

Chapter 02: Algebra

Multiple Choice

1. If $x = 7$, solve the expression $6 - x$.

- a. 0
- b. 1
- c. -1
- d. 13

ANSWER: c

2. Solve the expression $\left(\frac{2}{4}\right) \times y$ when $y = 2$.

- a. 4
- b. 2
- c. 1
- d. $\frac{1}{2}$

ANSWER: c

3. Calculate the residual volume (RV) given the following data.

TLC = 5,500 ml; IC = 3,000 ml; ERV = 1,100 ml

- a. 4,400 ml
- b. 4,100 ml
- c. 2,500 ml
- d. 1,400 ml

ANSWER: d

4. Which of the following formulas represents an algebraic expression with one variable?

- a. $^{\circ}\text{C} = (\text{^{\circ}\text{F}} - 32) \frac{5}{9}$
- b. $\text{C.O.} = \text{SV} \times \text{HR}$
- c. $\frac{V_D}{V_T} = \frac{\text{PaCO}_2 - \text{PECO}_2}{\text{PaCO}_2}$
- d. $G_{\text{AV}} = \frac{\dot{V}}{\text{PIP} - P_{\text{STATIC}}}$

ANSWER: a

5. Which of the following terms matches the definition “the opposite value of a negative real number”?

- a. opposite
- b. reciprocal
- c. multiplicative inverse
- d. additive inverse

ANSWER: d

Chapter 02: Algebra

6. Identify the quotient in the following equation.

$$\left[\frac{12}{3} = 4 \right]$$

- a. 12
- b. 4
- c. 3
- d. 12/3

ANSWER: b

7. Solve $24 + (-15)$.

- a. 39
- b. -39
- c. 9
- d. -9

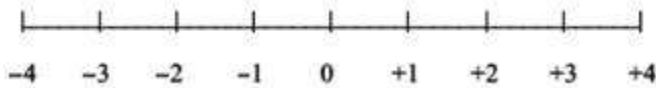
ANSWER: c

8. Which of the following terms matches the definition “the distance a number is from zero on a number line”?

- a. origin
- b. absolute value
- c. opposite value
- d. real number

ANSWER: b

9. Using the number line below, determine the opposite value of -3.



- a. 0
- b. -3
- c. +3
- d. +4

ANSWER: c

10. What is the absolute value of -10?

- a. -10
- b. 0
- c. 10
- d. *cannot* be determined without a number line

ANSWER: c

11. Determine the $P_{\text{transpulmonary}}$ when the P_{alv} is 0 cm H₂O and the P_{pl} is -8 cm H₂O.

- a. 8 cm H₂O

Chapter 02: Algebra

- b. 0 cm H₂O
- c. -5 cm H₂O
- d. -8 cm H₂O

ANSWER: a

12. Calculate the absolute pressure change that occurs when a pressure measurement fluctuates from 770 torr to -8 torr. (Assume the normal “textbook” value for the barometric pressure.)

- a. 2 torr
- b. -8 torr
- c. 18 torr
- d. -18 torr

ANSWER: c

13. What is the pressure change expressed in terms of relative pressure values when a pressure measurement changes from 1,041 cm H₂O to 1,033 cm H₂O?

- a. 8 cm H₂O
- b. -8 cm H₂O
- c. -1 cm H₂O
- d. 0 cm H₂O

ANSWER: b

14. Simplify the following equation.

$$\dot{V}_{O_2} = \dot{Q}_T \times (CaO_2 - C\bar{v}O_2).$$

$$\dot{Q}_T = 6 \text{ L/minute}$$

$$(CaO_2 - C\bar{v}O_2) = 5.0 \text{ vol\%}$$

- a. 30,000 ml O₂/minute
- b. 300 ml O₂/minute
- c. 30 ml O₂/minute
- d. 3 ml O₂/minute

ANSWER: b

15. How many terms are in the algebraic expression $10x^2 + 2x - 3$?

- a. two terms
- b. three terms
- c. five terms
- d. six terms

ANSWER: b

Chapter 02: Algebra

16. Simplify the algebraic expression $2\{4[5x^2 + 3(4x^2 - 2x^2)] - 6y\}$.

- a. $88x^2 - 12y$
- b. $88x^2 - 24y$
- c. $44x^2 - 24y$
- d. $44x^2 - 12y$

ANSWER: a

17. After combining like terms, solve the equation

$$CI = \frac{SV \cdot HR}{BSA}$$

$$CI = 3.7 \text{ L/minute/m}^2$$

$$HR = 80 \text{ beats/minute}$$

$$BSA = 1.7 \text{ m}^2$$

- a. $SV = 174 \text{ ml/beat}$
- b. $SV = 86 \text{ ml/beat}$
- c. $SV = 79 \text{ ml/beat}$
- d. $SV = 37 \text{ ml/beat}$

