

## **Pilbeam: Mechanical Ventilation, 4<sup>th</sup> Edition**

### **Test Bank**

#### **Chapter 1: Oxygenation and Acid-Base Evaluation**

##### **MULTIPLE CHOICE**

1. The diffusion of carbon dioxide across the alveolar capillary membrane is \_\_\_\_\_.  
A. equal to oxygen  
B. less than oxygen  
C. 10 times greater than oxygen  
D. 20 times greater than oxygen

ANS: D

2. When the blood  $\text{PCO}_2$  decreases, the oxygen dissociation curve shifts to the \_\_\_\_\_.  
A. right and the P50 decreases  
B. left and the P50 increases  
C. right and the P50 increases  
D. left and the P50 decreases

ANS: D

3. Which of the following would be inconsistent with respiratory alkalosis?  
A.  $\text{pH} = 7.57$   
B.  $\text{PaCO}_2 = 30$  mm Hg  
C.  $\text{pH} = 7.63$   
D.  $\text{PaCO}_2 = 42$  mm Hg

ANS: D

4. The oxyhemoglobin dissociation curve depicts the relationship \_\_\_\_\_.  
A. between percentage saturation of oxygen and partial pressure of oxygen in arterial blood  
B. between percentage saturation of oxygen and fraction of inspired oxygen in venous blood  
C. hemoglobin levels in the blood and oxygen saturation  
D. hemoglobin levels in the blood and oxygen tension

ANS: A

5. After taking an arterial blood sample and mean exhaled air sample, the  $\text{PCO}_2$  values were found to be 40 mm Hg and 27 mm Hg, respectively. The ratio of ventilation to dead space is \_\_\_\_\_.
- A. 0.20
  - B. 0.25
  - C. 0.33
  - D. 0.41

ANS: C

6. While breathing room air, a patient has a  $\text{P50}$  of 39 mm Hg. This situation could be the result of \_\_\_\_\_.  
I. decrease in hydrogen ion concentration  
II. an elevated temperature  
III. an elevated 2,3-diphosphoglycerate
- A. I only
  - B. II and III
  - C. II only
  - D. I and III

ANS: B

7. Mixed venous blood entering the pulmonary capillaries normally has a  $\text{PO}_2$  of 47 mm Hg; the saturation of hemoglobin is approximately \_\_\_\_\_.  
A. 50%  
B. 75%  
C. 65%  
D. 85%

ANS: B

8. Oxygen that is carried in the dissolved form is expressed as \_\_\_\_\_.  
I.  $\text{SaO}_2$   
II.  $\text{V}_T$   
III.  $\text{PAO}_2$   
IV.  $\text{PaO}_2$
- A. II and IV
  - B. I and II
  - C. III only
  - D. IV only

ANS: D

**Please refer to this data: pH = 7.33; PaCO<sub>2</sub> = 34 mm Hg; PaO<sub>2</sub> = 80 mm Hg; SaO<sub>2</sub> = 92%; Hb = 8 gm%.**

9. This patient's hemoglobin concentration most likely represents \_\_\_\_.
- A. erythrocytopenia
  - B. secondary polycythemia
  - C. primary hysteria
  - D. anemia

ANS: D

10. Calculate this person's dissolved arterial oxygen content.
- A. 0.102 vol %
  - B. 0.24 vol %
  - C. 0.34 vol%
  - D. 0.28 vol%

ANS: B

11. Calculate this person's combined arterial oxygen.
- A. 8.84 vol%
  - B. 10.24 vol%
  - C. 13.56 vol%
  - D. 23.56 vol%

ANS: B

12. Calculate the amount of oxygen combined to hemoglobin in a patient having 13 gm% Hb, a PaO<sub>2</sub> of 60 mm Hg, and an arterial oxygen saturation of 85%.
- A. 20.10 vol%
  - B. 7.2 vol%
  - C. 15.2 vol%
  - D. 14.81 vol%

ANS: C

13. Which measurement best assesses the presence or absence of ventilatory failure?
- A. PaCO<sub>2</sub>

- B.  $\text{PaO}_2$
- C. pH
- D.  $\text{HCO}_3$

ANS: A

14. Interpret the following ABG data: pH = 7.17;  $\text{PaCO}_2$  = 42 mm Hg;  $\text{PaO}_2$  = 100 mm Hg;  $\text{HCO}_3$  = 16 mmol/L.

