1. The kidney functions in
   A. preventing blood loss.   C. synthesis of vitamin E.   E. making ADH.
   B. white blood cell production.  D. excretion of metabolic wastes.

2. Which of the following functions would not be performed by the kidney?
   A. urine storage  C. maintenance of fluid balance  E. regulate synthesis of RBCs
   B. excretion of waste  D. regulate synthesis of vitamin D

3. Urine is carried from the kidneys to the urinary bladder by the
   B. ureter.   D. renal columns.

4. Arrange the following structures in correct sequence:
   (1) ureter  (2) renal pelvis  (3) calyx  (4) urinary bladder  (5) urethra
   A. 1, 2, 3, 4, 5  C. 2, 4, 5, 3, 1  E. 1, 3, 2, 4, 5
   B. 3, 2, 1, 4, 5  D. 3, 4, 1, 2, 5

5. The kidney is protected from mechanical shock by the

6. Blood vessels, nerves, and the ureter enter and leave the kidney at the
   D. renal capsule.  E. renal pyramid.

7. The portion of the kidney that is composed of cone-shaped renal pyramids is called the
   B. medulla.  D. calyx.

8. Cortical tissue located between the pyramids is called the
   A. calyx tissue.  C. renal columns.  E. renal corpuscles.
   B. renal papillae.  D. medullary rays.

9. The structural and functional units of the kidney are called
10. The network of capillaries that is located in Bowman's capsule is called the
A. vasa recta.           C. peritubular capillary.       E. efferent arteriole.
B. glomerulus.        D. proximal convoluted capillary.

11. The renal corpuscle consists of
A. the renal pelvis and the renal tubules.
B. the glomerulus and Bowman's capsule.
C. Bowman's capsule and the renal pelvis.
D. the proximal convoluted tubule and the glomerulus.
E. afferent and efferent arteriole.

12. The visceral layer of Bowman's capsule
A. is part of the filtration membrane.
B. is called endothelium.
C. contains podocytes.
D. is part of the filtration membrane and is called endothelium.
E. is part of the filtration membrane and contains podocytes.

13. Which of the following layers of the filtration membrane is closest to the plasma?
A. parietal layer of Bowman's capsule
B. macula densa
C. glomerular endothelium
D. the basement membrane
E. podocytes

14. The openings between the endothelial cells of the glomerular capillaries are called
A. fenestrae.
B. gap junctions.
C. filtration slits.
D. macula densa.
E. membrane channels.

15. An obstruction in the afferent arteriole would reduce the flow of blood into the
A. glomerulus.
B. renal artery.
C. macula densa.
D. efferent arteriole.
E. arcuate artery.

16. Arrange the following in the sequence in which filtrate moves through them.
   (1) loop of Henle
   (2) Bowman's capsule
   (3) distal convoluted tubule
   (4) proximal convoluted tubule
A. 1, 2, 3, 4
B. 4, 2, 1, 3
C. 2, 4, 3, 1
D. 2, 4, 1, 3
E. 3, 4, 1, 2

17. What type of cells form the proximal convoluted tubule?
A. simple cuboidal epithelium with microvilli
B. stratified squamous epithelium
C. pseudostratified ciliated columnar epithelium
D. simple columnar cells with microvilli and cilia

18. The vasa recta is a specialized portion of the
A. glomerulus.
B. afferent arteriole.
C. efferent arteriole.
D. peritubular capillary.
E. interlobular artery.
19. The urinary bladder
A. stores urine until it is voided.
B. empties to the exterior via the ureters.
C. contains a muscle called the trigone.
D. is superior to the kidney.
E. filters urine.

20. Skeletal muscle that surrounds the urethra as it extends through the pelvic floor forms the
A. trigone.
B. lamina propria.
C. external urinary sphincter.
D. internal urinary sphincter.
E. involuntary portion of bladder control.

21. Urine formation involves
A. filtration of the plasma.
B. reabsorption from the filtrate.
C. secretion into the filtrate.
D. production of red blood cells.
E. filtration of the plasma, reabsorption from the filtrate, and the secretion into the filtrate.

22. Formation of filtrate depends on a
A. pressure gradient.  
B. concentration gradient.  
C. volume gradient.  
D. temperature gradient.  
E. osmotic gradient.

23. The active transport of substances into the filtrate is called tubular
A. filtration.  
B. reabsorption.  
C. secretion.  
D. elimination.  
E. excretion.

24. The part of the cardiac output that passes through the kidneys is the…
A. renal fraction.  
B. filtration fraction.  
C. clearance fraction.  
D. glomerular flow rate.  
E. cardiac fraction.

25. The amount of filtrate produced per minute is called the
A. renal fraction.  
B. filtration fraction.  
C. glomerular filtration rate.  
D. clearance fraction.  
E. renal rate.

