

Name \_\_\_\_\_

Choices may be used more than once or not at all.

**Matching**

1-5. Matching

- |               |   |          |
|---------------|---|----------|
| A) Inhalation | The lungs expand  | 1) _____ |
| B) Exhalation | The lungs contract  | 2) _____ |
| C) A & B      | The diaphragm pulls down on the lungs                               | 3) _____ |
|               | Occurs when pressure in lungs is lower than pressure in atmosphere  | 4) _____ |
|               | Occurs when pressure in lungs is higher than pressure in atmosphere | 5) _____ |

6-10. Place the following in the order they occur during quiet inhalation.

- |   |        |           |
|---|--------|-----------|
| A) Air is drawn into lungs  | first  | 6) _____  |
| B) Diaphragm is pulled down   | second | 7) _____  |
| C) Diaphragm muscles contract   | third  | 8) _____  |
| D) Lungs expand and the elastic connective tissue of lungs stretches          | fourth | 9) _____  |
| E) Parietal pleura of the diaphragm pulls on the visceral pleura of the lungs | fifth  | 10) _____ |

11-15. Matching ( $P_{rs} = P_{alv} - P_{atm}$ )

- |                          |  |           |
|--------------------------|--|-----------|
| A) $\approx 757$ mmHg    | Atmospheric pressure ( $P_{atm}$ )                               | 11) _____ |
| B) $\approx 760$ mmHg    | Respiratory system pressure ( $P_{rs}$ )                         | 12) _____ |
| C) $\approx +3$ mmHg     | Alveolar pressure ( $P_{alv}$ ) during quiet inhalation          | 13) _____ |
| D) $\approx -3$ mmHg     | Respiratory system pressure ( $P_{rs}$ ) during quiet inhalation | 14) _____ |
| E) $= P_{alv} - P_{atm}$ | Respiratory system pressure ( $P_{rs}$ ) during quiet exhalation | 15) _____ |

16-20. Matching (airway resistance =  $R_{aw}$ )

- |   |                            |           |
|---|----------------------------|-----------|
| A) Respiratory Volume each minute (MRV, $F_{air}$ ) | $= TV \times RR$           | 16) _____ |
| B) Respiratory Volume each breath (TV)              | $= P_{rs} / R_{aw}$        | 17) _____ |
| C) Respiratory system pressure ( $P_{rs}$ )         | About 500 mL               | 18) _____ |
| D) Respiratory rate (RR)                            | Is about 6 to 8 L/min      | 19) _____ |
|   | Is about 12-16 breaths/min | 20) _____ |

21-25. Matching

- |                              |   |           |
|------------------------------|---|-----------|
| A) Occurs in systemic organs | $O_2$ moves from air to blood                       | 21) _____ |
| B) Occurs in lungs           | $CO_2$ moves from blood to air                      | 22) _____ |
|                              | $O_2$ moves from blood to interstitial space        | 23) _____ |
|                              | $CO_2$ moves from interstitial space to blood       | 24) _____ |
|                              | $O_2$ moves from interstitial space to muscle cells | 25) _____ |

26-30. Matching

- |                                    |   |           |
|------------------------------------|---|-----------|
| A) Occurs in pulmonary capillaries | $Hb-H + O_2 \rightarrow Hb-O_2 + H^+$                       | 26) _____ |
| B) Occurs in systemic capillaries  | $Hb-H + O_2 \leftarrow Hb-O_2 + H^+$                        | 27) _____ |
|                                    | $Hb-H + CO_2 \rightarrow Hb-CO_2 + H^+$                     | 28) _____ |
|                                    | $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$ | 29) _____ |
|                                    | $CO_2 + H_2O \leftarrow H_2CO_3 \leftarrow H^+ + HCO_3^-$   | 30) _____ |

31-35. Matching

- |                                |  |           |
|--------------------------------|--|-----------|
| A) Shortage of $CO_2$ in blood | Makes the blood acidic                                     | 31) _____ |
| B) Excess of $CO_2$ in blood   | Makes the blood alkaline                                   | 32) _____ |
|                                | Stimulates reflex increases in rate and depth of breathing | 33) _____ |
|                                | Stimulates reflex decreases in rate and depth of breathing | 34) _____ |
|                                | Makes the blood have a higher hydrogen ion concentration   | 35) _____ |

36-40. Matching (approximate values)

- |   |   |           |
|---|---|-----------|
| A) $pO_2 \approx 160T$ ; $pCO_2 \approx 0.3T$ | Air in alveoli has partial pressures              | 36) _____ |
| B) $pO_2 \approx 100T$ ; $pCO_2 \approx 40T$  | Air in atmosphere has partial pressures           | 37) _____ |
| C) $pO_2 \approx 40T$ ; $pCO_2 \approx 45T$   | Blood in systemic veins has partial pressures     | 38) _____ |
| D) None of the above                          | Blood in pulmonary veins has partial pressures    | 39) _____ |
|   | Blood in pulmonary arteries has partial pressures | 40) _____ |