- A. Acute respiratory alkalosis
- B. Acute metabolic acidosis
- C. Partially compensated respiratory alkalosis
- D. Compensated respiratory alkalosis

ANS: B

15. A patient has a  $\text{PCO}_2$  of 21 mm Hg. Based on this information you may correctly conclude that \_\_\_\_.

- A. the patient's  $\text{CO}_2$  production is higher than normal
- B. the patient is hypoventilating
- C. the patient is hyperventilating
- D. the patient's tidal volume is less than normal

ANS: C

16. Which of the following best represent the partial pressure of all gases in the normally ventilated and perfused alveolus when breathing room air at sea level?

- A.  $\text{PO}_2$  = 100 mm Hg;  $\text{PCO}_2$  = 40 mm Hg;  $\text{PN}_2$  = 713 mm Hg;  $\text{PH}_2\text{O}$  = 47 mm Hg
- B.  $\text{PO}_2$  = 149 mm Hg;  $\text{PCO}_2$  = 40 mm Hg;  $\text{PN}_2$  = 573 mm Hg;  $\text{PH}_2\text{O}$  = 47 mm Hg
- C.  $\text{PO}_2$  = 100 mm Hg;  $\text{PCO}_2$  = 40 mm Hg;  $\text{PN}_2$  = 573 mm Hg;  $\text{PH}_2\text{O}$  = 37 mm Hg
- D.  $\text{PO}_2$  = 100 mm Hg;  $\text{PCO}_2$  = 40 mm Hg;  $\text{PN}_2$  = 573 mm Hg;  $\text{PH}_2\text{O}$  = 47 mm Hg

ANS: D

17. The physical process whereby gas molecules move from an area of high partial pressure to an area of low partial pressure is called \_\_\_\_.

- A. ventilation
- B. membrane exchange
- C. diffusion
- D. active transport

ANS: C

18. At a  $\text{PaO}_2$  of 30 mm Hg, what is the approximate  $\text{SaO}_2$ ?

- A. 53%
- B. 97%
- C. 72%
- D. 94%

ANS: A

19. What is the highest  $\text{PAO}_2$  one could expect to observe in an individual breathing room air at sea level?

- A. 120 to 130 mm Hg
- B. 710 to 760 mm Hg
- C. 640 to 670 mm Hg
- D. 90 to 100 mm Hg

ANS: A

20. The largest percentage of  $\text{CO}_2$  is transported in the blood as \_\_\_\_.

- A. bicarbonate ( $\text{HCO}_3$ )
- B. carbonic acid ( $\text{H}_2\text{CO}_3$ )
- C. carbonic anhydrase
- D. dissolved  $\text{CO}_2$

ANS: A

21. In the red blood cell, the rate of the hydrolysis of  $\text{CO}_2$  is increased by \_\_\_\_.

- A. carboxyhemoglobin
- B. 2,3,diphosphoglycerate
- C. carbonic anhydrase
- D. cholinesterase

ANS: C

22. During the hydrolysis reaction of  $\text{CO}_2$  within the red blood cell, many of the  $\text{HCO}_3$  ions produced diffuse out of the erythrocyte into the plasma. How does the red blood cell maintain electrolytic equilibrium under these circumstances?

- A. By shifting positive ions out of the red blood cell

- B. By shifting chloride ions into the red blood cell
- C. By shifting chloride ions out of the red blood cell
- D. By shifting positive ions into the red blood cell

ANS: B

23. Calculate a patient's arterial oxygen content if Hb = 11 gm%,  $\text{PaO}_2$  = 90 mm Hg, and  $\text{SaO}_2$  = 80%.
- A. 11.8 vol%
  - B. 12.2 vol%
  - C. 18.4 vol%
  - D. 20.1 vol%

ANS: B

24. Prior to treatment, Patient B's arterial blood gases were as follows: pH = 7.37,  $\text{PaO}_2$  = 50 mm Hg, and  $\text{PaCO}_2$  = 75 mm Hg. The physician ordered high-flow oxygen via non-rebreathing  $\text{O}_2$  mask. Over the next 4 hours the patient became somewhat confused and lethargic, and his breathing became shallow and slow. This would be consistent with \_\_\_\_.
- A. increased levels of 2,3diphosphoglycerate
  - B. early signs of  $\text{O}_2$  toxicity
  - C. loss of hypoxic drive
  - D. early signs of hypoxemia

ANS: C

25. A patient has a  $\text{P}_{50}$  value of 32 mm Hg. Which of the following is **not** true?
- A. A decreased affinity of hemoglobin for  $\text{O}_2$
  - B. A shift in the oxyhemoglobin curve to the right
  - C. Improved delivery of oxygen to the tissues
  - D. A lower than normal Hb saturation for a given  $\text{PO}_2$

ANS: B

26. A state of acidemia exists when \_\_\_\_.
- A. the  $\text{HCO}_3^-$  is >24 mEq/L
  - B. the blood pH is <7.35
  - C. the blood pH is 7.45
  - D. the  $\text{HCO}_3^-$  is <24 mEq/L

ANS: B

27. Which of the following would be common findings in “chronic” or compensated respiratory acidosis?

- I. An elevated  $\text{HCO}_3^-$
- II. A pH well below 7.35
- III. A pH above 7.45
- IV. A decreased  $\text{PCO}_2$

- A. I, III, and IV
- B. I only
- C. I, II, and IV
- D. III and IV

ANS: B

28. In regard to hypoxemia and peripheral chemoreceptors, stimulation to increase ventilation does not occur until the  $\text{PaO}_2$  falls below \_\_\_\_.

