RS—Physiology test banks

1. All the following laboratory values are consistent with pulmonary fibrosis EXCEPT?

a. Increased residual volume
b. Increased vascular resistance
c. Normal or above normal FEV1/FVC
d. Decreased lung compliance
e. Normal or above normal peak expiratory flow (corrected for lung volume)

Answer: A

2. Which of the following is NOT true at FRC?

a. It is about 75% TLC.
b. The elastic recoil of the chest wall is outward.
c. The elastic recoil of the lung is inward.
d. The lung-thorax system is at rest.
e. pulmonary vascular resistance is the lowest

Answer: B

3. Regarding dead space, choose the FALSE statement

a. is defined as the volume of gas which does not take part in gas exchange
b. physiological dead space is the same as alveolar dead space
c. physiological dead space is measured by measuring mixed expiratory PCO2
d. mechanical ventilation (respirator) increases dead space volume.
e. increases whenever V/Q ratio is increased

Answer: C

4. Regarding pulmonary vascular resistance, which one of the following is true?

a. is low at high lung volumes
b. is low at low lung volumes
c. if increased, can cause right heart failure
d. is measured through routine pulmonary function tests
e. is more than systemic vascular resistance.

Answer: B

5. Which of the following is NOT true concerning respiratory distress syndrome inpremature infants?
a. Their ability to synthesize surfactant is limited.
b. Higher pressures are required to ventilate the lungs.
c. Lung compliance is low.
d. Positive pressure respirators are often used to assist them in breathing.
e. Alveoli tend to overexpand and sometimes burst at the end of inspiration

Answer: E

6. Which of the following structures contains blood with the highest PCO2?
a. Carotid bodies.
b. Pulmonary veins
c. Superior vena cava
d. The midportion of pulmonary capillaries.
e. Systemic arterioles

Answer: C

7. What is expected in a premature baby with IRDS? T=alveolar surface tension, C=lung compliance, Pa02=arterial PO2?
a. T: Increase, C: increase, Pa02: increase
b. T: Increase, C: decrease, PaO2: decrease
c. T: Decrease, C: decrease, Pa02: equal
d. T: Increase, C: increase, PaO2: decrease
e. T: Increase, C: increase, PaO2: decrease

Answer: B

8. In an asthmatic attack,which of the following is expected ?
a. Wheezing sounds are heard during inspiration more than that during expiration.
b. Bronchodilators are contraindicated.
c. Work of breathing is increased.
d. FEV1 is expected to increase.
e. Every asthmatic patients is a member of the COPD family.

Answer: C

9. In the presence of active surfactants, all of the following are expected to decrease EXCEPT?
a. Tendency of the lung to collapse
b. Lung compliance
c. Surface tension forces in the alveoli
d. Lymph flow in the lung
e. Work of breathing.

Answer: B

10. Compared to a normal individual, a patient with idiopathic pulmonary fibrosis , one of the following is expected to be more than normal ?

a. TLC
b. Total pulmonary vascular resistance
c. FEV1
d. PaO2
e. Resting volume of lung-thorax system

Answer: B

11. Following a stab wound in the chest wall, the lung will ….. and the chest wall will …. ?

a- Expand, expand
b- Both become fixed at the FRC
c- Collapse, Collapse
d- Expand, Collapse
e- Collapse, Expand

Answer: E

12. Using the following data, calculate the physiological dead space, Tidal volume=600 ml Alveolar ventilation = 4.3 L/min, $PaCO_2$=40 mmHg, $PECO_2$=28 mmHg:

a- 100 ml
b- 150 ml
c- 180 ml
d- 200 ml

Answer: C

13. which of the following regarding Residual volume is correct?

a- It is the volume that remains in the lung after tidal volume expiration.
b- It decreases with COPD.
c- It decreases with fibrosis.
d- It remains the same during the entire life of a human being.