ANSWER: c

18. Transpose the Bohr equation below to solve for the $P\bar{E}CO_2$.

$$\frac{V_D}{V_T} = \frac{PaCO_2 - P\bar{E}CO_2}{PaCO_2}$$

- a. $P\bar{E}CO_2 = PaCO_2 + \left(\frac{V_D}{V_T}\right) PaCO_2$
- b. $P\bar{E}CO_2 = \left(\frac{V_D}{V_T}\right) PaCO_2 \div PaCO_2$
- c. $P\bar{E}CO_2 = PaCO_2 - \left(\frac{V_D}{V_T}\right) PaCO_2$
- d. $P\bar{E}CO_2 = PaCO_2 \left(\frac{V_D}{V_T}\right) + PaCO_2$

ANSWER: c

19. Two numbers whose product is unity are called _____.

- a. equivalentents
- b. reciprocals
- c. absolutes
- d. variables

ANSWER: b

Chapter 02: Algebra

20. The general formula $(x)(1/x) = 1$ is described by which of the following terms?

- a. multiplicative inverse
- b. additive inverse
- c. quotient
- d. factorization

ANSWER: a

21. Which of the following paired terms represent reciprocals?

- I. compliance and elastance
 - II. conductance and resistance
 - III. series resistance and parallel resistance
 - IV. mean airway pressure and peak inspiratory pressure
- a. I, IV only
 - b. II, IV only
 - c. I, II only
 - d. I, II, III only

ANSWER: c

22. What is the reciprocal of 0?

- a. 1
- b. 0
- c. infinity
- d. Zero has no reciprocal.

ANSWER: d

23. Find the answer to the problem $(-88) \div -11$

- a. -8
- b. 11
- c. 8
- d. 88

ANSWER: c

24. Perform the following mathematical operation: $(-3)(-12)$.

- a. 4
- b. 36
- c. -4
- d. -36

ANSWER: b

25. The rules listed below refer to which of the following mathematical operations?

- Find the number's additive inverse.
- Set up the problem as an addition problem.

Chapter 02: Algebra

- Apply the addition rules.
 - a. multiplication
 - b. division
 - c. addition
 - d. subtraction

ANSWER: d

26. Which of the following relationships are correct?

- I. $P_{\text{transmural}} = P_{\text{airway}} - P_{\text{pleural}}$
- II. $P_{\text{transpulmonary}} = P_{\text{alveolar}} - P_{\text{pleural}}$
- III. $P_{\text{thorax}} = P_{\text{pleural}} - P_{\text{airway}}$
- IV. $P_{\text{chest wall}} = P_{\text{pleural}} - P_{\text{atmospheric}}$
 - a. I, III only
 - b. III, IV only
 - c. I, II, III only
 - d. I, II, IV only

ANSWER: d

27. Solve the algebraic expression $(xy + 3y)/(z - 10)$ if $x = 2$, $y = 6$, and $z = 20$.

- a. 30
- b. 15
- c. 3
- d. 1

ANSWER: c

28. The point on a number line equivalent to zero is called the _____ .

- a. origin
- b. opposite
- c. absolute value
- d. reciprocal

ANSWER: a

29. What is the first rule for order of operations?

- a. Add and subtract left to right.
- b. Perform operations within parentheses.
- c. Perform operations within brackets.
- d. Multiply and divide left to right.

ANSWER: b

30. Simplify the algebraic expression $2[3x + 3(2y + x)] - 5z$ by combining like terms.

Chapter 02: Algebra

- a. $12x + 12y$
- b. $12x + 12y - 5z$
- c. $12x + 12y - 10z$
- d. $12y - 5z$

ANSWER: b

31. The term *additive inverse* applies to which mathematical operation?

- a. addition
- b. multiplication
- c. subtraction
- d. division

ANSWER: c

32. Which of the following terms is defined by the definition “the distance of a number from zero (0) on a number line”?

- a. opposite
- b. real number
- c. absolute value
- d. subtrahend

ANSWER: c

33. Using relative terms, what is another name, or term, used to describe atmospheric pressure?

- a. 0 pressure
- b. supra-atmospheric pressure
- c. subatmospheric pressure
- d. water vapor pressure

ANSWER: a

34. If pleural pressure is -3 cm H₂O at functional residual capacity, and if the inspiratory muscles produce a pressure of -5 cm H₂O to initiate an inspiration, what will be the pressure in the pleural space at that moment?

- a. -2 cm H₂O
- b. -3 cm H₂O
- c. -5 cm H₂O
- d. -8 cm H₂O

ANSWER: d

35. At what point during the respiratory cycle is the pressure gradient between the atmosphere and the alveoli zero?

- a. during inspiration
- b. during expiration

Chapter 02: Algebra

- c. at functional residual capacity
- d. during a vital capacity maneuver

ANSWER: c

36. At what lung volume, lung capacity, or point during the respiratory cycle is the opposition of the elastic forces between the lungs and chest wall at equilibrium?

