Air Before Exchange

How airway structures prepare each breath

HAP.12.2 "Describe structural adaptations of the respiratory tract and relate these structural features to the function of preparing incoming air for gas exchange at the alveolus."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline four airway structures that change or guide incoming air. Circle what each structure does, then draw a line connecting each structure to its action.

A Breath on a Cold Morning

1. On a cold, dusty morning, a runner inhales through her nose. Air does not travel down a smooth, empty tube. Curved shelves of bone called nasal conchae make it swirl across the nasal lining, increasing contact with that surface. A rich network of blood vessels beneath the lining transfers heat to the air. Moist tissue adds water vapor, so the air is less likely to dry the delicate surfaces farther inside. Coarse hairs near the nostrils trap larger particles. These features change chilly, dry, dusty air before it reaches the deep lung spaces where gas exchange occurs.

2. The runner's next airway, the trachea, must stay open even when her neck bends. C-shaped rings of cartilage brace its walls without forming a rigid pipe. Inside the trachea and larger bronchi, sticky mucus catches fine dust and microbes that escaped the nose. Tiny moving cilia on lining cells sweep the mucus upward toward the throat, where it can be swallowed or coughed out. This clearing action keeps particles from piling up near the alveoli. If debris reaches those tiny air sacs, it can irritate or damage the thin surface across which oxygen and carbon dioxide move.

3. The bronchi divide repeatedly into smaller tubes, ending in bronchioles that lead toward clusters of alveoli. Smooth muscle in bronchiole walls can change the width of these small passages, affecting how easily air reaches the sacs. Each alveolus has a very thin, moist wall beside tiny blood vessels. The moist surface helps gases dissolve, and the short distance across the wall lets oxygen enter blood while carbon dioxide leaves it. Warming, moistening, and cleaning incoming air help preserve that exposed surface. The route works as a team: open passages deliver air, while earlier structures prepare it for exchange.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the shape of the nasal conchae and the blood vessels beneath the nasal lining work together to warm incoming air?

2. How does moist tissue in the nose help protect surfaces deeper in the respiratory tract?

3. How do mucus and cilia in the trachea and larger bronchi work together to keep particles away from the alveoli?

4. How do cartilage rings in the trachea and smooth muscle in the bronchioles each help air reach the alveoli?

3 YOUR TURN

Your own words

Invent a breathing mask for a cold, dusty run, inspired by two different airway adaptations. In four sentences, describe two mask parts, name the airway structures they copy, and explain how each part would help air arrive ready for gas exchange at the alveoli.

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PART 1 · READ AND MARK

Underline four airway structures that change or guide incoming air. Circle what each structure does, then draw a line connecting each structure to its action. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the shape of the nasal conchae and the blood vessels beneath the nasal lining work together to warm incoming air?	**The conchae make air swirl against the nasal lining, increasing contact with the surface where blood vessels transfer heat to the air.**
2	How does moist tissue in the nose help protect surfaces deeper in the respiratory tract?	**It adds water vapor to incoming air, making the air less likely to dry the delicate surfaces farther inside.**
3	How do mucus and cilia in the trachea and larger bronchi work together to keep particles away from the alveoli?	**Mucus catches fine particles, and cilia sweep the mucus toward the throat to be swallowed or coughed out.**
4	How do cartilage rings in the trachea and smooth muscle in the bronchioles each help air reach the alveoli?	**Cartilage rings keep the trachea open. Smooth muscle changes the width of bronchioles, affecting how easily air reaches the alveoli.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A soft filter layer copies the mucus lining in the trachea by catching fine dust before it reaches the alveoli. A breathable inner layer that holds moisture from exhaled air copies the moist nasal lining. That layer adds water vapor to dry incoming air. Together, the parts reduce debris and dryness at the thin alveolar walls, helping keep those surfaces suitable for gas exchange.

Accept any four accurately connected structure-and-function pairs for the marking job. For the mask task, accept plausible mask parts modeled on two distinct airway adaptations, with an accurate explanation of how both help prepare air for the alveoli.