Answer: D

14. Which of the following values is above normal in-patient suffering from severe respiratory muscle weakness?

a- Tidal volume
b- Oxyhemoglobin Saturation.
c- Vital capacity
d- Arterial PH
e- Arterial PCO_2

Answer: E

15. A 12 years-old boy has a severe asthmatic attack with wheezing. His arterial pO2 is 60 mmHg and pcO2 is 30 mmHg. His:

a- FEV1/FVC % is increased.
b- V/Q ratio is increased in the affected areas of his lung
c- Arterial pCO2 is higher than normal because of inadequate gas exchange
d- arterial pCO2 is lower than normal because hypoxemia is causing him to hyper-ventilate
e- Residual volume is reduced

Answer: D

16. The largest cross-sectional area and therefore lower resistance of airways?

a- Trachea
b- Alveoli
c- Bronchioles
d- A+C

Answer: B

17. At the end of normal quite expiration, just before the start of inspiration, the lungs are said to be in:

a- RV
b- ERV
c- FRC
d- IRV
e- TLC

Answer: C

18. Oxygens percentage in the atmospheric air is …… that CO2 percentage and its solubility in solution (Example: Blood) is …… than CO2 solubility.

a- Lower, higher
b- Higher, lower
c- Lower, lower
d- Higher, higher

Answer: B

19. Which of the following is the most factor that can increase the volume of air entering the lung?

a- Increase in the pressure gradient.
b- Increase in action potential
c- Both a+b
d- Decrease in the pressure gradient

Answer: A

20. Fick's law depend on multiple factors, which one of them will have the most effect when observing the diffusion of different gases?

a- Partial pressure gradient
b- Temperature
c- Diffusion distance
d- Diffusion coefficient
e- Diffusion surface area

Answer: D

21. Which of the following will decrease diffusion?

a- Decreased surface area
b- Increased fluid in the lung
c- Decreased pressure coefficient
d- All the above

Answer: D

22. The primary force responsible for the movement of air into the lungs during inspiration?

a- Atm-pressure
b- Muscular spasm
c- Reduced surface tension of alveoli
d- Pressure difference between atmospheric-intrapulmonary.
e- Muscular relaxation

Answer: D

23. Even after forceful exhalation, a certain volume of air remains in the lungs, referred to as?

a- Tidal volume
b- ERV
c- Vital capacity.
d- Residual volume.
e- IRV

Answer: D

24. Regarding intrapleural pressure, which one is true?

a- Less than ATM-pressure only during inspiration
b- Becomes equal to external environmental air pressure by action of respiratory muscles
c- Difference between the pressure in the pleural cavity and that within the alveoli
d- Always less than ATM-pressure.
e- Increases in positivity when the diaphragm and external intercostal muscle contract

Answer: D

25. In a normal human, The total lung capacity (TLC) is approximately equal to?

a- 6 L
b- 2 L
c- 4 L
d- 9 L
e- 15 L
Answer: A

26. Vital capacity is defined as?
A- Sum of all lung volumes
B- Sum of tidal volume plus residual volume
C- Sum of inspiratory reserve volume plus expiratory reserve volume
D- Sum of Inspiratory reserve volume plus tidal volume and expiratory reserve volume
Answer: D

27. Which of the following will the have the highest percentage of CO2?
A- Alveolar air
B- Pulmonary arteries
C- Pulmonary veins
D- Interstitial fluid
E- Systemic arteries
Answer: B

28. At the end of quite respiration, muscles are relaxed and lungs content represents.
a- RV
b- ERV
c- FRC
d- IRV
e- TLC
Answer: C

29. Regarding surfactants, one is true?
a- Increase pleural pressure
b- Reduce surface tension of the fluid lining the alveoli
c- Decrease alveolar pressure
d- Make inspiration more difficult
e- Can cause pneumothorax
Answer: B

30. Assuming a normal anatomic dead space of 150 ml and a fixed respiratory minute ventilation of 6 L /min. Which combination of respiratory rate and tidal volume will give the largest alveolar ventilation?
a- 200 ml at 30 breaths/min
b- 300 ml at 20 breaths/min
c- 400 ml at 15 breaths/min

d- 600 ml at 10 breaths/min
e- Alveolar ventilation is not affected by tidal volume and respiratory rate

Answer: D

31. If dead space is one third of the tidal volume and arterial PCO2 is 45 mmHg,what is the mixed expired pCO2?

a- 20 mmHg
b- 30 mmHg
c- 40 mmHg
d- 45 mmHg
e- 60 mmHg

Answer: B

32. Which person would be expected to have the largest PAO2-PaO2 gradient? (Astand for alveolar and a-stands for arterial)

a- Normal person during exercise
b- Person with pulmonary fibrosis
c- Person with anemia but normal lungs
d- Person at 5000 meter above the sea level

