

LESSON 3.1 - AN INTRODUCTION TO RESPIRATION

Overview:

Students will share any experiences that they may have had with respiratory illness or distress, brainstorm what they know and would like to learn about the respiratory system, and complete an introductory vocabulary, reading and question package.

Suggested Timeline: 1.5 hours

Materials:

- Reflections on the Respiratory System (Student Handout)
- An Introduction to Respiration (Student Handout)

Method:

INDIVIDUAL FORMAT:

1. Have students complete Reflections on the Respiratory System (Student Handout) and submit their sheet. Use the information about what students would like to learn about the respiratory system as a guide for extensions to this section of the human systems unit.
2. Have students complete the vocabulary, reading and question package An Introduction to Respiration (Student Handout).

GROUP FORMAT:

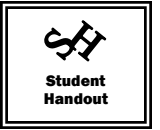
1. Have students complete Reflections on the Respiratory System (Student Handout).
2. Have students share their information with the class and begin a discussion. Tidbits of information to share:
 - We breathe 13 pints of air each minute.
 - More than half a liter of water is lost per day through breathing.
 - People who are 30 take in double the oxygen compared to a person who is 80. Source: www.medindia.net/know/ur/body/ressystem.asp
 - The right lung is slightly larger than the left lung
 - The surface area of the lungs is roughly the same size as a tennis court. Source: www.fortunecity.com/campus/leftback/1037/respiratory_system.htm
3. Use the information about what students would like to learn about the respiratory system as a guide for extensions to this section of the human systems unit.
4. Have students complete the vocabulary, reading and question package 'An Introduction to Respiration' (Student Handout) and review in class.

Assessment and Evaluation:

- Assessment of student's prior knowledge and understanding of the respiratory system
- Assessment of quality of students' answers to questions in handout
- Student grade on quiz

Extension:

Build a concept map for the respiratory system section of this unit



Name: _____ Date: _____

REFLECTIONS

REFLECTIONS ON THE RESPIRATORY SYSTEM

Think of a time when you had a cold or another, and possibly more serious, health issue that affected your ability to breathe. Describe how it felt.

Complete the first two columns of the chart.

What do you know about the respiratory system?	What do you want to learn about the respiratory system?	What did you learn about the respiratory system?

Name: _____ Date: _____ Period: _____

An Introduction to Respiration

VOCABULARY

respiration –

breathing –

trachea –

bronchi –

alveoli –



PART I: What is Breathing and Respiration?

All living things need energy to live – you, bacteria, grass and dogs! Energy is needed for the cells in your body to function to keep you alive.

Living things get energy the same way your car gets its energy - by burning a fuel. In a car, energy is released when oxygen from the air combines with the gasoline in the engine.

In animals, oxygen is combined with food that has been broken down and energy is released. This life process is called **respiration**. Respiration is the release of energy by combining oxygen with digested food (glucose).

Here is what happens:

digested food + oxygen → energy and waste products

Respiration can also be shown in this way:

Glucose (fuel) + oxygen → energy + water (waste) + carbon dioxide (waste)

In many animals, breathing is done by the action of the lungs. Breathing in is taking air into the lungs and forcing the air out of your lungs.

Breathing and respiration are *related*, but they are not the same. Breathing is the action of air going into and out of your lungs. Respiration is using the oxygen in that air to release energy from the food that you eat.

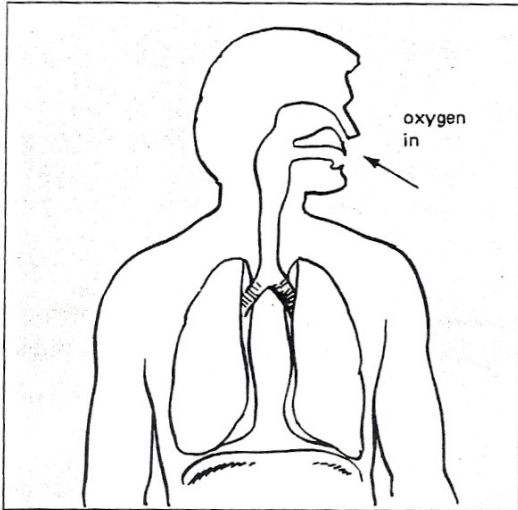


Figure A

Breathing in (inhaling) sends oxygen into the lungs.

