**B6 - RESPIRATION**

**6.2 Gas Exchange**

1. **Identify on diagrams and name the larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries.**





1. **List the features of gas exchange surfaces in animals.**
* Wall of the alveolus is thin (a single layer of cells) to allow gases to diffuse across them quickly;
* They are moist to prevent the cells from drying and to allow gases to dissolve;
* They have a large surface area , so that a lot of gas can diffuse across at the same time;
* They have a high concentration gradient - maintained by the movement of air & blood.
1. **Explain the role of mucus and cilia in protecting the gas exchange system from pathogens and particles.**

 **Air**

**Diagram of lining of trachea**

* The lining contains two kinds of cells: Goblet cells and ciliated cells;
* Goblet cells make sticky, slimy mucus;
* Many of the bacteria in the air and dust particles get trapped in the mucus;
* Ciliated cells have tiny, microscopic hair on them called cilia;
* The cilia beat in unison, and sweep the mucus upwards, towards the back of the throat.
1. **Describe the effects of tobacco smoke and its major toxic components (tar, nicotine, carbon monoxide, smoke particles) on the gas exchange system.**

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| Chemical | Effects on gas exchange system |
| Carbon monoxide | A poisonous gas; combines with hemoglobin in RBC, preventing them from transporting oxygen |
| Nicotine | Addictive; increases heart rate & blood pressure |
| Smoke particles | Irritate the air passages, causing inflammation & increased mucus production, resulting in chronic bronchitis; coughing and the presence of particles in the alveoli can lead to emphysema (breaking the walls of the alveoli) |
| Tar | A carcinogen - increases the risk of lung cancer; lines the air passages, increasing mucus production and paralyzing and damaging cilia, causing bronchitis. |

1. **State the differences in composition between inspired and expired air.**

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| --- | --- | --- | --- |
| *Gas* | *Inspired air %* | *Expired air %* | *Explanation* |
| Nitrogen | 79 | 79 | Not used or produced by body processes |
| Oxygen | 21 | 16 | Used up in the process of respiration |
| Carbon dioxide | 0.04 | 4 | Produced in the process of respiration |
| Water vapour | Variable | Saturated | Produced in the process of respiration, moisture evaporates from the surface of the alveoli |

1. **Use lime water as a test for carbon dioxide to investigate the differences in composition between inspired and expired air.**

*IGCSE Biology* (Jones & Jones), p. 122, activity 9.5 ‘comparing the CO2 content of inspired & expired air’.

1. **Investigate and describe the effects of physical activity on rate and depth of breathing.**
2. **Explain the effects of physical activity on the rate and depth of breathing.**
* The volume of air breathed in and out during normal, relaxed breathing is about 0.5 litres (the tidal volume);
* The breathing rate is about 12 breaths per minute;
* During exercise, the volume inhaled (depth) increases to about 5 litres ( depending on the age, sex, size and fitness of the person);
* The maximum amount of air breathed in and out in one breath is the vital capacity;
* The breathing rate can increase to over 20 breaths per minute;
* The total lung volume is greater than the vital capacity because some air always remains in the lungs (otherwise the lungs would collapse and the alveoli walls would stick together)
* Breathing rate and depth increase to absorb more oxygen for the muscles as exercising muscles need to respire more to get more energy.