Answer: B

33. A patient with restrictive lung disease will have a relatively normal?

a- FEV1
b- FVC
c- V/Q ratio
d- FEV1/FVC
e- Pulmonary vascular resistance

Answer: D

34. The greatest increase in the physiological dead space would be expected with?

a- Pulmonary embolism
b- Atelectasis's.
c- Pneumothorax
d- Bronchoconstriction.
e- Decrease V/Q ratio

Answer: A

35. Regarding physiological dead space, one of the following is wrong?

a- Generally, is equal to or greater than the anatomic dead space
b- Increased in lung disease
c- Increased whenever the V/Q ratio is increased
d- Equal to alveolar wasted volume (alveolar dead space)

Answer: D

36. Which of the following statements regarding surfactants is incorrect?
a- Responsible for hysteresis
b- Increases pulmonary resistance
c- Commonly deficient in term-neonates
d- Prevents the occurrence of pulmonary edema
e- Its production needs corticosteroids
Answer: C

37. Regarding lung compliance, all of the following are correct EXCEPT?
a- Expressed as unit change in volume per unit change in pressure.
b- Maximal during quite breathing
c- The more surface tension, the more the compliance
d- Decreases in fibrosis
e- Increases in emphysema
Answer: C

38. One of the following is true regarding FRC?
a- It is resting volume of the lung
b- It is resting volume of the thorax
c- At FRC, intra-alveolar pressure= atmospheric pressure
d- At FRC, intra-pleural pressure is more than atmospheric pressure
e- At FRC, lung compliance is the lowest
Answer: C

39. A person breathes into and from a spirometer (volume 12 liters) containing 10% helium gas mixture. After equilibration, helium concentration of expired gas was found to be 6.67%. His ERV is 4.2 liters. What is his residual volume? (Hint: V1C1=V2C2)
a- 1000 ml
b- 1200 ml
c- 1800 ml
d- 1500 ml
Answer: C

40. The work of breathing is:
a- Inversely related to lung compliance
b- Remains constant during exercise
c- Not affected by airway resistance
d- Is less in pulmonary fibrosis
e- Is less in emphysema
Answer: A

41. Regarding Pneumothorax, one of the following isn't true?
a- Diameter of the thorax increases
b- Venous return decreases
c- Vital capacity (VC) decreases
d- Lung compliance increases
e- Lung collapses
Answer: D

42. Which of the following is not correct regarding exhalation (expiration)?
a- Expiration is typically a passive process
b- Expiration can be active
c- The elastic properties of the lung tissue help it to excel deoxygenated air outside during exhalation
d- In COPD, patients face problems mainly during expiration.
e- Exhalation starts when the expiratory muscles relax.
Answer: E

43. All of the following lab-values are consistent with Pulmonary fibrosis except?
a- Normal or above FEV1/FVC ratio
b- Increased vascular resistance
c- Normal or above normal peak expiratory flow (corrected for lung volume)
d- Increased residual volume (RV)
e- Decreased compliance
Answer: D

44. In normal individual, regarding gas exchange across pulmonary capillaries during mild exercise, which of the following statements is TRUE?
a- CO2 crosses the membrane easier than 02
b- Diffusing capacity of the lung for 02 is more than for CO2, the most important factor to play role is the molecular weight of both gases
c- The length of capillary required for gas equilibrium is shorter during exercise
d- ABGs become grossly abnormal
e- Equilibrium across the respiratory membrane is never achieved
Answer: A

45. One of the followings is expected in idiopathic pulmonary fibrosis.
a- lower than normal FRC.
b- higher than normal tidal volume.
c- lower than normal pulmonary vascular resistance.
d- higher than normal TLC.
e- higher than normal lung compliance
Answer: A

46. Regarding bronchial asthma, all the following statements are true EXCEPT?
a- Cough suppressants are highly indicated
b- Airway resistance is increased.
c- During the attack, FEV1.0/FVC is < 80%
d- Bronchodilators can be given to asthmatic patients
e- Patients might be allergic to pollens
Answer: C

