MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Oxygen is more easily loaded onto the hemoglobin molecule when the temperature is ______________ and the pH is ____________.
   A) low; low          B) low; high          C) high; low          D) high; high

2) The partial pressure of a gas is found by multiplying the __________ of a gas by the ____________ by a gas mixture.
   A) fractional concentration; total volume occupied
   B) fractional volume; total pressure exerted
   C) fractional concentration; total pressure exerted
   D) fractional volume; total volume occupied

3) During **expiration** intra-alveolar pressure __________ as the alveolar volume __________.
   A) decreases; decreases
   B) increases; increases
   C) increases; decreases
   D) decreases; increases

4) In restrictive pulmonary disease there is a decrease in:
   A) total lung capacity
   B) inspiratory reserve volume
   C) vital capacity
   D) all the above

5) The intrapleural pressure results from:
   A) the elastic fibers in the lungs
   B) the elastic forces of the chest wall
   C) the surface tension of the water in the alveoli
   D) all of the above

6) Asthma ____________ airway resistance by causing ____________.
   A) increases; spastic contraction of smooth muscles of bronchioles
   B) decreases; spastic contraction of smooth muscles of bronchioles
   C) increases; an increase in mucus production in the airways
   D) decreases; an increase in mucus production in the airways

7) The filtration fraction is equal to the ____________ divided by the renal ____________ flow rate.
   A) glomerular hydrostatic pressure; blood
   B) glomerular filtration rate; plasma
   C) glomerular filtration rate; blood
   D) glomerular hydrostatic pressure; plasma

8) The movement of filtered solutes and water from the lumen of the renal tubule back into the plasma is:
   A) filtration
   B) reabsorption
   C) secretion
   D) none of the above

9) In the lungs, a low partial pressure of oxygen causes __________ and an increase in the partial pressure of carbon dioxide causes __________.
   A) vasodilation; bronchoconstriction
   B) vasoconstriction; bronchoconstriction
   C) vasoconstriction; bronchodilation
   D) vasodilation; bronchodilation

10) If the humidity is 100%, and the partial pressure of water is 47 mm Hg, the atmospheric pressure at sea level is:
    A) 807 mm Hg
    B) 760 mm Hg
    C) 700 mm Hg
    D) 713 mm Hg

11) Sympathetic stimulation causes __________ and epinephrine causes __________.
    A) bronchodilation; bronchodilation
    B) bronchoconstriction; bronchoconstriction
    C) bronchodilation; bronchoconstriction
    D) bronchoconstriction; bronchoconstriction
12) The region of the renal tubule that is designed to create an osmotic gradient is the:
   A) loop of Henle  B) proximal tubule  C) distal tubule  D) collecting duct

13) Substances that are secreted into the renal tubule include:
   A) waste products  B) potassium  C) H ion  D) all the above

14) The peripheral chemoreceptors that regulate respiration are sensitive to oxygen:
   A) when it drops below 80 mm Hg  B) when it drops below 60 mm Hg
   C) when it drops below 100 mm Hg  D) all of the time

15) The hemoglobin oxygen disassociation curve is:
   A) exponential  B) deltoid  C) linear  D) sigmoid

16) If the glomerular filtration rate is 125 ml/min and the plasma concentration of solute X is 2 mg/ml, the
   filtered load for solute X would be:
   A) 250 mg/min  B) 64.5 mg/min  C) 125 mg/min  D) Cannot be calculated with the information provided

17) The residual volume is the volume of air that remains in the lungs after a:
   A) minimum expiration  B) maximum expiration
   C) minimum inspiration  D) maximum inspiration

18) The pressure gradient that causes air to flow into and out of the lungs results from changes in:
   A) airway resistance  B) lung volume
   C) lung compliance  D) atmospheric pressure

19) Select the gas(es) whose partial pressure(s) increase(s) when air is in the alveoli compared to the atmosphere:
   A) carbon dioxide  B) oxygen  C) water vapor  D) both A and C

20) All the below are primary functions of the urinary system except:
   A) gluconeogenesis  B) regulation of plasma ionic composition
   C) regulation of plasma osmolarity  D) removal of metabolic waste products

21) Ventilation of the lungs results from _____________ of air as a result of pressure gradients created between
   the intra- alveolar and ______________ pressure.
   A) diffusion; intrapleural  B) bulk flow; atmospheric
   C) diffusion; atmospheric  D) bulk flow; intrapleural

22) At a given partial pressure the relative concentration of different dissolved gases will differ based on there
   _____________ in the liquid.
   A) density  B) temperature  C) volume  D) solubility

23) If the mean arterial pressure were to drop below 80 mm Hg the sympathetic activity would _____________
   and the afferent and efferent arterioles of the renal corpuscle would _________________.
   A) increase; contract  B) decrease; relax  C) increase; relax  D) decrease; contract