41-45. Matching

- |                                  |   |           |
|----------------------------------|---|-----------|
| A) Obstructive pulmonary disease | Asthma is a common example of                   | 41) _____ |
| B) Restrictive pulmonary disease | Pulmonary fibrosis is a common example of       | 42) _____ |
|                                  | Occurs when compliance of lungs decreases       | 43) _____ |
|                                  | Occurs when resistance of airways increases     | 44) _____ |
|                                  | Bronchitis and emphysema are common examples of | 45) _____ |

46-50. Matching (TV = tidal volume)

- |                                       |                 |           |
|---------------------------------------|-----------------|-----------|
| A) ERV (expiratory reserve volume) =  | about 2.2L      | 46) _____ |
| B) FRV (functional residual volume) = | RV + ERV        | 47) _____ |
| C) IRV (inspiratory reserve volume) = | VC - (IRV + TV) | 48) _____ |
| D) RV (residual volume) =             | IRV + TV + ERV  | 49) _____ |
| E) VC (vital capacity) =              | VC - (TV + ERV) | 50) _____ |

51-55. Matching

- |                      |       |           |
|----------------------|-------|-----------|
| A) Flow (F)          | F / R | 51) _____ |
| B) Pressure (P)      | F x R | 52) _____ |
| C) Resistance (R)    | P / F | 53) _____ |
| D) None of the above | P / R | 54) _____ |
|                      | P x R | 55) _____ |

56-60. Matching (airway resistance =  $R_{aw}$ )

- |  |                            |           |
|--|----------------------------|-----------|
| A) Respiratory Volume each minute ( $F_{air}$ , MRV) | = TV x RR                  | 56) _____ |
| B) Respiratory Volume each breath (TV)               | = $P_{rs} / R_{aw}$        | 57) _____ |
| C) Respiratory system pressure ( $P_{rs}$ )          | About 500 mL               | 58) _____ |
| D) Respiratory rate (RR)                             | Is about 6 to 8 L/min      | 59) _____ |
|  | Is about 12-16 breaths/min | 60) _____ |

61-65. Matching

- |                                |   |           |
|--------------------------------|---|-----------|
| A) Shortage of $CO_2$ in blood | Makes the blood acidic  | 61) _____ |
| B) Excess of $CO_2$ in blood   | Makes the blood alkaline  | 62) _____ |
|                                | Stimulates <u>reflex</u> increases in rate and depth of breathing | 63) _____ |
|                                | Stimulates <u>reflex</u> decreases in rate and depth of breathing | 64) _____ |
|                                | Makes the blood have a higher hydrogen ion concentration          | 65) _____ |

66-70. Place in order the structures through which renal blood passes.

- |                            |        |           |
|----------------------------|--------|-----------|
| A) Interlobar veins        | first  | 66) _____ |
| B) Efferent arterioles     | second | 67) _____ |
| C) Afferent arterioles     | third  | 68) _____ |
| D) Peritubular capillaries | fourth | 69) _____ |
| E) Glomerular capillaries  | fifth  | 70) _____ |

71-75. Matching

- |  |                                   |           |
|--|-----------------------------------|-----------|
| A) Major site(s) for renal filtration of blood       | Proximal convoluted tubules (PCT) | 71) _____ |
| B) Major sites(s) for renal reabsorption of filtrate | Distal convoluted tubules (DCT)   | 72) _____ |
|  | Collecting ducts (CDs)            | 73) _____ |
|  | Glomerular capillaries            | 74) _____ |
|  | Nephron loop                      | 75) _____ |

76-80. Matching

- |  |                 |           |
|--|-----------------|-----------|
| A) Remain(s) in the glomerular capillaries during renal filtration | Water           | 76) _____ |
| B) Is(are) pushed into the capsular space during renal filtration  | Glucose         | 77) _____ |
| C) None of the above   | Electrolytes    | 78) _____ |
|  | Large proteins  | 79) _____ |
|  | Red blood cells | 80) _____ |

81-85. Matching (FYI, about 20% of cardiac output goes to the kidneys)

- |                        |  |           |
|------------------------|--|-----------|
| A) 1 to 1.5 mL/min     | Formation of urine by the kidney in diabetes insipidus | 81) _____ |
| B) 5 to 10mL/min       | Normal reabsorption of tubular fluids by the kidneys   | 82) _____ |
| C) 123.5 to 124 mL/min | Normal formation of filtrate by the kidneys            | 83) _____ |
| D) 125 mL/min          | Normal flow of blood plasma into kidneys               | 84) _____ |
| E) 600 mL/min          | Normal formation of urine by the kidneys               | 85) _____ |

86-90. Place the following in the order that plasma / filtrate travels during formation of urine.