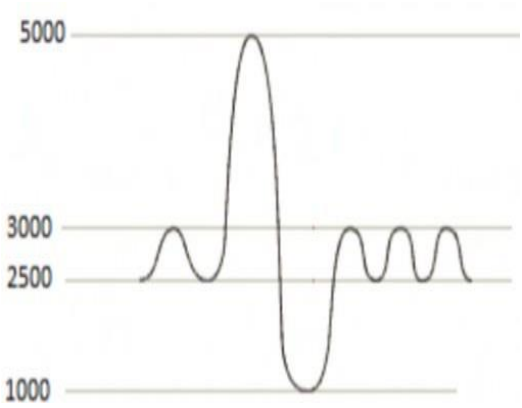
47. Regarding lung diseases, one of the following is true?
a- Increase in the diameter of the airways by 10% results in a increase in airwayresistance by more than 10%
b- COPDS are least common seen in clinical Practice
c- Pulmonary fibrosis is an example of increase airway resistance.
d- In pulmonary fibrosis, FEF1/FVC ratio is greater or equivalent to normal
e- In obstructive lung diseases, difficulty is during inhaling rather than during exhaling
Answer: D

48. One of the following PFT values are consistent with both obstructive and restrictive lung diseases?
a- Decreased residual volume
b- Normal or above normal TLC
c- Decreased vascular resistance
d- Decreased FEV1.0
e- Decreased FEV1.0/FVC
Answer: D

49. Which of the following is FALSE concerning airway resistance (R)?
a- In the later generations, the radii are smaller, increasing the total resistance at each successive generation.
b- Under normal conditions, R resides mainly in the large airways
c- Whenever R is increased FEV1.0/FVC is below normal.
d- Airway resistance can be increased by loss of tissue elasticity and contraction of bronchial smooth muscles
Answer: A

50. When the inspiratory muscles are relaxed, the lungs are said to be at ?
a- Vital capacity
b- Residual volume
c- Minimal volume
d- Functional residual capacity
e- Inspiratory capacity
Answer: D

51. Which of the following statements regarding the figure is true?



a- VC cannot be calculated
b- This person has very large physiological dead space.
c- This person has fibrosis
d- This person has COPD
e- This person could be normal

Answer: E

52. Place the following steps for normal inhalation in order:

(1) decrease in intrapleural pressure to 754 mmHg (from -4 mmHg to -6 mmHg).
(2) flow of air from higher to lower pressure (inhalation).
(3) lung size increases.
(4) decrease in intra-alveolar pressure to 759 mmHg (-1 mmHg).
(5). contraction of the diaphragm + external intercostals muscles

a- 5, 2, 3 ,4 ,1
b- 1, 3 ,4 ,5 ,2
c- 5 ,4 ,3 ,2 ,1
d- 5, 1 ,3 ,4 ,2
e- 1, 2, 3, 4 ,5

Answer: D

53. Lack of O2 equilibration is due to: **Diffusion limitation**

54. Patient with inadequate surfactant (RDS) will have relatively normal: **FEV1/FVC**

55. What would be the expected effect of pulmonary edema on pulmonary diffusion capacity for O2? **Reduce diffusion capacity for O2 & CO2**

56. Regarding residual volume represents the following except: r**esting volume in the lung (it's the minimal volume which represents the resting volume)**.

57. The O2 consumption of the respiratory muscle is decreased by: **A decrease in airway resistance**

58. Person suffers from stab injury and air entered, when pneumothorax? collapse of the lung -> venous return will decrease significantly -> **the person will die from decreased VR before dying from the collapse.**

59. Which parameter decrease with emphysema? **Diffusion area**

60. Intrapleural pressure: **Always less than alveolar pressure**

61. Tidal volume = 550 ml Pulmonary capacity = 6000 ml Dead space = 150 ml Ventilation rate 14ml/min Resting alveolar ventilation is? Ans: 5.6 L/min

