

Physiology

1. At sea level, which of the following is NOT correct

- a) Total pressure of gas mixture = barometric pr-water vapor pr= 713 mmHg
- b) The atmospheric (barometric) pressure = 760 mmHg
- c) PO₂ in alveolar air = 80 mmHg
- d) PO₂ in atmospheric air = 100 mmHg
- e) The partial pressure of CO₂ (PCO₂) in alveolar air = 40 mmHg

2. Severe decrease in blood flow to the tissue may cause

- a) Histotoxic hypoxia
- b) Anemic hypoxia
- c) Stagnant hypoxia
- d) Hypoxic hypoxia
- e) None of the above

3. Regarding CO₂ transport in the blood

- a) The Haldane effect is the fact that oxygenation of the blood increases its ability to carry CO₂
- b) An increase in PCO₂ in blood shift oxygen dissociation curve to the left
- c) Approximately 30% of the venous arterial difference is attributable to carbamino compounds
- d) Ionic dissociation of carbonic acid requires the presence of carbonic anhydrase to be a fast process
- e) 50% is in the dissolved form

4. Transpulmonary (transmural) pressure

- a) Is increased during inspiration
- b) Is the pressure difference between alveoli and atmosphere
- c) Is decreased when intra-pleural pressure becomes more negative
- d) All of the above
- e) None of the above

5. One of the following is specific for measurement of small airway function

- a) Tidal volume
- b) FEV₁
- c) FVC
- d) FEF_{25-75%}
- e) Inspiratory capacity

6. Which is true regarding surfactant

- a) It reduces the surface tension of the fluid lining the alveoli
- b) It contains calcium
- c) It prevents alveolar collapse
- d) It is secreted by type II alveolar cells
- e) All of the above

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7. Regarding dead space

- a) Physiological dead space can be measured by the nitrogen meter method
- b) It causes an increase in PCO_2 in expired air relative to alveolar PCO_2
- c) Anatomical dead space can be measured by using the Bohr's equation
- d) It reduces alveolar ventilation in shallow rapid breathing
- e) All of the above

8. With regard to chemoreceptors, which is false

- a) The peripheral chemoreceptors are located in the carotid and aortic bodies
- b) The medullary chemoreceptors respond to a change in blood pCO_2
- c) The peripheral chemoreceptors respond to blood H^+
- d) The peripheral chemoreceptors respond to pO_2
- e) The medullary chemoreceptors respond to blood H^+

9. Apnea is caused by the following conditions EXCEPT

- a) Voluntary effort
- b) Obesity
- c) During swallowing (pharyngeal stage)
- d) Decreased arterial PO_2
- e) Apnea after hyperventilation

10. Compliance of the lung is reduced by all of the following EXCEPT

- a) High expanding pressures
- b) Alveolar oedema
- c) Emphysema
- d) Consolidation
- e) Lung fibrosis

11. Increased lung compliance is associated with

- a) Increasing age
- b) Interstitial fibrosis
- c) Increasing pulmonary venous pressure
- d) Low lung volumes associated with hypoventilation
- e) High expanding volumes

12. Increase in respiratory rate may be caused by the following EXCEPT

- a) Strong pneumotaxic center stimulation
- b) Exercise
- c) Hypoxia
- d) Acidosis
- e) Decrease in CO_2 tension

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13. All the following are true about CO₂ transport in blood EXCEPT

- a) Bicarbonate is 70%
- b) Tidal CO₂ is 4 ml
- c) Carbamino-compound is 23%
- d) CO₂ dissolved in plasma is 7%
- e) CO₂ content is 52 ml/100 ml arterial blood

14. Ficks law of diffusion is dependent on all EXCEPT

- a) Thickness of membrane barrier
- b) Solubility of the gas
- c) The area of the membrane
- d) The molecular weight of the gas
- e) The posture of the subject

15. Which of the following represents the pressure difference that acts to distend lungs

- a) Airway opening pressure
- b) Transpulmonary pressure
- c) Alveolar pressure
- d) Transthoracic pressure
- e) All of the above

16. The Haldane effect refers to

- a) The increased capacity for deoxygenated blood to carry CO₂
- b) The chloride shift that occurs to maintain electrical neutrality
- c) The dissociation constant for the bicarbonate buffer system
- d) The shape of the CO₂ dissociation curve
- e) The carriage of dissolved CO₂ according to Henry's law