- |                                      |        |           |
|--------------------------------------|--------|-----------|
| A) Proximal convoluted tubules (PCT) | first  | 86) _____ |
| B) Distal convoluted tubules (DCT)   | second | 87) _____ |
| C) Glomerular capillaries            | third  | 88) _____ |
| D) Collecting ducts (CD)             | fourth | 89) _____ |
| E) Nephron loop                      | fifth  | 90) _____ |

91-95. Matching (In the context of renal tubules)

- |                                    |                                      |           |
|------------------------------------|--------------------------------------|-----------|
| A) Located in basolateral membrane | Water channels                       | 91) _____ |
| B) Located in apical membrane      | Sodium/Potassium pumps               | 99) _____ |
| C) A & B                           | Sodium/Glucose co-transporters       | 93) _____ |
|                                    | Sodium/Bicarbonate co-transporters   | 94) _____ |
|                                    | Sodium/Hydrogen counter-transporters | 95) _____ |

96-100. Matching (prominent effects)

- |  |                              |            |
|--|------------------------------|------------|
| A) Controlled in large part by aldosterone | PCT                          | 96) _____  |
| B) Controlled in large part by vasopressin | DCT                          | 97) _____  |
| C) None of the above                       | Collecting duct              | 98) _____  |
|  | Thick ascending nephron loop | 99) _____  |
|  | Thin descending nephron loop | 100) _____ |

101-105. Matching (PCT= proximal tubule; DCT-1= distal tubule 1; DCT-2= distal tubule 2; CD= collecting duct)

- |  |                                     |            |
|--|-------------------------------------|------------|
| A) Na <sup>+</sup> reabsorption is controlled by angiotensin (without aldosterone) | In the PCT                          | 101) _____ |
| B) H <sub>2</sub> O reabsorption is controlled by vasopressin                      | In the DCT-1                        | 102) _____ |
| C) K <sup>+</sup> secretion is controlled by aldosterone                           | In the DCT-2 and CD                 | 103) _____ |
| D) None of the above   | In the Thin descending nephron loop | 104) _____ |
| E) B and C   | In the Thick ascending nephron loop | 105) _____ |

106-110. Matching

- |  |  |            |
|--|--|------------|
| A) Glomerulosa cells of adrenal cortex | Produce renin                                      | 106) _____ |
| B) Cardiac stretch (volume) receptors  | Produce aldosterone                                | 107) _____ |
| C) Juxtaglomerular cells of kidney     | Detect K <sup>+</sup> concentration of blood       | 108) _____ |
| D) Osmoreceptors                       | Detect total electrolyte concentration of blood    | 109) _____ |
|  | Detect changes in blood volume and cardiac filling | 110) _____ |

111-115. Matching (NE = norepinephrine; E = epinephrine)

- |  |  |            |
|--|--|------------|
| A) Angiotensin II acting on AT-1 receptors | Causes vasoconstriction                      | 111) _____ |
| B) Vasopressin acting on V1a receptors     | Increases renal water reabsorption           | 112) _____ |
| C) Vasopressin acting on V2 receptors      | Stimulates renal production of renin         | 113) _____ |
| D) NE / E acting on beta-1 receptors       | Increases renal sodium reabsorption          | 114) _____ |
| E) A and B                                 | Stimulates adrenal production of aldosterone | 115) _____ |

116-50. Matching

- |  |  |            |
|--|--|------------|
| A) Eating 1 gram of sodium (salt load) | Stimulates thirst  | 116) _____ |
| B) Drinking 1000 mL water (water load) | Stimulates water retention                                 | 117) _____ |
|  | Stimulates water excretion                                 | 118) _____ |
|  | Stimulates secretion of vasopressin                        | 119) _____ |
|  | Stimulates production of renin - angiotensin - aldosterone | 120) _____ |

121-125. Place the following in order, after loss of blood volume.

- |  |        |            |
|--|--------|------------|
| A) Vasopressin is secreted from the posterior pituitary                      | first  | 121) _____ |
| B) Magnocellular neurons in the hypothalamus are stimulated                  | second | 122) _____ |
| C) Venous and atrial stretch receptors detect low blood volume               | third  | 123) _____ |
| D) Signals from stretch receptors travel to brainstem and hypothalamus       | fourth | 124) _____ |
| E) Vasopressin binds to V2 receptors in cells of collecting ducts in kidneys | fifth  | 125) _____ |

126-130. Place the following in order, after loss of blood volume.

- |   |        |            |
|---|--------|------------|
| A) Angiotensin II binds to AT1 receptors                      | first  | 126) _____ |
| B) Angiotensin I is converted to angiotensin II               | second | 127) _____ |
| C) Angiotensinogen is cleaved to angiotensin I                | third  | 128) _____ |
| D) Sympathetic preganglionic neurons are stimulated           | fourth | 129) _____ |
| E) Renin is secreted from the juxtaglomerular cells of kidney | fifth  | 130) _____ |

131-135. Place the following in order, in response to increased carbonic acid ( $H_2CO_3$ ) in blood.