62. Which of the following does not play a role in inspiration: **Relaxation of diaphragmatic muscle.**

63. With tidal volume of 450ml and arterial PCO2 of 40mmHg and mean expired and PCO2 of 32 and respiratory rate of 20/min, alveolar ventilation would be**: 7.2l/min**
64. Surfactants prevent lung collapse by: **Decreasing the pressure within alveoli**
65. Wrong about COPD: **decreased compliance**
66. Wrong about physiological dead space: **decreased in pulmonary embolism**
67. Wrong about restrictive diseases: **FEV1.0 is unchanged**
68. True regarding pneumothorax: **lung collapsed inwards and chest springs outwards**
69. True about the end of forced expiration: **lung tending to collapse, chest expand, lung-chest expand**
70. Lowest PCO2 is found in: **first portion of expired air**
71. True in case of fibrosis: **decreased RV, VC & TLC.**
72. which of the following test can be used to detect diffusion capacity abnormalities of the lung: **diffusion capacity of CO**
73. if at rest alveolar pressure was 0 and IPP was -4 mmHg, which of the following represent pressures at the end of inspiration with an open epiglottis: **alveolar pressureis 0 and IPP is: -6 mmHg.**
74. which of the following decrease during emphysema: **surface area of perfusion**
75. True regarding a patient with pulmonary fibrosis: **Decreased peak expiratory flow, decreased FEV1 and increase collapsing forces**
76. True regarding the diffusion capacity (DL) for oxygen: **Is indirectly measured through CO.**
77. One is considered a wrong statement: CO2 dissolved is less than O2 dissolved.
78. RR=10 breaths/minute, tidal volume=600mL, Vd=150mL, then respiratory minute ventilation (RMV) and alveolar ventilation (AV) respectively: **6L/minute, 4.5L/minute**
79. the base of the lungs receives more inspired air due to the fact: **base is more compliant**
80. Wrong regarding an individual with pulmonary edema, which is wrong: oxygen transport becomes "perfusion" limited.
81. Which of the following should be avoided with emphysema patient: **pure O2 supplementation**

Explanation: treating a chronic emphysema patient with oxygen **increased the blood oxygen levels too rapidly**. This may result in knocking out his hypoxic drive resulting in apnea, hypercapnia and causing further depression of the respiratory drive leading to respiratory failure.

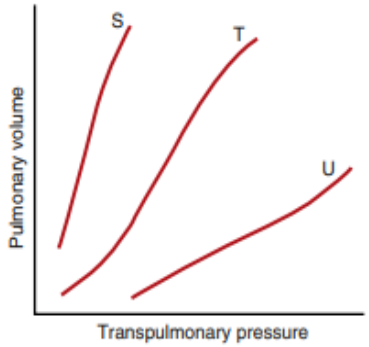
Physiology-Selected Book questions (Guyton, BRS)

1- The pleural pressure of a normal 56-year-old woman is approximately −5 cm H2O during resting conditions immediately before inspiration (i.e., at functional residual capacity [FRC]). What is the pleural pressure (in cm H2O) during inspiration?
a- +1

b- +4
c- 0
d- −3
e- -7

Answer: e

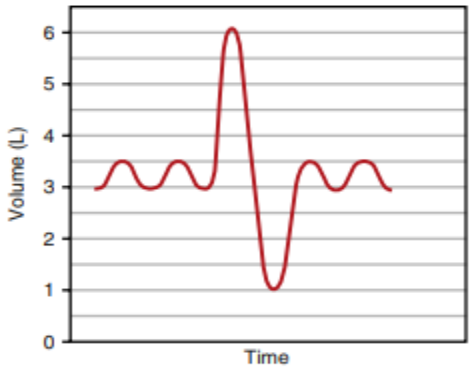
2- The above figure shows three different curves (S, T, and U) for isolated lungs subjected to various transpulmonary pressures. Which of the following best describes the relative compliances for the three curves?



a- S < T < U
b- S < T > U
c- S − T − U
d- S > T < U
e- S > T > U

Answer: e

3- A 22-year-old woman inhales as much air as possible and exhales as much air as she can, producing the spirogram shown in the figure. A residual volume of 1.0 liter was determined using the helium dilution technique. What is her FRC (in liters)?



a- 2.0
b- 2.5
c- 3.0
d- 3.5
e- 4.0
f- 5.0

Answer: a

4- The various lung volumes and capacities include the total lung capacity (TLC), vital capacity (VC), inspiratory capacity (IC), tidal volume (VT), expiratory capacity (EC), expiratory reserve volume (ERV), inspiratory reserve volume (IRV), functional residual capacity (FRC), and residual volume (RV). Which of the following lung volumes and capacities can be measured using direct spirometry without additional methods?