17. Obstructive sleep apnea is caused by

- a) Damage of respiratory center
- b) Hypothyroidism
- c) Stroke
- d) Neuromuscular abnormalities
- e) All of the above

18. Pulmonary vascular resistance

- a) Is decreased by histamine
- b) Increases with recruitment
- c) Increases as venous pressure rises
- d) Is increased by muscular pulmonary arterioles which regulate flow to various regions of the lungs
- e) Is increased at both high and low lung volumes

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19. Regarding control of ventilation

- a) The apneustic center lies in the medulla
- b) The chemoreceptors in the aortic bodies respond to a fall in arterial pH
- c) Peripheral chemoreceptors respond to decreases in arterial pO₂
- d) The central chemoreceptors respond to changes in oxygen concentrations
- e) The most important factor in control of ventilation under normal conditions is the PO₂ of the arterial blood

20. Principal of acclimatization to low PO₂

- a) Increased number of red blood cells
- b) Increased pulmonary diffusing capacity
- c) Increased pulmonary ventilation
- d) Increased vascularity of peripheral tissue
- e) All of the above

21. All the following are true about control of respiration EXCEPT

- a) Excess CO₂ or H ions in blood act directly on respiratory center.
- b) Blood CO₂ is more potent stimulant than H ions in blood.
- c) Change in blood CO₂ has potent acute effect on controlling respiratory drive.
- d) Ventral respiratory group of neurons generate the basic rhythm of respiration.
- e) O₂ lack in blood act mainly on peripheral chemoreceptors.

22. Very low level of oxygen in the inspired air:

- a) Increases the pulmonary ventilation.
- b) Inhibits peripheral chemoreceptors.
- c) Causes hypoxemia that inhibits aortic chemoreceptors.
- d) Stimulates the respiratory center via central chemoreceptors.
- e) All of the above.

23. Surfactant

- a) It increases surface tension
- b) Is increased in cigarette smoking
- c) Surface tension is proportional to their concentration
- d) Is produced by type I alveolar cells
- e) Prevents pulmonary oedema

24. Carotid body stimulation occurs with

- a) Increased BP
- b) Increased pO₂
- c) Decreased BP
- d) Decreased pO₂
- e) Increased pH

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25. All of the following pairings are correct (in normal person at rest) EXCEPT

- a) Physiologic dead space = 150 ml
- b) Alveolar ventilation = 7500 ml
- c) Tidal volume = 500 ml
- d) Functional residual capacity = volume of gas in lung after normal expiration
- e) Pulmonary blood flow = 5000 ml/min

26. With regard to the distribution of pulmonary blood flow

- a) Hypoxia leads to pulmonary vasodilation
- b) Typically there is a zone at the apex that is not perfused
- c) The net balance of Starling forces acts to keep the alveoli dry
- d) The mean pulmonary arterial pressure is 8 mmHg
- e) Flow is determined by the arterial/alveolar pressure difference

27. During respiration

- a) Transverse diameter is increased by diaphragm contraction during inspiration
- b) At normal resting expiration, contraction of internal intercostals is the main cause of air outflow
- c) Sternomastoid and scaleni helps only in the process of forced expiration
- d) External intercostals contraction helps in the generation of negative intra-pulmonary pressure
- e) External intercostals contraction helps in the inspiration only during exercise

28. All the following shift the oxygen dissociation curve to the right EXCEPT

- a) Increased temperature
- b) Carbon monoxide poisoning
- c) Increased CO₂
- d) Increased hydrogen ion
- e) Increased biphosphoglycerate

29. In hyaline membrane disease or respiratory distress syndrome all are true except

- a) Prolonged intrauterine asphyxia damage type II pneumocytes
- b) Surfactant deficiency is the most important cause
- c) Alveolar period ends when the baby is 8 months
- d) Affect 2% of newly born babies and more common in premature babies d O
- e) Premature babies delivered in terminal sac period usually die

30. With respect to regional gas exchange in the upright lung

- a) PH is highest at the bases of the lungs
- b) Ventilation/perfusion ratio is abnormally high at the top of the lungs
- c) Ventilation is greater at the top of the lungs
- d) PO₂ is highest at the bases of the lungs
- e) Perfusion is much greater at the top of the lungs compared with the bases

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31. With respect to dead space