24) The Bohr effect concerns the effect of _____________ on the affinity of hemoglobin for oxygen.
   A) temperature  B) pressure  C) carbon dioxide  D) hydrogen ion
25) The component of the glomerular membrane that acts as the primary barrier to the filtration of proteins is the:
   A) capillary endothelial layer  B) mesangial cell layer
   C) epithelial layer of Bowman’s capsule  D) basement membrane

26) The chloride shift refers to the exchange of __________ for chloride that occurs in the __________.
   A) carbon dioxide; Type I alveolar cell  B) carbon dioxide; erythrocyte
   C) bicarbonate; erythrocyte  D) bicarbonate; Type I alveolar cell

27) If the glomerular hydrostatic pressure is 50 mm Hg; the Bowman’s capsule oncotic pressure is 10 mm Hg;
   the Bowman’s capsule hydrostatic pressure is 15 mm Hg and the glomerular oncotic pressure is 25 mm Hg,
   the glomerular filtration pressure would be equal to ______________ mm Hg.
   A) 50  B) 30  C) 20  D) 0

28) In the deoxygenated blood entering the pulmonary capillaries, the partial pressure of oxygen is ________
   mm Hg and that of carbon dioxide is __________ mm Hg.
   A) 40; 46  B) 100; 40  C) 160; 0.23  D) 40; 40

29) The transpulmonary pressure is the difference between the __________ pressure and the __________ pressure.
   A) intrapleural; atmospheric  B) intra-alveolar; intrapleural
   C) intra-alveolar; atmospheric  D) intrapleural; intra-abdominal

30) Intra-alveolar pressure:
   A) is always negative  B) is 0 mm Hg
   C) is always less than intrapleural pressure  D) varies with ventilation

31) When the hemoglobin molecule is 100% saturated it is bound to __________ oxygen molecules.
   A) 8  B) 3  C) 4  D) 7

32) All of the Starling forces are involved in the processes that occur during:
   A) reabsorption  B) secretion
   C) glomerular filtration  D) all of the above

33) In the lungs, carbon dioxide __________ the erythrocte and bicarbonate __________ the erythrocyte.
   A) leaves; enters  B) enters; enters  C) leaves; leaves  D) enters; leaves

34) If the tidal volume is 600 ml, the anatomical dead space is 200 ml, and the respiratory rate is 10 breaths per
   minute, what is the alveolar ventilation?
   A) 6,000 ml/min  B) 5,000 ml/min  C) 8,000 ml/min  D) 4,000 ml/min

35) Hyperventilation occurs when:
   A) alveolar ventilation increases to meet tissue demands
   B) alveolar ventilation is insufficient to meet tissue demands
   C) alveolar ventilation decreases to meet tissue demands
   D) alveolar ventilation exceeds the demands of the tissues

36) The muscle of expiration include the:
   A) external intercostals  B) internal intercostals
   C) abdominal muscles  D) both b and c

37) The active transport of substances reabsorbed by the renal tubules involves:
A) active transporters in the apical membrane
B) active transporters in the basolateral membrane
C) carrier proteins in the apical membrane
D) all the above are possible

38) Infant respiratory distress syndrome causes a(n) ________ in lung compliance due to the lack of ________.
   A) decrease; elastic fibers   B) increase; elastic fibers
   C) decrease; surfactant       D) increase; surfactant

39) If the respiratory quotient is 0.8, and the cells of the body consume 250 ml/min of oxygen, the amount of carbon dioxide produced by the body is:
   A) 280 ml/min   B) 300 ml/min   C) 250 ml/min   D) 200 ml/min

40) During quiet breathing, the inspiratory muscles ________ during the inspiration and the expiratory muscles ________ during expiration.
   A) remain relaxed; relax   B) remain relaxed; contract
   C) contract; contract     D) contract; remain relaxed

41) All the below are basic exchange processes of the kidney except:
   A) secretion   B) reabsorption   C) glomerular filtration   D) synthesis

42) Most of the carbon dioxide transported in the blood is in the form of:
   A) bicarbonate ion dissolved in plasma   B) carbaminohemoglobin
   C) carbon dioxide dissolved in plasma   D) none of the above

43) Forced vital capacity is the test in which the patient makes a maximum ________ and then ________ as forcefully and rapidly as possible.
   A) inspiration; inhales   B) inspiration; exhales
   C) expiration; inhales     D) expiration; exhales

44) All the below affects the resistance to airflow in the respiratory tract EXCEPT:
   A) secretion of mucus in the airways   B) smooth muscles in the bronchioles
   C) transpulmonary pressure   D) passive forces exerted on the airways