- |   |        |            |
|---|--------|------------|
| A) $H_2CO_3$ is broken down to $CO_2$ and $H_2O$ in renal tubules             | first  | 131) _____ |
| B) $H^+$ is secreted into filtrate; $HCO_3^-$ is reabsorbed into blood        | second | 132) _____ |
| C) $H_2CO_3$ dissociates into $H^+$ and $HCO_3^-$ in renal tubular cells      | third  | 133) _____ |
| D) Concentration of carbonic acid ( $H_2CO_3$ ) increases in renal filtrate   | fourth | 134) _____ |
| E) $CO_2$ and $H_2O$ are synthesized back to $H_2CO_3$ in renal tubular cells | fifth  | 135) _____ |

**Fill in** – Note: Substitute answers may at times be correct.

1. Minute respiratory volume (MRV) = TV x \_\_\_\_\_.
2. Given a TV of 400 mL and a RR (respiratory rate) of 15 /min, the MRV would be \_\_\_\_\_ L/min.
3. During exhalation the respiratory system pressure is about \_\_\_\_\_ (number) mmHg.
4. Minute respiratory volume (MRV) = (\_\_\_\_\_ - \_\_\_\_\_) /  $R_{aw}$ .
5. Given ( $P_{alv}-P_{atm}$ ) of 3 T and a  $R_{aw}$  of 0.5 T/L/min, the MRV would be \_\_\_\_\_ L/min.
6. High  $pCO_2$  in the blood will cause a reflex \_\_\_\_\_ (change) in respiratory rate.
7. Epinephrine binds to adrenergic Beta-2 receptors in the lungs and causes \_\_\_\_\_ of the respiratory airways.
8. Acetylcholine binds to cholinergic M-3 receptors in the lungs and causes \_\_\_\_\_ of the respiratory airways.
9. Chronic obstructive pulmonary diseases are caused by \_\_\_\_\_ of the respiratory airways.
10. Chronic restrictive pulmonary diseases are caused by low \_\_\_\_\_ of the lungs.
11. Minute respiratory volume (MRV) = \_\_\_\_\_ x \_\_\_\_\_.
12. Given a RR of 14/min and a TV of 500 mL, the MRV would be \_\_\_\_\_ L/min.
13. Given ( $P_{alv}-P_{atm}$ ) of 3 T and a  $R_{aw}$  of 0.3 T/L/min, the MRV would be \_\_\_\_\_ L/min
14. High  $pCO_2$  in the blood will cause a reflex \_\_\_\_\_ (change) in respiratory depth.
15. Epinephrine binds to adrenergic Beta-2 receptors in the lungs and causes \_\_\_\_\_.
16. Acetylcholine binds to cholinergic M-3 receptors in the lungs and causes \_\_\_\_\_.
17. About 67% of solute and water reabsorption occurs from the \_\_\_\_\_.
18. About 25% of solute reabsorption occurs from the \_\_\_\_\_.
19. About 15% of water reabsorption occurs from the \_\_\_\_\_.
20. Sodium reabsorption from the renal tubules is stimulated by \_\_\_\_\_ (hormone).
21. Water reabsorption from the renal tubules is stimulated largely by \_\_\_\_\_ (a hormone).
22. Low blood volume will stimulate a reflex \_\_\_\_\_ (change) in \_\_\_\_\_ (a hormone).
23. High blood osmolarity will stimulate a reflex \_\_\_\_\_ (change) in \_\_\_\_\_ (a hormone).
24. \_\_\_\_\_ (a hormone) is stimulated by dehydration.

25. High blood volume will stimulate a reflex \_\_\_\_\_ (change) in \_\_\_\_\_  
(a hormone).
26. Low blood osmolarity will stimulate a reflex \_\_\_\_\_ (change) in \_\_\_\_\_  
(a hormone).
27. A 1 L solution of 150 mM NaCl in water has an osmolarity of \_\_\_\_\_ mOsm/L.
28. A 1 L solution with 2.54g NaCl ( 1g Na, 1.54g Cl) in water has an osmolarity of \_\_\_\_\_ mOsm/L.

Name \_\_\_\_\_

Choices may be used more than once or not at all.

**Matching**

1-5. Matching

- |               |   |                 |
|---------------|---|-----------------|
| A) Inhalation | The lungs expand  | 1) <u>  A  </u> |
| B) Exhalation | The lungs contract  | 2) <u>  B  </u> |
| C) A & B      | The diaphragm pulls down on the lungs                               | 3) <u>  A  </u> |
|               | Occurs when pressure in lungs is lower than pressure in atmosphere  | 4) <u>  A  </u> |
|               | Occurs when pressure in lungs is higher than pressure in atmosphere | 5) <u>  B  </u> |

6-10. Place the following in the order they occur during quiet inhalation.