- a) Physiological dead space is measured by analysis of single breath nitrogen curves
- b) Total dead space equals physiological dead space + anatomic dead space
- c) Anatomic dead space is less than physiological dead space in healthy persons
- d) For a constant minute ventilation, alveolar ventilation is decreased as respiratory rate increases
- e) Dead space volume is equal to the person's weight in kg

32. Regarding ventilation/perfusion differences in the lungs

- a) dead space
- b) V/Q ratio is low at the bases
- c) The relative change in blood flow from apex to base is less than relative change in ventilation
- d) change in ventilation
- e) In healthy individuals, anatomical dead space is less than physiological
- f) V/Q differences are due to gravity
- g) All of the above

33. This blood gas picture reveals which of the following PH = 7.52, pCO₂ = 20 mmHg, pO₂ = 120 mmHg, bicarb = 16 mmol/l

- a) Mixed respiratory/metabolic alkalosis
- b) Metabolic acidosis
- c) Respiratory alkalosis with partial renal compensation
- d) Respiratory acidosis
- e) Metabolic alkalosis

34. The anatomic dead space

- a) Varies with minute ventilation
- b) Is alveolar minus the pathological dead space
- c) Will increase in C.O.P.D
- d) All of the above
- e) Is typically 150 mL

35. Hypoxemia is caused by all of the following EXCEPT

- a) Hypoventilation
- b) Pulmonary fibrosis
- c) Residing at high altitudes
- d) Anemia
- e) Left to right shunt

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36. Arterial PCO₂ is increased in a normal individual while:

- a) Descending a mountain.
- b) Hyperventilating.
- c) Hypoventilating.
- d) Breathing a gas mixture with high O₂.
- e) All of the above

37. One of the following cannot be measured by a spirometer

- a) Functional residual capacity
- b) Inspiratory reserve volume
- c) Inspiratory capacity.
- d) Tidal volume
- e) Expiratory reserve volume

38. Regarding buffers of the body

- a) Initial correction of pH disturbance is best achieved by the kidneys.
- b) Hb is an important buffer of the blood.
- c) The phosphate buffer system is the predominant buffer in the blood.
- d) Bones contribute to the buffer system by taking up HCO₃.
- e) All of the above are correct.

39. Concerning the Lungs, which of the following is true

- a) The total surface area of lung is 70-80 square meters.
- b) The conduction zone is responsible for conditioning in hot climate.
- c) Its lining is formed mainly of Type 2 Alveolar cells that release surfactant.
- d) The alveolar Type 1 cells secrete the elastin and collagen Garde.
- e) The pulmonary interstitial tissue contains some WBCs.

40. The displacement of CO₂ from the blood to alveoli is facilitated by

- a) Decreased pulmonary blood flow
- b) Binding of O₂ with Hb in the lungs.
- c) Increased thickness of respiratory membrane.
- d) Decreased surface area of respiratory membrane.
- e) All of the above.

41. At high altitudes all of the following occur in an effort to acclimatize EXCEPT

- a) Hypoventilation.
- b) Increased numbers of capillaries per unit volume in peripheral tissues.
- c) O₂ dissociation curve shifts to right.
- d) Polycythemia.
- e) Pulmonary vasoconstriction.

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42. Regarding ventilation

- a) FEV1 is dependent on expiratory effort.
- b) FEV1 is about 42% of FVC in a patient with obstructive lung disease.
- c) FEV1 is decreased much more than FVC in patients with lung fibrosis.
- d) FVC in an average healthy person is about 3100 ml.
- e) Normal FEV1 is 70% of FVC.

43. the barometric pressure (of dry air) is 600 mmHg and the percentage of oxygen is 20%, the partial pressure of oxygen is

- a) 20 mmHg
- b) 30 mmHg
- c) 120 mmHg
- d) 200 mmHg
- e) 150 mmHg

44. Concerning O₂ transport, oxygen capacity of the blood is determined by

- a) Plasma volume
- b) Amount of O₂ dissolved in the blood
- c) Amount of Hb in the blood
- d) Affinity of Hb for oxygen
- e) All of the above

45. The main respiratory control neurons

- a) Are unaffected by stimulation of pain receptors
- b) Send out regular bursts of impulses to inspiratory muscles during quiet respiration
- c) Are unaffected by impulses from the cerebral cortex
- d) Are located in the pons.
- e) Send out regular bursts of impulses to expiratory muscles during quiet respiration