26. At the rate of 125 ml of filtrate/minute, estimate the amount of filtrate formed in 24 hours.
A. 45 liters  
B. 90 liters  
C. 125 liters  
D. 180 liters  
E. 200 liters

27. What percent of filtrate becomes urine?
A. less than 1%  
B. 5%  
C. 10%  
D. 80%  
E. 90%

28. Plasma contains a much greater concentration of _____ than the glomerular filtrate.
A. urea  
B. water  
C. protein  
D. sodium ions  
E. glucose
29. Decreased blood colloid osmotic pressure affects renal function by
   A. increasing net filtration pressure.
   B. increasing capsular pressure.
   C. increasing glomerular capillary pressure.
   D. increasing blood pressure in the afferent arteriole.
   E. None of these choices is correct.

30. If the following hypothetical conditions exist in the nephron, calculate the net filtration pressure.
   glomerular capillary pressure = 80 mmHg
   blood colloid osmotic pressure = 20 mmHg
   capsular hydrostatic pressure = 10 mmHg
   A. 110 mmHg
   B. 90 mmHg
   C. 50 mmHg
   D. 30 mmHg
   E. 20 mmHg

31. Which of the following pressures tends to force fluid from the glomerulus through the filtration membrane into Bowman's capsule?
   A. tubular pressure
   B. capsular pressure
   C. colloid osmotic pressure
   D. glomerular capillary pressure
   E. None of these...

32. Which of the following events would increase filtration pressure?
   A. increase in capsular pressure
   B. constriction of the efferent arteriole
   C. increase in colloid osmotic pressure
   D. decrease in renal blood flow
   E. dilation of the efferent arteriole

33. What is the effect of intense sympathetic stimulation on the GFR?
   A. GFR increases
   B. GFR decreases
   C. GFR is not affected
   D. GFR increases, then decreases

34. Most water is reabsorbed from the filtrate in the
   A. proximal convoluted tubule.
   B. descending loop of Henle.
   C. ascending loop of Henle.
   D. distal convolute tubule.
   E. collecting duct.

35. The proximal convoluted tubule is
   A. lined with epithelial cells that lack microvilli.
   B. the site of glucose and amino acid reabsorption.
   C. permeable to water if ADH is present.
   D. impermeable to water.
   E. the site of water secretion.

36. Arrange the following in correct order.
   (1) cotransport molecule binds to sodium and glucose
   (2) establish sodium concentration gradient between tubular cells and tubular lumen
   (3) sodium and glucose moved into tubular cell
   (4) active transport of sodium from tubular cells to interstitial area
   A. 2, 1, 3, 4
   B. 4, 2, 1, 3
   C. 1, 3, 4, 2
   D. 2, 4, 1, 3
   E. 1, 2, 3, 4
37. Water reabsorption by the renal tubules uses
A. active transport. 
B. cotransport. 
C. solvent drag. 
D. osmosis. 
E. None of these…

38. The collecting ducts and distal convoluted tubules
A. reabsorb glucose. 
B. collect filtrate from Bowman's capsule. 
C. actively transport sodium ions but not chloride ions. 
D. vary in their permeability to water relative to the amounts of ADH present. 
E. do not alter their permeability to water.

39. When ADH binds to receptor sites on distal convoluted tubule cells,
A. filtrate volume increases. 
B. filtrate osmolality decreases. 
C. potassium is secreted from the cells. 
D. the distal convoluted tubule is less permeable to water. 
E. the distal convoluted tubule is more permeable to water.

40. Tubular reabsorption and tubular secretion differ in that
A. tubular secretion is a passive process; tubular reabsorption uses active transport. 
B. tubular secretion adds materials to the filtrate; tubular reabsorption removes materials from the filtrate. 
C. tubular reabsorption increases urine volume; tubular secretion decreases urine volume. 
D. tubular reabsorption occurs in Bowman's capsule; tubular secretion occurs in the peritubular capillary. 
E. tubular secretion moves materials from the filtrate into the blood; tubular reabsorption moves materials from the blood into the filtrate.

41. The countercurrent multiplier system
A. is found in the collecting duct. 
B. is assisted by hormones. 
C. has fluid flowing in parallel tubes in opposite directions. 
D. maintains the solute concentration of the medullary interstitial fluid. 
E. has fluid flowing in parallel tubes in opposite directions and maintains the solute concentration of the medullary interstitial fluid.

42. A countercurrent mechanism is in
A. the afferent and efferent arterioles. 
B. the glomerulus and Bowman's capsule. 
C. the proximal and distal convoluted tubules. 
D. the loop of Henle only. 
E. both the loop of Henle and the vasa recta.

43. In which of the following locations is filtrate osmolality highest?
A. end of proximal convoluted tubule 
B. tip of the loop of Henle 
C. end of distal convoluted tubule 
D. beginning of distal convoluted tubule 
E. descending loop of Henle

44. The kidney dialysis machine is an example of a mechanical
A. active transport system. 
B. countercurrent system. 
C. cotransport system. 
D. sorting system. 
E. toy.
45. By the time filtrate reaches the tip of the loop of Henle, _____ of the filtrate volume has been reabsorbed.
   A. 65%       C. 80%       E. 100%
   B. 75%       D. 95%

46. Decreased ADH levels results in a urine high in
   A. potassium.       C. glucose content.       E. hydrogen ions.
   B. water content.   D. bicarbonate content.