- |   |        |                  |
|---|--------|------------------|
| A) Air is drawn into lungs  | first  | 6) <u>  C  </u>  |
| B) Diaphragm is pulled down   | second | 7) <u>  B  </u>  |
| C) Diaphragm <u>muscles</u> contract  | third  | 8) <u>  E  </u>  |
| D) Lungs expand and the elastic connective tissue of lungs stretches          | fourth | 9) <u>  D  </u>  |
| E) Parietal pleura of the diaphragm pulls on the visceral pleura of the lungs | fifth  | 10) <u>  A  </u> |

11-15. Matching ( $P_{rs} = P_{alv} - P_{atm}$ )

- |                          |  |                  |
|--------------------------|--|------------------|
| A) $\approx 757$ mmHg    | Atmospheric pressure ( $P_{atm}$ )                               | 11) <u>  B  </u> |
| B) $\approx 760$ mmHg    | Respiratory system pressure ( $P_{rs}$ )                         | 12) <u>  E  </u> |
| C) $\approx +3$ mmHg     | Alveolar pressure ( $P_{alv}$ ) during quiet inhalation          | 13) <u>  A  </u> |
| D) $\approx -3$ mmHg     | Respiratory system pressure ( $P_{rs}$ ) during quiet inhalation | 14) <u>  D  </u> |
| E) $= P_{alv} - P_{atm}$ | Respiratory system pressure ( $P_{rs}$ ) during quiet exhalation | 15) <u>  C  </u> |

16-20. Matching (airway resistance =  $R_{aw}$ )

- |   |                            |                  |
|---|----------------------------|------------------|
| A) Respiratory Volume each minute (MRV, $F_{air}$ ) | $= TV \times RR$           | 16) <u>  A  </u> |
| B) Respiratory Volume each breath (TV)              | $= P_{rs} / R_{aw}$        | 17) <u>  A  </u> |
| C) Respiratory system pressure ( $P_{rs}$ )         | About 500 mL               | 18) <u>  B  </u> |
| D) Respiratory rate (RR)                            | Is about 6 to 8 L/min      | 19) <u>  A  </u> |
|   | Is about 12-16 breaths/min | 20) <u>  D  </u> |

21-25. Matching

- |                              |   |                  |
|------------------------------|---|------------------|
| A) Occurs in systemic organs | $O_2$ moves from air to blood                       | 21) <u>  B  </u> |
| B) Occurs in lungs           | $CO_2$ moves from blood to air                      | 22) <u>  B  </u> |
|                              | $O_2$ moves from blood to interstitial space        | 23) <u>  A  </u> |
|                              | $CO_2$ moves from interstitial space to blood       | 24) <u>  A  </u> |
|                              | $O_2$ moves from interstitial space to muscle cells | 25) <u>  A  </u> |

26-30. Matching

- |                                    |   |                  |
|------------------------------------|---|------------------|
| A) Occurs in pulmonary capillaries | $Hb-H + O_2 \rightarrow Hb-O_2 + H^+$                       | 26) <u>  A  </u> |
| B) Occurs in systemic capillaries  | $Hb-H + O_2 \leftarrow Hb-O_2 + H^+$                        | 27) <u>  B  </u> |
|                                    | $Hb-H + CO_2 \rightarrow Hb-CO_2 + H^+$                     | 28) <u>  B  </u> |
|                                    | $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$ | 29) <u>  B  </u> |
|                                    | $CO_2 + H_2O \leftarrow H_2CO_3 \leftarrow H^+ + HCO_3^-$   | 30) <u>  A  </u> |

31-35. Matching

- |                                |   |                  |
|--------------------------------|---|------------------|
| A) Shortage of $CO_2$ in blood | Makes the blood acidic  | 31) <u>  B  </u> |
| B) Excess of $CO_2$ in blood   | Makes the blood alkaline  | 32) <u>  A  </u> |
|                                | Stimulates <u>reflex</u> increases in rate and depth of breathing | 33) <u>  B  </u> |
|                                | Stimulates <u>reflex</u> decreases in rate and depth of breathing | 34) <u>  A  </u> |
|                                | Makes the blood have a higher hydrogen ion concentration          | 35) <u>  B  </u> |

36-40. Matching (approximate values)

- |   |   |                  |
|---|---|------------------|
| A) $pO_2 \approx 160T$ ; $pCO_2 \approx 0.3T$ | Air in alveoli has partial pressures              | 36) <u>  B  </u> |
| B) $pO_2 \approx 100T$ ; $pCO_2 \approx 40T$  | Air in atmosphere has partial pressures           | 37) <u>  A  </u> |
| C) $pO_2 \approx 40T$ ; $pCO_2 \approx 45T$   | Blood in systemic veins has partial pressures     | 38) <u>  C  </u> |
| D) None of the above                          | Blood in pulmonary veins has partial pressures    | 39) <u>  B  </u> |
|   | Blood in pulmonary arteries has partial pressures | 40) <u>  C  </u> |