46. Regarding the lung

- a) The terminal bronchioles are the smallest airways without alveoli
- b) Alveoli are about 0.3 mm in diameter
- c) Anatomic dead space = 150 ml
- d) There are about 300 million alveoli in the human lung
- e) All of the above are true

47. All of the following shift the oxygen dissociation curve to the right EXCEPT

- a) Increased temperature
- b) Decreased pH
- c) Carbon monoxide
- d) Increased 2,3 DPG
- e) Increased pCO₂

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48. A permanent inhabitant at 4500 m

- a) Has a decreased 2,3 DPG
- b) Shows increased ventilation
- c) May have a normal HCO_3^-
- d) Has a high alveolar PO_2 level
- e) Is highly sensitized to the stimulatory effects of hypoxia

49. Causes of hypoxic hypoxia include all of the following EXCEPT

- a) Congestive heart failure
- b) Pulmonary fibrosis
- c) Morphine
- d) Fatigue
- e) Pulmonary shunting

50. With respect to gas transport in the blood

- a) Normal arterial blood with a pO_2 of 100mmHg contains 3ml of dissolved oxygen per liter
- b) The great bulk of carbon dioxide in blood is found as dissolved carbon dioxide and carbamino compounds
- c) Oxygen capacity is the total amount of oxygen that can be carried in 100ml of blood
- d) Haldane effect refers to the shift of Chloride ions into the RBC to maintain electrical neutrality after carbon dioxide diffuses out of cells
- e) Arterial pO_2 measures the amount of oxygen bound to hemoglobin

51. In CO_2 transport

- a) The osmolarity of RBCs in venous blood is increased compared to arterial blood
- b) CO_2 does not react with plasma proteins
- c) The solubility of CO_2 in blood is less than O_2
- d) The HCO_3^- content of venous blood is reduced compared to arterial blood
- e) The hematocrit of venous blood is 3% less than arterial blood

52. Pulmonary compliance

- a) Is increased by pulmonary fibrosis
- b) Is independent of lung volume
- c) Is decreased in emphysema
- d) Is defined as the change in pressure per unit change in volume
- e) Compliance is slightly greater when measured during deflation than when measured during inflation

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53. Which of the following equalizes air pressure between alveoli?

- a) smooth muscle cells of pulmonary arteries and veins
- b) fused basal laminae of epithelial and endothelial cells
- c) type II pneumocytes.
- d) pores of Kohn
- e) alveolar macrophages

54. Vital capacity increases in

- a) Athletes
- b) Lung fibrosis
- c) Airway obstruction
- d) Pregnancy
- e) All of the above

55. Alveolar surfactant acts to increase pulmonary

- a) Surface tension
- b) Compliance
- c) Work of breathing
- d) Blood flow
- e) Airways resistance

56. Work of the lung in breathing

- a) Is increased with larger tidal volumes
- b) Is increased with higher flow rates
- c) In inspiration need to overcome elastic forces and viscous resistance
- d) In expiration need to overcome airway and tissue resistance
- e) All of the above

57. With regards to the normal alveolus

- a) Large alveoli have a tendency to collapse into smaller ones
- b) Surfactant is composed of hydrophilic molecules
- c) Surfactant is produced by type I pneumocytes
- d) Alveolar size has little effect on the surface tension
- e) Surrounding tissues exert a force preventing alveolar collapse

58. With regards to ventilation

- a) The autonomic control center is located in the midbrain
- b) Arterial pO₂ must be below 80mmHg to produce increased discharge from peripheral chemoreceptor
- c) Brainstem respiratory neurons only discharge during inspiration
- d) Medullary chemoreceptors monitor O₂ concentrations in the CSF
- e) In metabolic alkalosis ventilation is depressed

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59. Regarding airway resistance

- a) Decreased $p\text{CO}_2$ in alveolar gas causes an increase in airway resistance
- b) Poiseuille equation denotes pressure volume characteristics for turbulent flow
- c) As lung volume reduces, airway resistance reduces also
- d) The very small bronchioles are the major site of resistance to airflow
- e) Contraction of bronchial smooth muscle by stimulation of adrenergic receptors increases airway resistance

60. Lung compliance

- a) Falls if the lung remains unventilated for long periods
- b) Rises if the pulmonary venous pressure is increased
- c) Is the area under the pressure volume curve
- d) Falls as the lung ages
- e) Is normally 100 mL/cm water