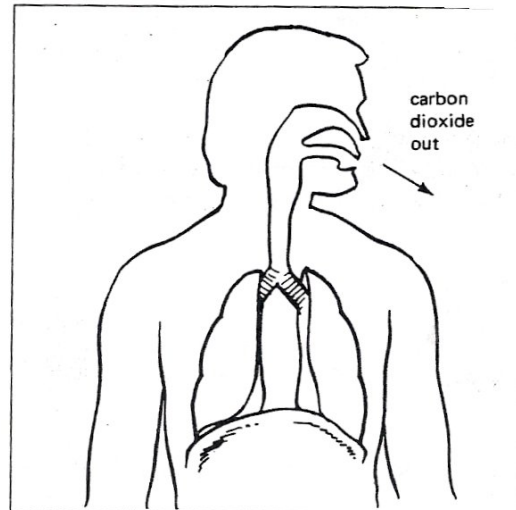


Figure B

Breathing out (exhaling) sends carbon dioxide waste out of the lungs.

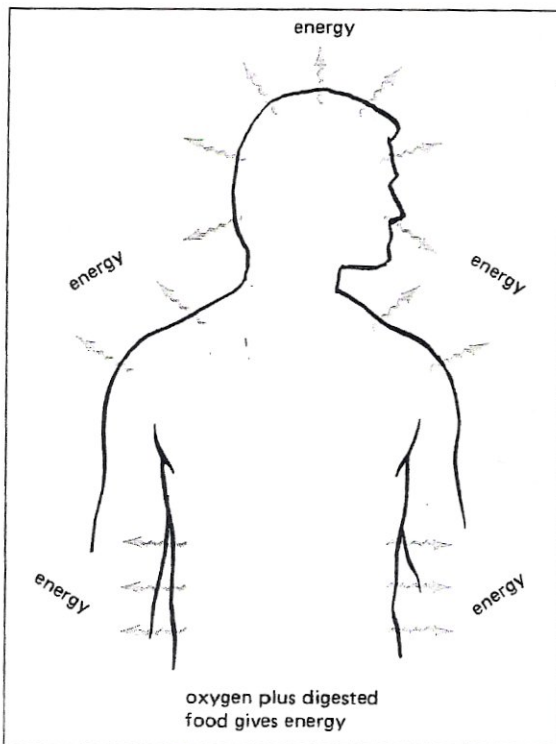


Figure C

Answer these questions about respiration:

1. What brings oxygen to all parts of the body?

2. What does respiration make that living things need?

3. What waste materials does respiration give off?

Breathing is an involuntary process. This means that it occurs without you having to think about it.

How Does Breathing Take Happen?

Why does your chest move when you breathe? Some people think that air in the lungs makes their chest move in and out. This is incorrect. It is actually the moving of your *chest* that makes your lungs expand and contract.

Your chest size changes when you breathe because of the actions of your rib muscles and your **diaphragm** muscle.

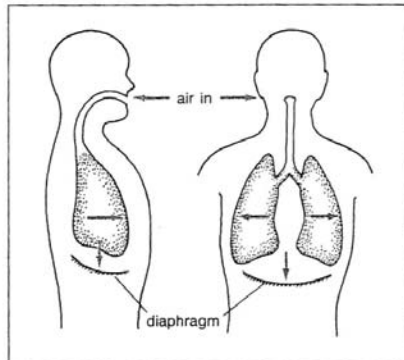


Figure D Inhaling

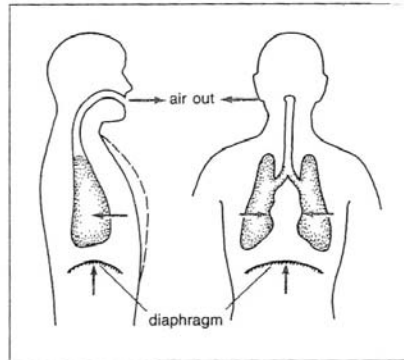


Figure E Exhaling

Choose the correct word and write it in each blank.