41-45. Matching

- |                                  |   |                  |
|----------------------------------|---|------------------|
| A) Obstructive pulmonary disease | Asthma is a common example of                   | 41) <u>  A  </u> |
| B) Restrictive pulmonary disease | Pulmonary fibrosis is a common example of       | 42) <u>  B  </u> |
|                                  | Occurs when compliance of lungs decreases       | 43) <u>  B  </u> |
|                                  | Occurs when resistance of airways increases     | 44) <u>  A  </u> |
|                                  | Bronchitis and emphysema are common examples of | 45) <u>  A  </u> |

46-50. Matching (TV = tidal volume)

- |                                       |                 |                  |
|---------------------------------------|-----------------|------------------|
| A) ERV (expiratory reserve volume) =  | about 2.2L      | 46) <u>  B  </u> |
| B) FRV (functional residual volume) = | RV + ERV        | 47) <u>  B  </u> |
| C) IRV (inspiratory reserve volume) = | VC - (IRV + TV) | 48) <u>  A  </u> |
| D) RV (residual volume) =             | IRV + TV + ERV  | 49) <u>  E  </u> |
| E) VC (vital capacity) =              | VC - (TV + ERV) | 50) <u>  C  </u> |

51-55. Matching

- |                      |       |                  |
|----------------------|-------|------------------|
| A) Flow (F)          | F / R | 51) <u>  D  </u> |
| B) Pressure (P)      | F x R | 52) <u>  B  </u> |
| C) Resistance (R)    | P / F | 53) <u>  C  </u> |
| D) None of the above | P / R | 54) <u>  A  </u> |
|                      | P x R | 55) <u>  D  </u> |

56-60. Matching (airway resistance =  $R_{aw}$ )

- |  |                            |                  |
|--|----------------------------|------------------|
| A) Respiratory Volume each minute ( $F_{air}$ , MRV) | = TV x RR                  | 56) <u>  A  </u> |
| B) Respiratory Volume each breath (TV)               | = $P_{rs} / R_{aw}$        | 57) <u>  A  </u> |
| C) Respiratory system pressure ( $P_{rs}$ )          | About 500 mL               | 58) <u>  B  </u> |
| D) Respiratory rate (RR)                             | Is about 6 to 8 L/min      | 59) <u>  A  </u> |
|  | Is about 12-16 breaths/min | 60) <u>  D  </u> |

61-65. Matching

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|--------------------------------|---|------------------|
| A) Shortage of $CO_2$ in blood | Makes the blood acidic  | 61) <u>  B  </u> |
| B) Excess of $CO_2$ in blood   | Makes the blood alkaline  | 62) <u>  A  </u> |
|                                | Stimulates <u>reflex</u> increases in rate and depth of breathing | 63) <u>  B  </u> |
|                                | Stimulates <u>reflex</u> decreases in rate and depth of breathing | 64) <u>  A  </u> |
|                                | Makes the blood have a higher hydrogen ion concentration          | 65) <u>  B  </u> |

66-70. Place in order the structures through which renal blood passes.

- |                            |        |                  |
|----------------------------|--------|------------------|
| A) Interlobar <u>veins</u> | first  | 66) <u>  C  </u> |
| B) Efferent arterioles     | second | 67) <u>  E  </u> |
| C) Afferent arterioles     | third  | 68) <u>  B  </u> |
| D) Peritubular capillaries | fourth | 69) <u>  D  </u> |
| E) Glomerular capillaries  | fifth  | 70) <u>  A  </u> |

71-75. Matching

- |  |                                   |                  |
|--|-----------------------------------|------------------|
| A) Major site(s) for renal filtration of blood       | Proximal convoluted tubules (PCT) | 71) <u>  B  </u> |
| B) Major sites(s) for renal reabsorption of filtrate | Distal convoluted tubules (DCT)   | 72) <u>  B  </u> |
|  | Collecting ducts (CDs)            | 73) <u>  B  </u> |
|  | Glomerular capillaries            | 74) <u>  A  </u> |
|  | Nephron loop                      | 75) <u>  B  </u> |



76-80. Matching

- |  |                 |                  |
|--|-----------------|------------------|
| A) Remain(s) in the glomerular capillaries during renal filtration | Water           | 76) <u>  B  </u> |
| B) Is(are) pushed into the capsular space during renal filtration  | Glucose         | 77) <u>  B  </u> |
| C) None of the above   | Electrolytes    | 78) <u>  B  </u> |
|  | Large proteins  | 79) <u>  A  </u> |
|  | Red blood cells | 80) <u>  A  </u> |

81-85. Matching (FYI, about 20% of cardiac output goes to the kidneys)

- |                        |  |                  |
|------------------------|--|------------------|
| A) 1 to 1.5 mL/min     | Formation of urine by the kidney in diabetes insipidus | 81) <u>  B  </u> |
| B) 5 to 10mL/min       | Normal reabsorption of tubular fluids by the kidneys   | 82) <u>  C  </u> |
| C) 123.5 to 124 mL/min | Normal formation of filtrate by the kidneys            | 83) <u>  D  </u> |
| D) 125 mL/min          | Normal flow of blood plasma into kidneys               | 84) <u>  E  </u> |
| E) 600 mL/min          | Normal formation of urine by the kidneys               | 85) <u>  A  </u> |

86-90. Place the following in the order that plasma / filtrate travels during formation of urine.