45) Pulmonary surfactant is secreted by:
   A) alveolar macrophages   B) Type III cells
   C) Type I cells   D) Type II cells

46) The sum of tidal volume, inspiratory reserve volume, expiratory reserve volume and residual volume is equal to:
   A) vital capacity   B) functional residual capacity
   C) inspiratory capacity   D) total lung capacity

47) The intrinsic control of glomerular filtration rate that involves the macula densa is:
   A) sympathetic nervous activity   B) mesangial cells
   C) tubuloglomerular feedback     D) myogenic regulation

48) The Starling force that is considered negligible during glomerular filtration is:
   A) Bowman’s capsule hydrostatic pressure   B) glomerular oncotic pressure
   C) glomerular capillary hydrostatic pressure   D) Bowman’s capsule oncotic pressure
49) The region of the renal tubule with the most microvilli on the apical membrane and the most mitochondria is the:
   A) proximal tubule   B) distal tubule   C) collecting duct   D) loop of Henle

50) A solute will "spillover" into the urine when:
   A) the transport maximum is exceeded  B) all carrier proteins and pumps are occupied
   C) the renal threshold is reached  D) all of the above

51) Given that the tidal volume is 400 ml, the inspiratory reserve volume is 1000 ml, total vital capacity is 3000 ml, and the respiration rate is 10, calculate the minute ventilation during quiet breathing?
   A) 10,000 ml/min  B) 30,000 ml/min  C) 4,000 ml/min  D) 14,000 ml/min

52) The clearance of inulin can be used to estimate the:
   A) renal plasma flow  B) glomerular filtration rate
   C) renal blood flow  D) all of the above

53) The clearance for a particular substance is equal to the ______ over the ______ for the substance.
   A) filtration rate; plasma concentration  B) excretion rate; plasma concentration
   C) excretion rate; urine concentration  D) filtration rate; urine concentration

54) If the clearance of a substance is greater than the GFR then net __________ has occurred in the renal tubules
   A) reabsorption  B) excretion  C) filtration  D) secretion

55) The internal urethral sphincter is controlled by the:
   A) enteric neurons  B) somatic motor neurons
   C) parasympathetic neurons  D) sympathetic neurons

56) The micturition reflex can be inhibited by descending pathways from the __________ that can __________ parasympathetic neurons to the smooth muscle in the wall of the urinary bladder.
   A) cerebral cortex; inhibit  B) medulla oblongata; stimulate
   C) medulla oblongata; inhibit  D) cerebral cortex; stimulate

57) The transport of materials across the wall of the GI tract normally involves a ______ of water and solutes and the transport of material across the walls of the renal tubules amounts to a __________ of water and solutes by the body.
   A) net gain; net loss  B) net loss; net gain  C) net loss; net loss  D) net gain; net gain

58) The osmolarity of the peritubular fluid in the medulla of the kidney is:
   A) 600 mOsmoles  B) 1200 mOsmoles  C) 300 mOsmoles  D) all of the above

59) The osmotic gradient in the kidney medulla result from active transport of ions from the __________ of the loop of Henle and the counter current multiplier effect of the __________.
   A) ascending limb; loop of Henle  B) descending limb; loop of Henle
   C) ascending limb; collecting duct  D) descending limb; collecting duct

60) Water is reabsorbed when __________ is added to the apical membrane and __________ levels increase.
   A) aquaporin-3; ADH  B) aquaporin-2; ADH
   C) aquaporin-2; aldosterone  D) aquaporin-3; aldosterone
61) Sodium is important because it is the key determinant of:
   A) extracellular fluid osmolarity
   B) mean arterial pressure
   C) plasma volume
   D) all of the above

62) Reabsorption of sodium in the proximal tubule is associated with the reabsorption of:
   A) water
   B) glucose
   C) amino acids
   D) all of the above

63) The ultimate source of energy that enables the kidney to move sodium is:
   A) sodium/bicarbonate antiporters
   B) osmosis
   C) carbonic anhydrase
   D) sodium/potassium pump

64) Aldosterone _____________ the number of sodium and potassium channels in the ______________ membrane of the epithelial cells.
   A) decreases; apical
   B) increases; apical
   C) decreases; basolateral
   D) increases; basolateral

65) Potassium is secreted by ______________ cells through potassium channels in the ______________.
   A) principal; basolateral
   B) intercalated; basolateral
   C) principal; apical
   D) intercalated; apical

66) Select the substance below that is regulated by the integumentary, skeletal and urinary systems together:
   A) sodium
   B) iron
   C) calcium
   D) potassium

67) The conversion of 7-dehydrocholesterol to activated vitamin D₃ involves the:
   A) liver
   B) kidney
   C) skin
   D) all of the above