- When you inhale (see Figure D),
 - the ribs move _____.
inward OR outward
 - the diaphragm moves _____.
upward OR downward
 - there is now _____ space in the chest area.
more OR less
 - air rushes _____ to fill this space.
in OR out
- When you exhale (see Figure E),
 - the ribs move _____.
inward OR outward
 - the diaphragm moves _____.
upward OR downward
 - there is now _____ space in the chest area.
more OR less
 - because of this pressure, air moves _____ the lungs.
into OR out of

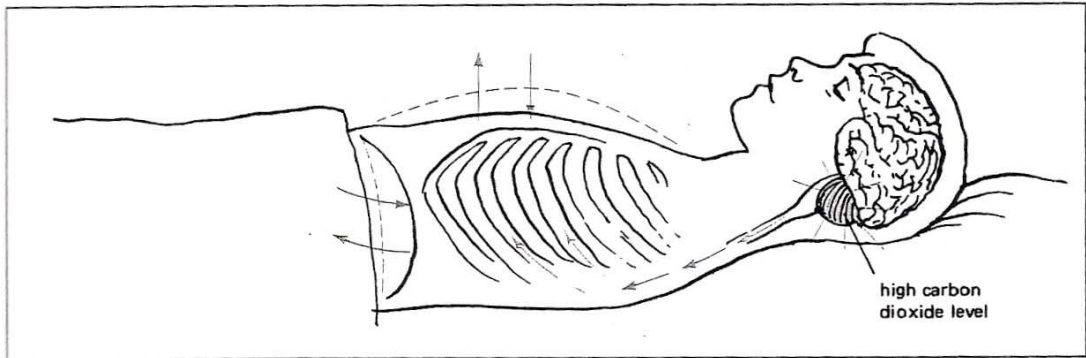


Figure F

What causes you to breathe?

Breathing happens automatically. When the amount of carbon dioxide in your blood increases to a certain level, a message is sent to your brain. Your brain then sends a message to your diaphragm and rib muscles to increase the size of your chest cavity. This causes air to move into the lungs.

Each of the following goes with either inhaling or exhaling. Place a checkmark in the box where you think each statement belongs.

		INHALING	EXHALING
1.	air moves out of the lungs		
2.	air moves into the lungs		
3.	ribs move out		
4.	ribs move in		
5.	chest space becomes smaller		
6.	chest space becomes larger		
7.	diaphragm moves down		
8.	diaphragm moves up		

Adapted from *What is Breathing and Respiration?*, pp. 90-94 *Biology Science Workshop Series*

PART II: What is the Respiratory System?

Almost all living things (except some bacteria) need oxygen to live. The lungs are the organs involved with breathing. They are the main organs that make up the respiratory system. The function of the respiratory system is to take oxygen into the lungs and to get rid of water and carbon dioxide.

This is the path that air takes when you inhale and exhale:

1. Air enters the body through the nose or mouth.
2. The air moves goes into the throat and passes through the windpipe or **trachea**.
3. The trachea divides into two tubes called **bronchi**. Each bronchus extends into one of the lungs.
4. Inside of the lungs, the bronchi branch into smaller and smaller tubes. At end of the smallest tubes are air sacs called **alveoli**. Each alveolus is surrounded by capillaries.

When the air is in the air sacs or alveoli, two important things happen:

- The blood picks up oxygen from the alveoli.
- The alveoli pick up carbon dioxide from the blood.

When you exhale, you breathe out the carbon dioxide. Some waste water and heat are also exhaled.

The respiratory tract is made up of the structures that air passes through when we breathe. The respiratory tract is shown in Figure A. Use Figure A to answer the questions or complete the sentences.

