

## QUIZ HUBIO 541 - THE RESPIRATORY SYSTEM

Nov. 16, 2005

Use a number 2 pencil to mark your answer sheet.

Under ID NUMBER print your **UW student number** and under SPECIAL CODES print your **School of Medicine ID number**. Mark the corresponding grids.

Print your **name (LAST NAME FIRST)** in the spaces provided and mark the corresponding grid under each space.

**Please** use the **far right hand column of the name grid** to indicate your **GROUP**.

**Grp 1 = A; 2 = B, 3 = C; 4 = D; 5 = E; 6 = F; 7 = G; 8 = H.**

Mark the group you are attending. If not attending a group, mark **X**

Be certain that **ALL** information is correctly and completely gridded.

When marking an answer, be sure that you are marking beside the proper question number. Mark only one choice for each of the first 48 items. Erase completely if you change an answer. After completing the examination, check for and correct light or stray marks, poor erasures and multiple answers.

Questions 1-10 will count 2 points each; questions 11-30 will count 1 point each, and the last page will count 20 points for a total exam score of 60 points.

1. I have read the instructions above and
  - A. I'm one of the 10% that never get the word.
  - B. I'm one of the 5% that screw it up anyway.
  - C. I refuse to use a number associated with a 2-8 football team.
  - D. I can't be bribed by a mere 2 points.
  - E. I have correctly entered name, UW number, SOM ID, and **Group** number.  
(this answer will self-destruct if not proven true!)
  
2. Which of the following values can be obtained by spirometry?
  - A. FRC - Functional Residual Capacity
  - B. TLC - Total Lung Capacity
  - C. VC - Vital Capacity
  - D. DL - Diffusion Capacity
  - E. RV - Residual Volume
  
3. Starting from FRC you take a slow deep breath, pause, then passively exhale. During this maneuver, which one of the following statements could be true?
  - A. Pleural pressure stays near -5 cm H<sub>2</sub>O, while alveolar pressure rises from zero to +25 cm H<sub>2</sub>O.
  - B. Pleural pressure falls to -10 cm H<sub>2</sub>O, while alveolar pressure falls to -25 cm H<sub>2</sub>O.
  - C. Pleural pressure falls to -25 cm H<sub>2</sub>O, then rises to +25 on exhalation.
  - D. Pleural pressure falls to -25 cm H<sub>2</sub>O, while alveolar pressure never falls below zero.
  - E. Pleural pressure falls to -30 cm H<sub>2</sub>O, while alveolar pressure falls to -5 cm H<sub>2</sub>O, then rises to +5 cm H<sub>2</sub>O during exhalation.

4. During the latter portion of a forced expiration, the maximum flow rate is:
- limited by the turbulence of air in the trachea.
  - effort-dependent.
  - limited by dynamic airway compression.
  - determined by diaphragmatic strength.
  - measured as the FEV<sub>1</sub>
5. A patient aspirated a grape which now partially obstructs the right mainstem bronchus. The distal alveoli are normal but the ventilation to the right lung is only half of that to the left lung. What distribution of his 6 liter/minute total pulmonary blood flow would lead to the best arterial PO<sub>2</sub>?
- Left 0 ; Right 6
  - Left 2 ; Right 4
  - Left 3 ; Right 3
  - Left 4 ; Right 2
  - Left 6 ; Right 0
6. Which one of the following relationships is correct?:
- $P_{atm}O_2 = P_{A}O_2 > P_{a}O_2$
  - $P_{atm}O_2 < P_{A}O_2 > P_{a}O_2$
  - $P_{atm}O_2 > P_{A}O_2 > P_{a}O_2$
  - $P_{atm}O_2 + P_{A}O_2 = P_{a}O_2$
  - $P_{atm}O_2 - P_{A}O_2 = P_{a}O_2$
7. An oceanographer is in a deep sea submersible in which the pressure is three atmospheres. Assuming that 1 atmosphere = 760 mm Hg , F<sub>I</sub>O<sub>2</sub> = 0.21, the oceanographer's PaCO<sub>2</sub> is 40 mm Hg and she has an R value of 0.8 , the correct value for her alveolar PO<sub>2</sub> is closest to:
- 100 mmHg
  - 200 mm Hg
  - 300 mm Hg
  - 400 mm Hg
  - 500 mm Hg
8. A tendency to hypoventilate would be opposed by all of the following **EXCEPT**:
- the effect of PaCO<sub>2</sub> on the peripheral chemoreceptors
  - the effect of PaCO<sub>2</sub> on the central chemoreceptors
  - the effect of PaO<sub>2</sub> on the central chemoreceptors
  - the effect of pH on the peripheral chemoreceptors
  - the effect of pH on the central chemoreceptors
9. An increase in the calculated (A-a)ΔO<sub>2</sub> would be expected in:
- an otherwise normal subject who is hypoventilating.
  - an otherwise normal subject who is hyperventilating.
  - an otherwise normal subject at high altitude.
  - an otherwise normal subject breathing 12% oxygen.
  - an otherwise normal subject whose coronary veins all drain into the left heart.