- |                                      |        |                  |
|--------------------------------------|--------|------------------|
| A) Proximal convoluted tubules (PCT) | first  | 86) <u>  C  </u> |
| B) Distal convoluted tubules (DCT)   | second | 87) <u>  A  </u> |
| C) Glomerular capillaries            | third  | 88) <u>  E  </u> |
| D) Collecting ducts (CD)             | fourth | 89) <u>  B  </u> |
| E) Nephron loop                      | fifth  | 90) <u>  D  </u> |

91-95. Matching (In the context of renal tubules)

- |                                    |                                      |                  |
|------------------------------------|--------------------------------------|------------------|
| A) Located in basolateral membrane | Water channels                       | 91) <u>  C  </u> |
| B) Located in apical membrane      | Sodium/Potassium pumps               | 99) <u>  A  </u> |
| C) A & B                           | Sodium/Glucose co-transporters       | 93) <u>  B  </u> |
|                                    | Sodium/Bicarbonate co-transporters   | 94) <u>  A  </u> |
|                                    | Sodium/Hydrogen counter-transporters | 95) <u>  B  </u> |

96-100. Matching (prominent effects)

- |  |                              |                   |
|--|------------------------------|-------------------|
| A) Controlled in large part by aldosterone | PCT                          | 96) <u>  C  </u>  |
| B) Controlled in large part by vasopressin | DCT                          | 97) <u>  A  </u>  |
| C) None of the above                       | Collecting duct              | 98) <u>  B  </u>  |
|  | Thick ascending nephron loop | 99) <u>  C  </u>  |
|  | Thin descending nephron loop | 100) <u>  C  </u> |

101-105. Matching (PCT= proximal tubule; DCT-1= distal tubule 1; DCT-2= distal tubule 2; CD= collecting duct)

- |  |                                     |                   |
|--|-------------------------------------|-------------------|
| A) Na <sup>+</sup> reabsorption is controlled by angiotensin (without aldosterone) | In the PCT                          | 101) <u>  A  </u> |
| B) H <sub>2</sub> O reabsorption is controlled by vasopressin                      | In the DCT-1                        | 102) <u>  A  </u> |
| C) K <sup>+</sup> secretion is controlled by aldosterone                           | In the DCT-2 and CD                 | 103) <u>  E  </u> |
| D) None of the above   | In the Thin descending nephron loop | 104) <u>  D  </u> |
| E) B and C   | In the Thick ascending nephron loop | 105) <u>  D  </u> |

106-110. Matching

- |  |  |                   |
|--|--|-------------------|
| A) Glomerulosa cells of adrenal cortex | Produce renin                                      | 106) <u>  C  </u> |
| B) Cardiac stretch (volume) receptors  | Produce aldosterone                                | 107) <u>  A  </u> |
| C) Juxtaglomerular cells of kidney     | Detect K <sup>+</sup> concentration of blood       | 108) <u>  A  </u> |
| D) Osmoreceptors                       | Detect total electrolyte concentration of blood    | 109) <u>  D  </u> |
|  | Detect changes in blood volume and cardiac filling | 110) <u>  B  </u> |

111-115. Matching (NE = norepinephrine; E = epinephrine)

- |  |  |                   |
|--|--|-------------------|
| A) Angiotensin II acting on AT-1 receptors | Causes vasoconstriction                      | 111) <u>  E  </u> |
| B) Vasopressin acting on V1a receptors     | Increases renal water reabsorption           | 112) <u>  C  </u> |
| C) Vasopressin acting on V2 receptors      | Stimulates renal production of renin         | 113) <u>  D  </u> |
| D) NE / E acting on beta-1 receptors       | Increases renal sodium reabsorption          | 114) <u>  A  </u> |
| E) A and B                                 | Stimulates adrenal production of aldosterone | 115) <u>  A  </u> |

116-120. Matching

- |  |  |            |
|--|--|------------|
| A) Eating 1 gram of sodium (salt load) | Stimulates thirst  | 116) __A__ |
| B) Drinking 1000 mL water (water load) | Stimulates water retention                                 | 117) __A__ |
|  | Stimulates water excretion                                 | 118) __B__ |
|  | Stimulates secretion of vasopressin                        | 119) __A__ |
|  | Stimulates production of renin - angiotensin - aldosterone | 120) __B__ |

121-125. Place the following in order, after loss of blood volume.