	TLC	VC	IC	VT	EC	ERV	IRV	FRC	RV
A)	No	No	Yes	No	Yes	No	Yes	No	No
B)	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
C)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
D)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
E)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Answer: B

5- With a slow decrease in left heart function, which of the following will minimize the formation of pulmonary edema?

a- An increase in plasma protein concentration due to fluid loss
b- Increase in the negative interstitial hydrostatic pressure
c- Increased pumping of lymphatics

d- Increase in the concentration of interstitial protein

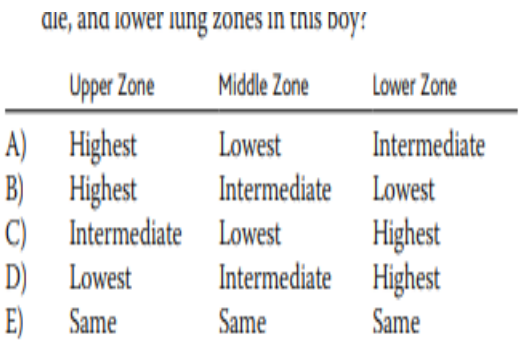
Answer: C

6- A patient has a dead space of 150 milliliters, FRC of 3 liters, VT of 650 milliliters, ERV of 1.5 liters, TLC of 8 liters, and respiratory rate of 15 breaths/min. What is the alveolar ventilation (Va)?

a- 5 L/min
b- 7.5 L/min
c- 6.0 L/min
d- 9.0 L/min

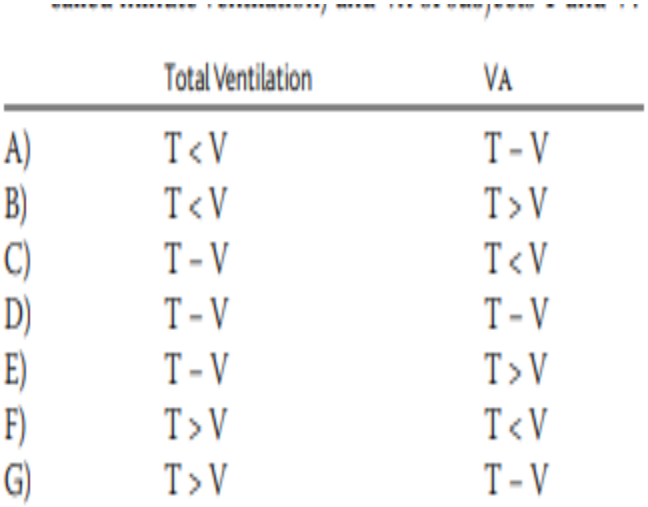
Answer: B

7- A healthy 10-year-old boy Mohammad Emyan breathes quietly under resting conditions. His tidal volume is 400 milliliters and his ventilation frequency is 12/min. Which of the following best describes the ventilation of the upper, middle, and lower lung zones in this boy?



Answer: D

8- An experiment is conducted in two persons (subjects T and V) with identical VTs (1000 milliliters), dead space volumes (200 milliliters), and ventilation frequencies (20 breaths per minute). Subject T doubles his VT and reduces his ventilation frequency by 50%. Subject V doubles his ventilation frequency and reduces his VT by 50%. What best describes the total ventilation (also called minute ventilation) and Va of subjects T and V?



Answer: E

9- If alveolar surface area is decreased 50% and pulmonary edema leads to a doubling of diffusion distance, how does diffusion of O2 compare with normal?

a- 25% increase
b- 50% increase
c- 25% decrease
d- 50% decrease
e- 75% decrease

Answer: E

10-Which of the following sets of differences best describes the hemodynamics of the pulmonary circulation when compared with the system circulation?