- A. 80 mm Hg
- B. 60 mm Hg
- C. 70 mm Hg
- D. 90 mm Hg

ANS: B

29. What percentage of saturation would you expect to find with  $\text{PaO}_2$  of 63 mm Hg?

- A. 53%
- B. 92%
- C. 62%
- D. 97%

ANS: B

30. Both anemia and carbon monoxide poisoning can cause severe hypoxia. Yet, neither condition results in a major stimulation of breathing. This is because \_\_\_\_.

- A. the peripheral chemoreceptors are responsive mainly to a decreased  $\text{PaO}_2$ , not a decreased  $\text{CaO}_2$
- B. anemia and carbon monoxide poisoning depress the peripheral chemoreceptors
- C. anemia and carbon monoxide poisoning depress the central chemoreceptors
- D. anemia and carbon monoxide poisoning cause stagnant hypoxia, not hypoxemia

ANS: A

31. Calculate the  $P_{I}O_2$  breathing ambient air at an Indian village in the Peruvian Andes, barometric pressure = 400 mm Hg.
- A. 149 mm Hg
  - B. 65 mm Hg
  - C. 84 mm Hg
  - D. 74 mm Hg

ANS: D

32. What is the alveolar  $PO_2$  for the situation in question 31 if the  $PaCO_2$  is 30 mm Hg?
- A. 50 mm Hg
  - B. 70 mm Hg
  - C. 62 mm Hg
  - D. 37 mm Hg

ANS: D

33. What type of hypoxia, if any, would an individual suffer at this altitude?
- A. Hypoxemic
  - B. Anemic
  - C. Histotoxic
  - D. Stagnant

ANS: A

**Calculate the following based upon this patient environment and the following arterial blood gases:  $F_{I}O_2 = 0.21$ ,  $PaO_2 = 68$  mm Hg,  $SaO_2 = 88\%$ ;  $Hb = 15$  g/dL,  $PaCO_2 = 40$  mm Hg,  $PvO_2 = 39$  mm Hg,  $SvO_2 = 70\%$ ,  $PB = 760$  mm Hg.**

34. The  $CaO_2$  is \_\_\_\_.
- A. 16.5 mL/dL
  - B. 17.9 mL/dL
  - C. 17.7 mL/dL
  - D. 19.8 mL/dL

ANS: C

35. The  $P(A-a)O_2$  in this patient is approximately \_\_\_\_.



- A. 10 mm Hg
- B. 20 mm Hg
- C. 30 mm Hg
- D. 40 mm Hg

ANS: C

36. A hypotensive patient is spontaneously breathing room air when an arterial blood gas sample is taken for analysis. The following values are found:  $\text{PaO}_2 = 105$  mm Hg,  $\text{PaCO}_2 = 25$  mm Hg,  $\text{pH} = 7.27$ , bicarbonate = 11 mEq/L. Based on this information, what best describes the patient's condition?
- A. Partially compensated respiratory acidosis
  - B. Uncompensated hyperventilation
  - C. Combined respiratory and metabolic acidosis
  - D. Completely compensated metabolic acidosis

ANS: A

37. The following arterial blood gas results are from a patient who is spontaneously breathing room air:  $\text{PaO}_2 = 55$  mm Hg,  $\text{PaCO}_2 = 58$  mm Hg,  $\text{pH} = 7.36$ , bicarbonate = 32 mEq/L. Which of the following best describes this patient's condition?
- A. Compensated respiratory alkalosis
  - B. Uncompensated metabolic acidosis
  - C. Uncompensated metabolic alkalosis
  - D. Compensated respiratory acidosis

ANS: D

38. What is the pH if the  $\text{H}^+$  concentration is 56 and the  $\text{PaCO}_2$  is normal?
- A. 7.29
  - B. 7.36
  - C. 7.40
  - D. 7.56

ANS: D

39. If your  $\text{PCO}_2$  is 36 and the  $\text{HCO}_2$  is 24, what should the pH be?
- A. 7.40
  - B. 7.50
  - C. 7.42
  - D. 7.56

ANS: C