- |  |        |            |
|--|--------|------------|
| A) Vasopressin is secreted from the posterior pituitary                      | first  | 121) __C__ |
| B) Magnocellular neurons in the hypothalamus are stimulated                  | second | 122) __D__ |
| C) Venous and atrial stretch receptors detect low blood volume               | third  | 123) __B__ |
| D) Signals from stretch receptors travel to brainstem and hypothalamus       | fourth | 124) __A__ |
| E) Vasopressin binds to V2 receptors in cells of collecting ducts in kidneys | fifth  | 125) __E__ |

126-130. Place the following in order, after loss of blood volume.

- |   |        |            |
|---|--------|------------|
| A) Angiotensin II binds to AT1 receptors                      | first  | 126) __D__ |
| B) Angiotensin I is converted to angiotensin II               | second | 127) __E__ |
| C) Angiotensinogen is cleaved to angiotensin I                | third  | 128) __C__ |
| D) Sympathetic preganglionic neurons are stimulated           | fourth | 129) __B__ |
| E) Renin is secreted from the juxtaglomerular cells of kidney | fifth  | 130) __A__ |

131-135. Place the following in order, in response to increased carbonic acid ( $H_2CO_3$ ) in blood.

- |   |        |            |
|---|--------|------------|
| A) $H_2CO_3$ is broken down to $CO_2$ and $H_2O$ in renal tubules             | first  | 131) __D__ |
| B) $H^+$ is secreted into filtrate; $HCO_3^-$ is reabsorbed into blood        | second | 132) __A__ |
| C) $H_2CO_3$ dissociates into $H^+$ and $HCO_3^-$ in renal tubular cells      | third  | 133) __E__ |
| D) Concentration of carbonic acid ( $H_2CO_3$ ) increases in renal filtrate   | fourth | 134) __C__ |
| E) $CO_2$ and $H_2O$ are synthesized back to $H_2CO_3$ in renal tubular cells | fifth  | 135) __B__ |

**Fill in** – Note: Substitute answers may at times be correct.

1. Minute respiratory volume (MRV) = TV x RR.
2. Given a TV of 400 mL and a RR (respiratory rate) of 15 /min, the MRV would be 6 L/min.
3. During exhalation the respiratory system pressure is about +3 (number) mmHg.
4. Minute respiratory volume (MRV) = (P<sub>alv</sub> - P<sub>atm</sub>) / R<sub>aw</sub>.
5. Given (P<sub>alv</sub>-P<sub>atm</sub>) of 3 T and a R<sub>aw</sub> of 0.5 T/L/min, the MRV would be 6 L/min.
6. High pCO<sub>2</sub> in the blood will cause a reflex increase (change) in respiratory rate.
7. Epinephrine binds to adrenergic Beta-2 receptors in the lungs and causes dilation of the respiratory airways.
8. Acetylcholine binds to cholinergic M-3 receptors in the lungs and causes constriction of the respiratory airways.
9. Chronic obstructive pulmonary diseases are caused by constriction of the respiratory airways.
10. Chronic restrictive pulmonary diseases are caused by low compliance of the lungs.
11. Minute respiratory volume (MRV) = RR x TV.
12. Given a RR of 14/min and a TV of 500 mL, the MRV would be 7 L/min.
13. Given (P<sub>alv</sub>-P<sub>atm</sub>) of 3 T and a R<sub>aw</sub> of 0.3 T/L/min, the MRV would be 10 L/min
14. High pCO<sub>2</sub> in the blood will cause a reflex increase (change) in respiratory depth.
15. Epinephrine binds to adrenergic Beta-2 receptors in the lungs and causes bronchodilation.
16. Acetylcholine binds to cholinergic M-3 receptors in the lungs and causes bronchoconstriction.
17. About 67% of solute and water reabsorption occurs from the proximal tubules.
18. About 25% of solute reabsorption occurs from the ascending nephron loop.
- 19 About 15% of water reabsorption occurs from the descending nephron loop.
20. Sodium reabsorption from the renal tubules is stimulated by angiotensin II / aldosterone (hormone).
21. Water reabsorption from the renal tubules is stimulated largely by vasopressin (a hormone).
22. Low blood volume will stimulate a reflex increase (change) in vasopressin (a hormone).
23. High blood osmolarity will stimulate a reflex increase (change) in vasopressin (a hormone).
24. Vasopressin (a hormone) is stimulated by dehydration.

25. High blood volume will stimulate a reflex \_\_decrease\_\_ (change) in \_\_vasopressin / angiotensin II\_\_ (a hormone).
26. Low blood osmolarity will stimulate a reflex \_\_decrease\_\_ (change) in \_\_vasopressin\_\_ (a hormone).
27. A 1 L solution of 150 mM NaCl in water has an osmolarity of \_\_300\_\_ mOsm/L.
28. A 1 L solution with 2.54g NaCl ( 1g Na, 1.54g Cl) in water has an osmolarity of \_\_87\_\_ mOsm/L.