	Flow	Resistance	Arterial Pressure
A)	Higher	Higher	Higher
B)	Higher	Lower	Lower
C)	Lower	Higher	Lower
D)	Lower	Lower	Lower
E)	Same	Higher	Lower
F)	Same	Lower	Lower

Answer: F

11- Blood gas measurements are obtained in a resting patient who is breathing room air. The patient has an arterial content of 19 ml O2/min with a Po2 of 95. The mixed venous O2 content is 4 ml O2/100 ml blood. Which condition does the patient have?

a- An increase in physiological dead space
b- B Pulmonary edema
c- A low Hb concentration
d- A low cardiac output

Answer: D

12- A normal male subject has the following initial conditions (in the steady state), If you ignore the contribution of dissolved O2 to the O2 content, what is the venous O2 content?

a- 2.2 ml O2/100 ml blood
b- 3.2 ml O2/100 ml blood
c- 4 ml O2/100 ml blood
d- 4.6 ml O2/100 ml blood
e- 6.2 ml O2/100 ml blood
f- 10.8 ml O2/100 ml blood
g- 16 ml O2/100 ml blood

Answer: D

13- The forces governing the diffusion of a gas through a biological membrane include the pressure difference across the membrane (ΔP), the cross-sectional area of the membrane (A), the solubility of the gas (S), the distance of diffusion (d), and the molecular weight of the gas (MW). Which changes increase the diffusion of a gas through a biological membrane?

Answer: E

	ΔP	A	S	d	MW
A)	Increase	Increase	Increase	Increase	Increase
B)	Increase	Increase	Increase	Increase	Decrease
C)	Increase	Decrease	Increase	Decrease	Decrease
D)	Increase	Increase	Increase	Decrease	Increase
E)	Increase	Increase	Increase	Decrease	Decrease

14- Arterial Po2 is 100 mm Hg and arterial Pco2 is 40 mm Hg. Total blood flow to a muscle is 700 ml/min. There is a sympathetic activation resulting in a decrease in blood flow of this muscle to 350 ml/min. There is no neuromuscular activation, and thus no contraction of the muscle. Which of the following will occur?

Answer: B

	Venous P_{O_2}	Venous P_{CO_2}
A)	↑	↓
B)	↓	↑
C)	↓	↔
D)	↔	↑
E)	↑	↑
F)	↓	↓
G)	↔	↔

15- . A 45-year-old man at sea level has an inspired O2 tension of 149 mm Hg, nitrogen tension of 563 mm Hg, and water vapor pressure of 47 mm Hg. A small tumor pushes against a pulmonary blood vessel, completely blocking the blood flow to a small group of alveoli. What are the O2 and carbon dioxide (CO2) tensions of the alveoli that are not perfused (in mm Hg)?

Answer: B

	CO_2	O_2
A)	0	0
B)	0	149
C)	40	104
D)	47	149
E)	45	149

16- Which of the following best describes the effect of decreasing V/Q ratio on the alveolar Po2 and Pco2?

Answer: D

	CO_2 Tension	O_2 Tension
A)	Decrease	Decrease
B)	Decrease	Increase
C)	Decrease	No change
D)	Increase	Decrease
E)	Increase	Increase

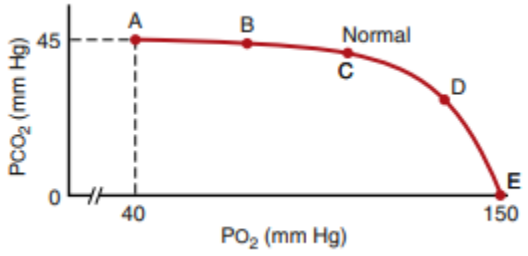
17- A 23-year-old medical student has mixed venous O2 and CO2 tensions of 40 mm Hg and 45 mm Hg, respectively. A group of alveoli are not ventilated in this student because mucus blocks a local airway. What are the alveolar O2 and CO2 tensions distal to the mucus block (in mm Hg)?

Answer: C

	CO_2	O_2
A)	40	100
B)	40	40
C)	45	40
D)	50	50
E)	90	40

18- A 67-year-old man has a solid tumor that pushes against an airway, partially obstructing air flow to the distal alveoli. Which point on the V/Q line of the O2- CO2 diagram below corresponds to the alveolar gas of these distal alveoli?

