activated by endogenous steroid hormone Aldosterone. It enhances the excretion of Na and water and retension of potassium. Epithelial cells in the late distal tubule and collecting duct contain cytoplasmic mineralocorticoid receptors. Aldosterone binds to it and subsequently conserve sodium and water and excrete potassium. Spironolactone antagonis this . It is a steroid lactone chemically related to the mineralocorticoid aldosterone .It stimulate the excretion of Na+, Cl – and water and reduce the excretion of K+,NH4, phosphate and H+. side effect may cause gynaecomastia, impotency, testicular atrophy. Prolonged use may cause hyperkalemia.

2. ACETAZOLAMIDE: It is an unsubstituted sulphonamid which inhibits carbonic anhydrase enzyme-enhances the alkaline urine-chloride is retained resulting in hyperchloraemic acidosis. When acidosis develop compensatory mechanism starts-more H+ ion to exchange with sodium then diuresis stops, called refractiveness. It inhibit carbonic anhydrase in eyes, CNS, Gastric mucosa and RBC-having anticonvulsant effect- reduce aqueous humour production in glaucoma. Mainly used as a diuretic 1. CARBONIC ANHYDRASE INHIBITORS: Carbonic anhydrase is an enzyme which catalyse the first part of the following reversible reaction-CO_2 + H_2O to form carbonic acid (H_2CO_3) and vice versa. H_2CO_3 split in to HCO_3 and H+. If enzyme is inhibited sufficient H+ is not produced for Na+ and H+ exchange and so Na_+ will go out along with a negative ion and iso osmotic amount of water and so increase urine volume. In the kidney it is seen in proximal convoluted tubule reducing the number of hydrogen ion available for Na+ H+ exchange , abolish Na+and HCO_3 reabsorption . loss of potassium is more- alkaline urine-acidosis develop-compensatory mechanism starts- diuresis stops. Inhibition of carbonic anhydrase also results in reduce aqueous humor and ceribrispinal fluid production-resulting in the relief of Glaucoma and Epilepsy. Diamox is an example.

3. ALDOSTERONE RECEPTOR ANTAGONIST: They block the action of aldosterone and promote the reabsorption of Na+ and excretion of K+ and H+ . Aldosterone antagonist save the potassium. Spironolactone - a synthetic steroid lactone related to aldosterone competing for mitochondrial receptors in renal tubular cells- weak diuretic- efficiently block potassium loss induced by other diuretics. It reduce the excretion of potassium, ammonium, phosphate and hydrogen .The active

metabolite of spironolactone is Canrenone which is active for a long period. Often used with other diuretic like thiazide or loop diuretic to prevent occuranceof hypokalemia

4. AQUARETICS:-group of pharmaceuticals which promote excretion of water without electrolyte loss –not strictly speaking diuretics eg.vaptans,vasopressin receptor antagonist conivapan, mozavaptan-act by inhibiting the action of vasopressin on its receptors V1A, V1B, V2..V2 blocking in kidney prevent ADH hormone from its action-more water loss without loss of mineral salt. Used in water overload. Tolvapan is another agent with selective V2 receptor blocking action.

5. ETHACRYNIC ACID: It is a loop diuretic-shares the same property as furosemide- inhibit Na, K, Cl, symport in the ascending limb of loop of Henle- no carbonic anhydrase inhibitory action-loss of potassium is less marked- chances of hypochloraemic alkalosis are greater than furosemide-ototoxicity is also more with ethacrynic acid.

6. FUROSEMIDE. It is a loop diuretic - related structurally to sulphonamide-it block Na+, K+ -Cl- symportes – excrete Ca and Mg + also tends to raise blood uric level by reducing its renal excretion. It is having a weak carbonic anhydrase inhibitory action. Side effects-hypotension, cardio vascular collapse, ototoxicity-reversibleloss of hearing, G.I.disturbances, metabolic alkalosis. Contraindications- Aminoglycosides, Theophylline, NSAIDsCephalosporins, purgatives. Used to reduce oedema, cardio-vascular and pulnmonary oedema, hepatic and renal dysfunction, hydrothorax, ascitis ,epistaxis.