- a. total lung capacity
- b. functional residual capacity
- c. residual volume
- d. normal end-inspiration

ANSWER: b

37. Calculate the pressure change that occurs when the atmospheric pressure changes from 770 mm Hg to -8 mm Hg?

- a. 78 mm Hg
- b. 762 mm Hg
- c. 8 mm Hg
- d. 18 mm Hg

ANSWER: d

38. Rearrange the following equation to solve for the PaCO₂?

$$pH = 6.10 + \log \left[\frac{[HCO_3^-]}{(PaCO_2)(0.03 \text{ mEq/L/torr})} \right]$$

- a. $PaCO_2 = pK + \log \frac{[HCO_3^-]}{0.03 \text{ mEq/L/mmHg}}$
- b. $PaCO_2 = \frac{[HCO_3^-]}{0.03 \text{ mEq/L/mmHg} \times \text{antilog}(pH - 6.1)}$
- c. $PaCO_2 = (\text{antilog } pH - 6.1) ([HCO_3^-]) \div 0.03 \text{ mEq/L/mm Hg}$
- d. $PaCO_2 = (0.03 \text{ mEq/L/mm Hg}) \div (\text{antilog } pH - 6.1) ([HCO_3^-])$

ANSWER: b

39. Solve for the two unknown values in the air-entrainment equation presented here:

$$(C_s \times \dot{V}_s) + (C_{ENV} \times \dot{V}_{ENV}) = (C_{DEL} \times \dot{V}_{DEL})$$

The following data represent the variables in the equation:

C_s (source gas concentration) = 100%

\dot{V}_s (source gas flow) = 20 L/minute

Chapter 02: Algebra

C_{ENT} (entrained gas concentration) = 20%

\dot{V}_{ENT} (entrained gas flow) = unknown

C_{DEL} (delivered gas concentration) = 80%

\dot{V}_{DEL} (delivered gas flow) = unknown

- a. $\dot{V}_{ENT} = 20$ L/minute; $\dot{V}_{DEL} = 30$ L/minute
- b. $\dot{V}_{ENT} = 30$ L/minute; $\dot{V}_{DEL} = 20$ L/minute
- c. $\dot{V}_{ENT} = 6.67$ L/minute; $\dot{V}_{DEL} = 26.7$ L/minute
- d. $\dot{V}_{ENT} = 26.7$ L/minute; $\dot{V}_{DEL} = 6.67$ L/minute

ANSWER: c

40. Calculate the PiO_2 using the data provided below:

$$PiO_2 = FiO_2(P_B - P_{H_2O})$$

FiO_2 (fraction of inspired O_2) = 0.21

P_B (barometric pressure) = 760 mm Hg

P_{H_2O} (partial pressure of water vapor) 47 mm Hg

PiO_2 = partial pressure of inspired O_2 (mm Hg)

- a. 159.6 mm Hg
- b. 149.7 mm Hg
- c. 120.0 mm Hg
- d. 108.4 mm Hg

ANSWER: b

41. Perform the following mathematical operation.

$$-6 + (-8)$$

- a. -2
- b. +2
- c. -14
- d. +14

Chapter 02: Algebra

ANSWER: c

42. On a number line, the point where zero (0) is located is called the _____.
- additive inverse
 - opposite
 - origin
 - absolute value

ANSWER: c

43. Calculate the transpulmonary pressure when the pressure in the pleural space is -8 cm H₂O and the pressure in the alveoli is 760 mm Hg.
- 8 cm H₂O
 - -8 cm H₂O
 - 760 mm Hg
 - 752 mm Hg

ANSWER: a

44. Simplify the following equation: $5[6x + 3(2y - 2x) + 10y]$
- $15x + 50y$
 - $15x + 80y$
 - $30x + 50y$
 - $80y$

ANSWER: d

45. Rearrange the following equation to solve for the V_{lost} .

$$C_{static} = \frac{(V_T - V_{lost})}{P_{plateau} - (PEEP_{applied} + PEEP_{auto})}$$

$C_{static} = 40$ ml/cm H₂O

$V_T = 750$ ml

$PEEP_{applied} = 5$ cm H₂O

$P_{plateau} = 25$ cm H₂O

$V_{lost} = ??$ ml

- 150 ml
- 135 ml
- 105 ml
- 95 ml

ANSWER: a

46. By multiplying the R_{aw} by G_{aw} what product would be expected?
- 0

Chapter 02: Algebra

b. 10^1

c. 1

d. *Cannot* be determined without the actual measurements of R_{aw} and G_{aw} .

ANSWER: c

47. Two numbers whose product is unity are _____.

a. opposites

b. reciprocals

c. absolute values

d. inverse values

ANSWER: b

48. What are physiological examples of a multiplicative inverse?

I. lung compliance and lung elastance

II. blood pH and PaCO_2

III. PaO_2 and SaO_2

IV. airway resistance and airway conductance

a. III only

b. I, II only

c. II, III only

d. I, IV only

ANSWER: d

49. Which of the following terms best describes the DLCO measurement?

a. compliance

b. conductance

c. elastance

d. resistance

ANSWER: b

50. Calculate the problem below when $x = 15$.

$$(x) \frac{10}{2}$$

a. 125

b. 75

c. 10

d. 3

ANSWER: b