68) The fastest defense the body has against a change in pH is:
   A) buffering
   B) lung ventilation
   C) renal excretion
   D) enzymatic degradation

69) Given a pH of 7.3, a pCO₂ of > 40 mm Hg and a [HCO₃⁻] of > 24 mM the diagnosis of the condition is:
   A) metabolic acidosis
   B) respiratory alkalosis
   C) metabolic alkalosis
   D) respiratory acidosis

70) Aldosterone causes the _____________ of sodium and the ____________ of potassium.
    A) secretion; secretion
    B) absorption; secretion
    C) secretion; absorption
    D) absorption; absorption

71) During active breathing (exertion), the inspiratory muscles __________ during inspiration and the expiratory muscles ___________ during expiration.
    A) remain relaxed; relaxed
    B) remain relaxed; contract
    C) contract; remain relaxed
    D) contract; contract

72) During micturition the stretch receptors activate __________ neurons and inhibit __________ neurons.
    A) parasympathetic; parasympathetic
    B) sympathetic; parasympathetic
    C) parasympathetic; sympathetic
    D) sympathetic; sympathetic

73) Oxygen is more easily unloaded from the hemoglobin molecule when the temperature is ________ and the pH is ________.
    A) low; high
    B) high; high
    C) high; low
    D) low; low

74) Sodium is important because of its effect on:
75) The alveolar partial pressures of oxygen and carbon dioxide are determined by:
A) minute alveolar ventilation
B) rates of oxygen consumption and carbon dioxide production
C) the partial pressures of oxygen and carbon dioxide in inspired air
D) all of the above

76) The creation of an osmotic pressure gradient in the medulla of the kidney involves the loop of Henle of the ________ nephrons and a counter-current ________ mechanism.
A) juxtamedullary; exchange
B) juxtamedullary; multiplier
C) cortical; multiplier
D) cortical; exchange

77) Select the pressure(s) that will vary during ventilation:
A) intrapleural pressure
B) transpulmonary pressure
C) intra-alveolar pressure
D) all of the above

78) At a given partial pressure the relative concentration of different dissolved gases will differ based on there ________ in the liquid.
A) solubility
B) density
C) volume
D) temperature

79) Given a GFR of 100 ml/min; a renal plasma flow of 400 ml/min; and a renal blood flow of 800 ml/min the filtration fraction is:
A) 0.25
B) 0.50
C) 4.0
D) 0.125

80) The partial pressure of carbon dioxide in the alveoli air is ________ mm Hg and the partial pressure of carbon dioxide in the deoxygenated blood leaving the alveoli is ________ mm Hg.
A) 40; 46
B) 40; 40
C) 46; 46
D) 46; 40

81) The late distal tubule and collecting duct have epithelial cells that have cell membranes that are ________ to water and that have aquaporin ________ in their basolateral membrane.
A) impermeable; 2
B) permeable; 3
C) permeable; 2
D) impermeable; 3

82) Aldosterone regulates the ________ of sodium and the ________ of potassium.
A) secretion; secretion
B) reabsorption; reabsorption
C) reabsorption; secretion
D) secretion; reabsorption

83) Hyperventilation ________ the pCO2 of the plasma and the kidney corrects this by reabsorbing ________ HCO3⁻.
A) decreases; less
B) increases; more
C) decreases; more
D) increases; less

84) ADH regulates the permeability of the late distal tubules and collecting ducts by binding to a receptor ________ that uses ________ as a secondary messenger.
A) in the plasma membrane; cyclic AMP
B) in the cytosol; cyclic GMP
C) in the plasma membrane; cyclic GMP
D) in the cytosol; cyclic AMP

85) Increasing the amount of bicarbonate in the blood will cause the pH to ________ and the partial pressure of carbon dioxide to ________.
A) decrease; increase
B) increase; increase
C) decrease; decrease
D) increase; decrease
1) B
2) C
3) C
4) D
5) D
6) A
7) B
8) B
9) C
10) B
11) A
12) A
13) D
14) B
15) D
16) A
17) B
18) B
19) D
20) A
21) B
22) D
23) A
24) D
25) D
26) C
27) C
28) A
29) B
30) D
31) C
32) C
33) A
34) D
35) A
36) D
37) D
38) C
39) D
40) D
41) D
42) A
43) B
44) C
45) D
46) D
47) C
48) D
49) A
50) D
51) C
52) B
53) B
54) D
55) D
56) A
57) A
58) D
59) A
60) B
61) D
62) D
63) D
64) B
65) C
66) C
67) D
68) A
69) D
70) B
71) D
72) C
73) C
74) C
75) D
76) B
77) D
78) A
79) A
80) B
81) D
82) C
83) A
84) A
85) B