1. Label the respiratory system diagram below and provide a brief description of each structure's functions.

- alveoli
- diaphragm
- larynx
- pleura
- pharynx
- trachea
- bronchial tube
- bronchioles
- nasal cavity

- nasal cavity = warms, moistens and filters air
- pharynx = where food and air cross to enter esophagus and trachea, respectively
- larynx = voice box
- trachea = carries air from pharynx to bronchi of lungs
- Bronchial tubes = branch from trachea into each lung
- Pleura = membranes surrounding and protecting lungs
- Bronchioles = smaller branches off of bronchial tubes
- alveoli = blind air sacs where gas exchange occurs with capillaries
- diaphragm = contracts for inhalation, relaxes for exhalation

2. Use a flow chart with arrows to describe the path of air flow from the nose to the alveoli during inspiration.
   
nose/mouth → pharynx → glottis → trachea → bronchi → bronchioles → alveoli

3. Describe how debris and particulate in air is removed from the lungs.
   = captured by mucus lining trachea and lungs, then mucus is propelled up to mouth by cilia, where it is then swallowed or spat out of the body
   = sometime coughing is necessary to help move mucus upwards
4. Where is the respiratory center located?
   = medulla oblongata of brain

5. What stimuli signal the respiratory center to initiate breathing?
   = increased CO₂ and H⁺ concentration stimulate increased breathing rate via the respiratory center of the medulla oblongata

6. What prevents the alveoli from over filling during forced inhalation such as when exercising?
   = alveolar stretch receptors detect inflation of alveoli and send a signal via the Vagus nerve to the respiratory center of the medulla oblongata that stops the phrenic nerve and intercostal nerves from stimulating the diaphragm and intercostal muscles from contracting, resulting in relaxation of these muscles and exhalation

7. How does oxygen gas move from the alveoli to the blood across the walls of the alveoli and the capillary?
   = diffusion

8. Oxygen is actually transported throughout the blood primarily as a complex within red blood cells, what is this complex called?
   = oxyhemoglobin

9. In what form is carbon dioxide found in plasma? Carbon dioxide reacts with water in red blood cells to produce what compounds? What enzyme assists in this process? How does hemoglobin help with carbon dioxide transported by red blood cells?
   = dissolved CO₂ in plasma
   = when CO₂ reacts with H₂O in red blood cells it is converted to bicarbonate ions (HCO₃⁻) and hydrogen ions (H⁺)
   = carbonic anhydrase
   = reacts with CO₂ to form carbaminohemoglobin

10. Hemoglobin helps to buffer the blood by binding to excess hydrogen ions. What is the name of the complex that forms between hydrogen ions and hemoglobin?
    = reduced hemoglobin

11. Give the full name for the following abbreviated compounds related to respiration and gas exchange.

    O₂ = oxygen
    Hb = hemoglobin
    HHb = reduced hemoglobin
    H⁺ = hydrogen ion
    HCO₃⁻ = bicarbonate ion
    CO₂ = carbondioxide
    HbO₂ = oxyhemoglobin
    HbCO₂ = carbaminohemoglobin
    H₂CO₃ = carbonic acid
    H₂O = water
12. List the set of equations that describe **external respiration in the alveoli of the lungs**. Remember the alveoli supply oxygen to the blood and receive carbon dioxide and water from the blood for removal.

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\begin{align*}
\text{Hb} + \text{O}_2 & \rightarrow \text{HbO}_2 \\
\text{HbCO}_3 & \rightarrow \text{Hb} + \text{CO}_2 \\
\text{HHb} & \rightarrow \text{Hb} + \text{H}^+ \\
\text{H}^+ + \text{HCO}_3^- & \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2
\end{align*}
\]

13. List the set of equations that describe **internal respiration in the capillary bed** between the capillary and the tissue fluid. Remember the tissues receive oxygen from the blood and dump carbon dioxide and water into the blood.

\[
\begin{align*}
\text{HbO}_2 & \rightarrow \text{Hb} + \text{O}_2 \\
\text{H}_2\text{O} + \text{CO}_2 & \rightarrow \text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^- \\
\text{Hb} + \text{CO}_2 & \rightarrow \text{HbCO}_3 \\
\text{Hb} + \text{H}^+ & \rightarrow \text{HHb}
\end{align*}
\]