Answer: B

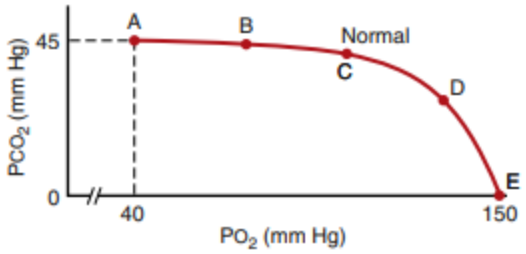


Explanation: When the ventilation is reduced to zero (Va/Q = 0), alveolar air equilibrates with the mixed venous blood entering the lung, which causes the gas composition of the alveolar air to become identical to that of the blood. This occurs at point A, where the alveolar Po2 is 40 mm Hg and the alveolar Pco2 is 45 mm Hg, as shown in the figure. A reduction in Va/Q (caused by the partially obstructed airway in this problem) causes the alveolar Po2 and Pco2 to approach the values achieved when Va/Q = 0.

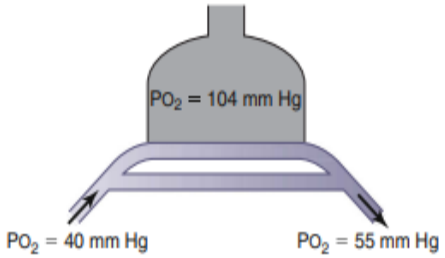
19- Using the same previous figure, A 55-year-old man has a pulmonary embolism that completely blocks the blood flow to his right lung. Which point on the V/Q line of the O2-CO2 diagram above corresponds to the alveolar gas of his right lung?

Answer: E

Explanation: An increase in Va/Q caused by the partially obstructed blood flow in this problem causes the alveolar Po2 and Pco2 to approach the values achieved when Va/Q = ∞. The point at which Va/Q is equal to infinity corresponds to point E in the figure (inspired gas).



20- The figure above shows a lung with a large shunt in which mixed venous blood bypasses the O2 exchange areas of the lung. Breathing room air produces the O2 partial pressures shown on the diagram. What is the O2 tension of the arterial blood (in mm Hg) when the person breathes 100% O2 and the inspired O2 tension is greater than 600 mm Hg?



a- 40
b- 55
c- 60
d- 175
e- 200
f- 600

Answer: C

Explanation: Breathing 100% O2 has a limited effect on the arterial Po2 when the cause of arterial hypoxemia is a vascular shunt. However, breathing 100% O2 raises the arterial Po2 to more than 600 mm Hg in a normal subject. With a vascular shunt, the arterial Po2 is determined by (a) highly oxygenated end-capillary blood (Po2 > 600 mm Hg) that has passed through ventilated portions of the lung, and (b) shunted blood that has bypassed the ventilated portions of the lungs and thus has an O2 partial pressure equal to that of mixed venous blood (Po2 = 40 mm Hg). A mixture of the two bloods causes a large fall in Po2 because the O2 dissociation curve is so flat in its upper range.

21- An anesthetized man is breathing with no assistance. He then undergoes artificial ventilation for 10 minutes at his normal VT but at twice his normal frequency. He undergoes ventilation with a gas mixture of 60% O2 and 40% nitrogen. The artificial ventilation is stopped, and he fails to breathe for several minutes. This apneic episode is due to which of the following?

a- High arterial Po2 suppressing the activity of the peripheral chemoreceptors
b- Decrease in arterial pH suppressing the activity of the peripheral chemoreceptors
c- Low arterial Pco2 suppressing the activity of the medullary chemoreceptors
d- High arterial Pco2 suppressing the activity of the medullary chemoreceptors
e- Low arterial Pco2 suppressing the activity of the peripheral chemoreceptors

Answer: C

Explanation: This patient would have increased alveolar ventilation (Va) because of increase in the respiratory frequency, therefore resulting in a decrease in arterial Pco2. The effect of this decrease in Pco2 would be an inhibition of the chemo sensitive area and a decrease in ventilation until Pco2 was back to normal. Breathing high O2 does not decrease nerve activity sufficient to decrease respiration. The response of peripheral chemoreceptors to CO2 and pH is mild and does not play a major role in the control of respiration.

End of physiology questions.