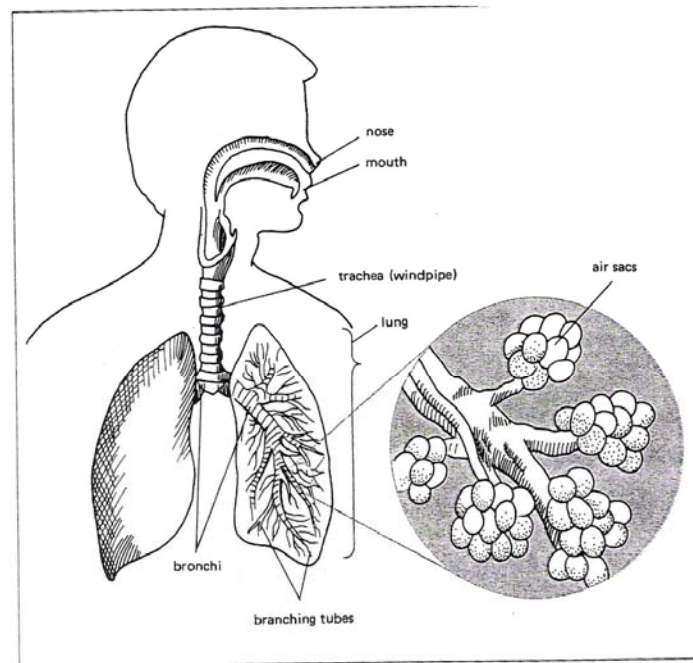


Figure A Notice the enlarged segment of the lung. Each small branch ends at an air sac.

1. The respiratory tract starts with the _____ and the _____.
2. The respiratory tract ends with millions of tiny _____.

3. The parts of the respiratory tract are listed below, but they are not in order. Rewrite them in the order in which air goes through the body.

- bronchi
- mouth and nose
- air sacs (alveoli)
- trachea
- branching tubes

_____ → _____ → _____ →
 _____ → _____

4. Each bronchus extends into a(n) _____.

The following is a diagram of an air sac, or alveolus. The lungs have millions of alveoli. Alveoli are very tiny. Answer the following questions about alveoli.

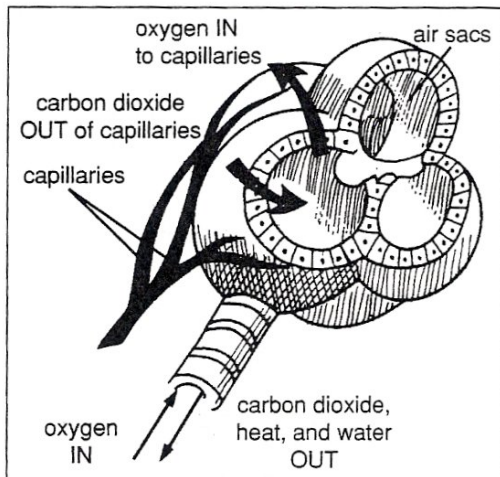


Figure B

1. Air that enters the air sacs is rich in _____.
 oxygen OR carbon dioxide
2. Air that leaves the air sacs is rich in _____.
 oxygen OR carbon dioxide
3. Air sacs are surrounded by _____.
4. The capillaries around the air sacs take in _____ and give off _____.
 oxygen OR carbon dioxide
5. List the three waste materials that the lungs excrete.
 _____, _____,



Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

Column A

Column B

___ 1. exhaling

a) where gases are exchanged

___ 2. inhaling

b) windpipe

___ 3. air sacs

c) breathing in

___ 4. trachea

d) surround the air sacs

___ 5. capillaries

e) breathing out

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some words may be used more than once.

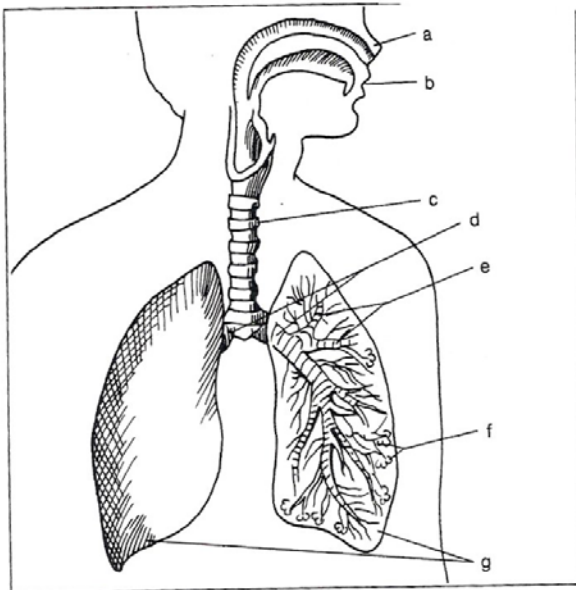
alveoli
inhaling
mouth

windpipe
bronchi
exhale

nose
capillaries
smaller and smaller

1. Breathing in is called _____.
2. We inhale through the _____ or _____.
3. The trachea is the scientific name for the _____.
4. The trachea divides into two tubes called _____.
5. In the lungs, the tubes branch into _____ tubes.
6. The lungs have millions of tiny air sacs called _____.
7. Air sacs have many _____.
8. We get rid of carbon dioxide waste when we _____.