61. In CO_2 transport

- a) 2,3 DPG concentration in RBC will alter the cell ability to catalyze CO_2
- b) Chloride shift allows CO_2 to dissociate
- c) Venous blood can carry more CO_2 than arterial blood
- d) There is equal amounts of CO_2 transported as dissolved CO_2 and carbamino compounds
- e) There is slightly more CO_2 in dissolved in the blood than O_2

62. Concerning airway resistance

- a) It is measured in $\text{cm H}_2\text{O/L/sec}$.
- b) Resistance = pressure/flow.
- c) Normally, it's about $(2 \text{ cm H}_2\text{O/L/sec})$.
- d) of airway resistance lies in the upper respiratory tract 50%.
- e) All of the above is correct.

63. With regard to pulmonary function

- a) Tidal volume is the volume of each maximal inspiration
- b) Vital capacity is equivalent to the total inspiratory reserve volume, tidal volume and expiratory reserve volume
- c) Tidal volume is measured by the single breath nitrogen technique
- d) Residual volume is the volume remaining at the end of passive expiration
- e) Residual volume can be measured directly

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64. The hemoglobin oxygen dissociation curve moves up and to the left with

- a) Increased hydrogen ion concentration
- b) Increased 2,3 DPG
- c) Hypothermia
- d) Hypercarbia
- e) All of the above

65. With respect to lung volumes and capacities

- a) He dilution measures the total volume of gas in the lung, including any trapped behind closed airways
- b) The volume of gas left in the lungs after a maximal expiration is the functional residual volume
- c) Vital capacity is the volume exhaled when a maximal inspiration is followed by a maximal expiration
- d) FRC can be measured with a spirometer
- e) TLC is the volume of the lung available to partake in gas exchange

66. Which of the following is true during inspiration

- a) Intrapleural pressure is positive
- b) Intrapleural pressure becomes more negative
- c) Alveolar pressure equals atmospheric pressure
- d) Alveolar pressure is positive
- e) All of the above

67. Which of the following increases the delivery of oxygen to tissues.

- a) Decreased PCO₂.
- b) Shift of O₂ hemoglobin dissociation curve to the left
- c) Increased H⁺ concentration.
- d) Decreased temperature.
- e) All of the above

68. Which is true regarding surfactant

- a) It contains calcium
- b) It prevents alveolar collapse
- c) It reduces the surface tension of the fluid lining the alveoli
- d) It is secreted by type II alveolar cells
- e) All of the above

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69. In control of ventilation the medullary chemoreceptors respond to

- a) Oxygen tension
- b) CO₂ tension
- c) H⁺ concentration and oxygen and CO₂ tension
- d) Hydrogen ion concentration
- e) H⁺ concentration and CO₂ tension

70. The following are true regarding lung volumes and compliance except

- a) FRC is the sum of ERV and RV
- b) Vital capacity is the largest amount of air that can be expired after a maximal inspiratory effort
- c) Compliance decreases in obstructive lung disease
- d) FEV₁/FVC ratio increases in obstructive lung disease
- e) The change in lung volume per unit change in airway pressure is the compliance of the lung

71. Oxygen Hemoglobin dissociation curve shifts

- a) To the right with CO poisoning
- b) To the left with a rise in pH
- c) To the left with anemia
- d) To the left with a rise in temperature
- e) To the right with a decrease in 2,3 DPG

72. Regarding ventilation during exercise

- a) Abrupt increase in ventilation at onset of exercise is due to increased respiratory rate.
- b) There is a fall in blood pH during moderate exercise.
- c) Pulmonary blood flow is increased from 5.5L/min-55L/min.
- d) Increases in ventilation are proportional to increased CO₂ production.
- e) CO₂ excretion increases from 200mL/min up to 8000mL/min.

73. In regional ventilation and perfusion of the lung

- a) When supine the apical and basal ventilation is equal.
- b) V/Q ratio increases down the lung.
- c) Upper regions of the lung ventilate better than the lower regions.
- d) The highest alveolar pO₂ is at the base of the lung.
- e) Blood flow is uniform throughout the normal lung.

74. Cyanosis indicates higher than normal blood concentration of

- a) Reduced hemoglobin.
- b) Carbon dioxide.
- c) Diphosphoglycerate (DPG).
- d) Bicarbonate.
- e) Carbon monoxide.