47. Diabetes insipidus is the result of decreased
   B. insulin production.  D. angiotensin II production.

48. Removal of the posterior pituitary will immediately cause
   A. a decrease in urine volume.
   B. an increase in urine volume.
   C. no change in urine volume.

49. The juxtaglomerular apparatus secretes
   A. renin.       C. oxytocin.       E. angiotensin.
   B. ADH.       D. aldosterone.

50. Renin converts
   A. angiotensin I to angiotensin II.
   B. angiotensin II to angiotensin I.
   C. angiotensinogen to angiotensin I.
   D. angiotensin II to angiotensin III.
   E. angiotensinogen to angiotensin II.

51. Angiotensin II
   A. is a potent vasodilator.
   B. stimulates aldosterone secretion.
   C. is formed from angiotensin I by the action of renin.
   D. acts on the collecting ducts to increase reabsorption of water.
   E. decreases blood pressure.

52. Increased aldosterone causes increased
   B. sodium secretion.  D. reabsorption of hydrogen ions.

53. Lasix is a diuretic that blocks the reabsorption of sodium in the ascending loop of Henle. The result of giving this drug would be
   A. increased urine output.
   B. decreased aldosterone production.
   C. decreased osmolality of the filtrate.
   D. increased osmolality of the urine.
   E. decreased urine volume.
54. Consumption of alcohol increases urine production by
A. decreasing the blood pressure.
B. causing retention of sodium ions.
C. inhibiting the release of ADH from the posterior pituitary.
D. stimulating the release of aldosterone from the adrenals.
E. stimulating the release of ADH from the posterior pituitary.

55. Atrial natriuretic hormone
A. promotes the secretion of ADH.
B. is secreted by the posterior pituitary.
C. causes the formation of concentrated urine.
D. is secreted when atrial blood pressure increases.
E. is secreted when atrial blood pressure decreases.

56. Autoregulation in the kidney involves changes in the degree of
A. constriction of afferent arterioles.
B. sympathetic stimulation.
C. aldosterone secretion.
D. ADH secretion.
E. None of these…

57. If extracellular fluid osmolality is 385 mOsm/kg (remember normal is ~300 mOsm), the kidneys will increase reabsorption of
A. urea.
B. water.
C. sodium.
D. potassium.
E. chloride.

58. When macula densa cells experience increased Na$^{+}$ concentration in the filtrate, they respond by
A. increasing afferent arteriole constriction.
B. decreasing urine production.
C. decreasing renin secretion.
D. increasing aldosterone secretion.
E. increasing renin secretion

59. Increased secretion of atrial natriuretic hormone results in
A. increased thirst.
B. increased urine output.
C. increased blood pressure.
D. increased osmolality of the extracellular fluid.
E. decreased urine output.

60. Urine flows through the ureters to the bladder as the result of
A. gravity.
B. a pressure gradient.
C. a concentration gradient.
D. peristaltic contractions.
E. osmotic gradient.

61. What part of the urinary bladder expands very little during bladder filling?
A. the fundus
B. the triploid
C. transitional epithelium
D. all of these resist expanding
E. none of these is correct

62. Why is the external urinary sphincter under conscious control?
A. It is made of smooth muscle.  C. It is made of skeletal muscle.
B. It is part of the detrusor muscle.  D. It is made of adventitia.
63. Which of the following statements concerning the micturition reflex is false?
A. The micturition reflex is initiated by stretching the bladder wall.
B. Afferent signals are conducted to the sacral segments of the spinal cord by the pelvic nerves.
C. Efferent signals are sent to the bladder by sympathetic fibers in the pelvic nerve.
D. The micturition reflex usually produces a series of contractions of the urinary bladder.
E. The micturition reflex is modified by centers in the pons and cerebrum.

64. In kidney nephron epithelial cells, solutes are symported with ______ as a result of the activity of ________.

A. Ca2+ ions; sodium facilitated diffusion pores.
B. Cl- ions; sodium facilitated diffusion pores.
C. K+ ions; sodium facilitated diffusion pores.
D. Mg2+ ions; sodium potassium exchange pumps.
E. Na+ ions; sodium potassium exchange pumps.

65. In kidney nephron epithelial cells, ________ move into cells by antiport mechanisms through the apical membrane in exchange for H+ ions moving out.

A. Ca2+ ions
B. Cl- ions
C. H+ ions
D. Mg2+ ions
E. Na+ ions

66. Which of these is the most abundant nitrogenous waste in the blood?
A. uric acid
B. urea
C. ammonia
D. hemoglobin
E. albumin

67. Which ion is the most abundant in urine?
A. sodium
B. potassium
C. calcium
D. magnesium
E. molybdenum

68-70. For the following questions, use the letters below to indicate which acid-base imbalance is most likely to occur as a result of the condition described.

A. respiratory acidosis
B. respiratory alkalosis
C. metabolic acidosis
D. metabolic alkalosis

68. prolonged diarrhea resulting in excessive loss of bicarbonate
69. hyperventilation
70. untreated diabetes mellitus (causing excessive metabolism of proteins)