

**Part I. Answer these questions by marking the best answer among the choices given: [5 points each]**

1. The reasons for using a ventilator on a patient do NOT include ...
  - a. Problems in increased airway resistance
  - b. Problems in respiratory muscles
  - c. Problems in short contact time (\*)
  - d. Problems in respiratory timing/control
2. When applying the same pressure to two balloons, the first balloon expanded twice as much as the second. This means that the first balloon has ... compliance than the second.
  - a. Four times
  - b. Double (\*)
  - c. Same
  - d. Half
3. The difference between peak inspiratory pressure and plateau pressure is due to ...
  - a. Low compliance of proximal airways (\*)
  - b. Low compliance of alveoli
  - c. High compliance of proximal airways
  - d. High compliance of alveoli
4. Total assumption of respiratory work by the ventilator is necessary in ... breathing mode.
  - a. Spontaneous
  - b. Assisted
  - c. Synchronized
  - d. Mandatory (\*)
5. Gas mixers ensure that the breathing gas is prepared and delivered with required ...
  - a. Quantity and composition (\*)
  - b. Humidity
  - c. Temperature
  - d. All of the above
6. Mechanical ventilators must be based on ... design.
  - a. Filtered breathing circuit
  - b. Rebreathing circuit
  - c. Non-rebreathing circuit (\*)
  - d. Spontaneous breathing
7. The ventilation mode that involves inspiratory and expiratory cycling base on time while not allowing triggered breaths is called ... ventilation.
  - a. Spontaneous
  - b. Mandatory (\*)
  - c. Synchronized
  - d. Assisted
8. When the breathing control of the patient is intact while his respiratory muscles are weak, the suitable ventilation mode should be ...
  - a. Mandatory breathing
  - b. Spontaneous breathing
  - c. Supported spontaneous breathing (\*)
  - d. Controlled ventilation
9. The variable that is measured and used to start inspiration is called ...
  - a. Trigger variable (\*)
  - b. Limit variable
  - c. Cycle variable
  - d. Baseline variable
10. For a patient with irregular breathing that causes the tidal volume to vary, ... should be a suitable administration device.

- Nasal cannula
- Variable performance mask
- Variable performance mask with reservoir (\*)
- Fixed performance mask

**Part II. Mark the following statement as either True (T) or False (F): [3 points each]**

- Gas flows from larger to smaller alveoli in the lungs. (T)
- Surface tension inside the alveoli is constant. (F)
- When using 100% oxygen for respiration, the speed of gas exchange will be higher. (T)
- Contact time is lower during exercise because of the higher heart rate. (T)
- Filtered ambient air may be used by some ventilator instead of hospital compressed air supply. (T)
- It is possible to use the mixer to prepare breathing gas of 15% oxygen concentration. (F)
- Variable performance masks are based on the Venturi mechanism. (F)
- The advantages of using CPAP include the increased respiratory volume. (T)
- Inspiratory cycling variable in ventilators can be either time or volume. (F)
- Spontaneous breaths are always accommodated in all ventilation modes. (F)

**Part III. Answer the following question: [10 points each]**

- It is desired to deliver a volume of breathing gas of 100 mL with oxygen concentration of 40% to a patient. Compute how compressed air and oxygen will be mixed to do that.

$$V_{\text{air}} + V_{\text{oxygen}} = 100 \text{ mL}$$

$$V_{\text{air}} \times 0.2 + V_{\text{oxygen}} = 100 \text{ mL} \times 0.4 = 40$$

$$\text{Hence, } V_{\text{air}} = 60/0.8 = 75 \text{ mL} \quad \text{and} \quad V_{\text{oxygen}} = 25 \text{ mL}$$

- Modify the following diagram to show the pressure waveform when the ventilator operates in the synchronized mandatory ventilation mode.