7. LOOP DIURETICS. They are otherwise called as high ceiling diuretics because they are the most potent diuretics. They block Na+, K+, 2Cl- symport in the thick ascending limb of loop of Henle. Most potent –maximum natriuretic effect up to 30% of the filtered sodium , cl and water. They also block ca++ and Mg++ reabsorption. They binds to Cl- binding site of symport. eg. furosemide, ethacrynic acid. Bumetamide is -effective even in impaired renal function-action not influenced by acid base balance- interfere with the countercurrent multiplier system at loop of henly-addictive with other agents –produce metabolic alkalosis.

8. MANNITOL: Non electrolyte, inert, carbon sugar alcohol- freely filtered at glomeruli –negligble reabsorption-used as an osmotic diuretic agent . It enhance the excretion of Na=, K+, Ca++, Mg++ , Cl-, HCO3 -, and phosphate, urea and uric acid . It enhance renal blood flow and glomerular filtration, reduce blood viscosity. It reduce intracranial and CSF pressure -poorly absorbed orally – 10-20% solution is given i/v. 90 % is excreted unchanged in urine. It causes fluid and electrolyte imbalance, may precipitate pulmonary oedema in CHF. Contra indicated in anurea secondary to renal disease, severe dehydration, pulmonary oedema, intracranial bleeding.

9. METHENEMINE: It is a urinary antiseptic, (Hexamine) synthetic compound, it is marketed as mandelated and hippurate-antibacterial activity is due to release of formaldehyde in acidic urine (no decoposition at pH 7.4) Active against Gm +ve and Gm-ve – Staphylococci, Enterococcus, E.coli, klebsiella, Enterobacter Proteus, Pseudomonas. Urea splitting bacteria like proteus tends to raise the pH of urine and inhibits its action. Enteric coated pills are used when administered orally to protect it from gastric acid. Contra indicated in hepatic disease, acidosis, nursing mother. Interact with urinary alkalinizing drugs, thiazides, carbonic anhydrase inhibitors, sulphonamide.

10. NALIDIXIC ACID: Nalidixic acid is a non fluorinated first generation quinolone –primarily used as urinary antiseptic- act against Gm.+ve bacteria E.coli, proteus, Clebsiella, Shigella, Enterobacter--well absorbed orally-highly protein bound . side effects- nausea, vomition, abdominal pain, photosensitivity, urticaria.

11. OSMOTIC DIURETICS: Non electrolytic –freely filtered, inert, not metabolized, contribute to osmolarity of plasma, used in cerebral oedema, burns, trauma, glaucoma, stimulate toxin excretion. Osmotic diuretics inhibits the passive reabsorption of water in those segment of nephron which are freely permeable to water.(proximal tubule, descending limb of loop of henly and distal tubule).It extract water from intracellular compartment and expand extracellular fluid volume – reduce blood tonicity, increase renal blood flow , glomerular filtration rate.eg. glycerine,mannitol.

12. POTASSIUM SPARING DIURETICS: Potassium sparing diuretics interfere with sodium reabsorption at the distal segment of nephron and promote sodium excretion while potassium is conserved .They are aldosterone receptor antagonist and inhibitors of renal epithelial sodium channel in distal collecting tubule. They are mild diuretic hence used along with other diuretic. Eg. Triamterene, amiloride and benzanil. They enhance the excretion of Na, Cl, HCo3 and reduce the excretion of K+, H+ , Ca++ and Mg+. Triamterene and Amiloride-causes retension of K –both are used along with loop diuretics or thiazides to reduce potassium excretion- act at late distal tubule and collecting duct-inhibit Na+ H+ antiport. blockade of sodium channel by this cause hyperpolarization of the luminal membranes-reduce the lumen –ve potential difference and decreases the excretion of potassium.