10. When an otherwise normal subject acutely hypoventilates, all of the following occur **EXCEPT**:
- $H^+$  and  $HCO_3^-$  ions are formed.
  - most of the added  $H^+$  ions will combine with  $HCO_3^-$  to form  $CO_2$ .
  - the  $HCO_3^-$  will rise by 1 mEq/liter for each 0.1 unit fall in pH.
  - the number of  $H^+$  ions associated with hemoglobin will increase.
  - A respiratory acidosis will develop.

**Questions 11-30** consist of a statement followed by numbered options, **any or all** of which may be correct. For each numbered option: answer **A** if the statement is **true** or answer **B** if the statement is **false**.

At Functional Residual Capacity (FRC):

- the lung has a positive recoil force (wants to be smaller).
- the chest wall has a negative recoil force (wants to be larger).
- the lung and chest wall have equal but opposite recoil forces.

At the end of a normal exhalation, gas in the trachea will have:

- a higher partial pressure of  $CO_2$  than the atmosphere.
- a  $PO_2$  which is the same as the atmospheric  $PO_2$ .
- a water vapor pressure near 47 mmHg.

A rounded density visualized on a standard PA chest radiograph just lateral to the right hilum and above the minor fissure could be in the:

- right upper lobe
- right middle lobe
- right lower lobe
- parietal pleura

A heavy cigar smoker has 15% of his hemoglobin saturated by carbon monoxide. Expected physiologic consequences and responses include:

- increased cardiac output.
- decreased  $PaO_2$ .
- increased hemoglobin-oxygen saturation.
- decreased arterial oxygen content.

An 18 year old man with cystic fibrosis presents with an acute illness. The arterial blood gas analysis while breathing room air revealed

$PaO_2$  40 mmHg,  $PaCO_2$  64 mmHg, pH of 7.30 and  $HCO_3^-$  of 32. (R= 0.8)

- The (A-a) $\Delta O_2$  is 60.
- The BE is +9
- A metabolic acidosis is present
- The acid-base data are compatible with chronic hypoventilation.

During lung inflation above FRC

- Extra-alveolar pulmonary blood vessels tend to increase in diameter.
- The resistance to flow through alveolar capillaries tends to increase.

ANSWER IN THE  
SPACE PROVIDED

Name \_\_\_\_\_

UW Student No. \_\_\_\_\_

The following four part question is a **required** portion of this quiz, worth 20 points.

Consider a local region of alveoli served by a small airway and its associated circulation. If the remainder of the lung functions normally, describe and explain the changes in  $PO_2$  in these alveoli and in the blood leaving their capillaries in the following conditions:

The airway is narrowed so that ventilation is markedly decreased, blood flow unchanged.

The blood flow is markedly reduced, ventilation is normal.

The airway is completely occluded.

What would happen to local blood flow in the last condition (occluded airway)?. Why?