13. SIDE EFFECTS OF CARBONIC ANHYDRASE INHIBITORS: It inhibits the uptake of iodine by the thyroid ,hypersensitivity, fever, headache, blood dyscrasia, urethral calculi, (calcium and phosphorus will precipitate in the alkaline urine), worsen acidosis, interfere with urinary tract antiseptic methenamine- drive ammonia of renal origin from urine in to circulation causing hepatic encephalopathy. Inhibition of carbonic anhydrase also results in reduce aqueous humor and ceribrispinal fluid production-resulting in the relief of Glaucoma and Epilepsy. Diamox is an example.

14. SIDE EFFECTS OF LOOP DIURETICS: Severe imbalance of potassium, sodium, chloride, calcium and magnesium can occurs –deafness following intra venous dosing. Dieresis is so rapid –feel lethargic, weakness, dizziness, anorexia, vomition, diarrhoea, leg cramps, liver damage, abdominal discomfort.

15. THIAZIDES: They are derivatives of sulphonamide and are related to carbonic anhydrase inhibitors. They mainly act in the distal tubule to decrease reabsorption of Na+ by inhibiting theNa+ , Cl- co- transporter. They are moderately effective diuretic- causes excretion of about 5% of sodium in the filtrate-action is independent of acid base alteration- causes excretion of more Na+, Cl-, HCO3- and K+.
Eg. Chlorothiazide, hydrochlorothiazides, bendroflumithiazide.

16. URINARY ANTISEPTICS: These are specific antibacterial substance meant for the urinary tract. They attain bactericidal concentration only in the urine hence useful only in u.tract infection.eg. Nalidixic acid and hexamine.Explain.....

17.URINARY TRAFCT ANTISPASMODICS: Agents which are used to counteract the smooth muscle spasm of urinary tract- used in dysuria, incontinence of urine, pylitis, supra pubic pain (not recommended in obstruction of the tract) Examples are Flavoxate hydrochloride, Ephedrine, Atropine, Oxybutynine chloride-explain

18.URINARY TRACT ANALGESICS: They are agents used to get analgesic effect in mucosa of urinary tract. Releave burning sensation arising from irritation, phenoxy pyridine hydrochloride –give red colour to the urine, ethoxazene is another agent-explain

19.URINARY ALKALINISERS: are substances which causes alkalinisation of the urine-correct acidosis, reduce uric acid crystalisation, increase antimicrobial action of aminoglycosides, erythromycin and fluoroquinolones-enhance solubility of sulfonamides, eg. Sodium bicarbonate, sod. citrate, sod. lactate, sod. acetate, tromethamine. Citrate and lactate are converted to bicarbonate by the liver, acetate is converted to bicarbonate outside liver.

20.URINARY ACIDIFIERS: Agents which acidify the urine- they increase the solubility of calcium in the urine, prevent calculi formation, increase anti bacterial action of methenemine., penicillins and tetracyclines in the urinary tract and itself make less conducive atmosphere for bacterial growth, reduce the odor and turbidity of urine prevent deposition of calcium on articles placed in the urinary tract.. Eg.Ammonium chloride, ammonium biphosphate, sodium acid phosphate, pot. Acid phosphate. Ascorbic acid, methionine

XI.WRITE ESSAYS ON:

1.Classify diuretics depending on their site of action,give suitable examples, explain Mercurials

2.Explain urinary acidifiers and urinary alkalinisers.

3.Classify diuretics depending on their mechanism of action explain Loop diuretics

4.Classify diuretics depending on their mechanism of action Explain potassium excreting and potassium retaining diuretics

5.What are carbonic anhydrase inhibitors, what are their site of actions ? how they will act as diuretics ,Explain.

6.Explain in detail Loop diuretics.

7.Indicate the site of action of diuretics on kidney tubules with the help of a diagram, what are high cealing diuretics ,explain