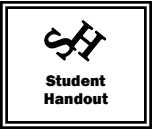
Identify the parts of the respiratory system. Write the correct letter on the lines provided.



1. bronchi _____
2. nose _____
3. branching tubes _____
4. mouth _____
5. air sacs _____
6. trachea _____
7. lung _____

Figure C

Adapted from *What is the Respiratory System?*, pp. 96-99 *Biology Science Workshop Series*



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Name: _____ Date: _____ Period: _____

QUIZ – An Introduction to Respiration

Answer 2 of the following 3 questions in the space provided. Each question is worth 5 marks.

1. When air comes into the respiratory system, it first enters the mouth or nose and then passes through many structures before oxygen is exchanged with carbon dioxide. Put the following words in the correct order, starting with the first structure through which air passes after it enters your mouth or nose.

bronchus, alveoli, branching tubes (bronchioles), trachea, throat

2. When someone breathes, you see their chest rising and falling. This occurs as their lungs fill up with air (inhalation), then release the air (exhale).

- a) What dome-shaped muscle is responsible for the increase and decrease in size of the chest cavity? **1 mark**

- b) What happens in the body to trigger this muscle to work? **2 marks**

- c) When inhaling, the dome-shaped muscle moves _____ and
up OR down

When exhaling, the dome-shaped muscle moves _____.
up OR down

2 marks

3. Explain what happens in the alveoli of the lungs. In your explanation, be sure to include the following terms: capillaries, oxygen, carbon dioxide, heat, water. **5 marks**

LESSON 3.2 - EXPLORING YOUR RESPIRATORY SYSTEM

Overview:

In a lab activity, students will listen to and analyze the sound of their breath, measure their lung capacity and examine the factors that affect lung capacity.

Suggested Timeline: 1 hour

Materials:

- Exploring Your Respiratory System (Student Handout)
- The following materials per lab group:
 - stethoscope
 - rubbing alcohol pads (1 per person)
 - tongue depressor (1 per person)
 - mirror
 - flashlight
 - access to computer with speakers
 - 100 mL graduated cylinder
 - 4 L milk jug (empty and clean)
 - permanent marker
 - rubber or plastic tubing
 - straw

Method:

1. Familiarize students with the procedure for the activity by demonstrating how to determine lung capacity using the given apparatus.
2. Have students complete the activity and submit their lab handout.

Evaluation:

Student grade on lab

Extensions:

- Show the PBS media program *Going to Extremes: High Anxiety* which examines mountain climbing and the effects on respiration
- Have students research the sport of free diving, the challenges divers face and how they train to overcome these challenges
- If you are close to a university, consider a trip to the kinesiology department. Allow students to learn about the different ways of measuring lung capacity and what the information is used for.
- Consider the effects of exercise on respiration rate.

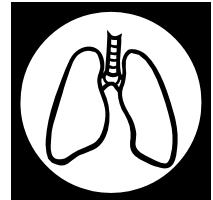
Name: _____ Partner(s): _____ Date: _____
Period: _____

Exploring Your Respiratory System

Purpose: To assess your respiratory system by listening to your breathing and determining your lung capacity.

Materials:

- stethoscope
- rubbing alcohol pad (1 per person)
- tongue
- tongue depressor (1 per person)
- mirror
- flashlight
- access to computer with speakers
- 100 mL graduated cylinder
- 4 L milk jug (empty and clean)
- permanent marker
- rubber or plastic tubing
- straw

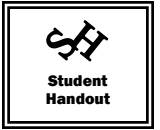


Procedure and Observations:

PART A – Respiratory System Sounds

1. Place the pad of the stethoscope to the left or right of the sternum (breastbone) so that it is positioned on top of one of your lungs.
2. Listen to your breath for ten seconds. Describe what it sounds like. (2 marks)

3. Clean the earpieces of the stethoscope with rubbing alcohol before returning it.
4. Go to the internet site: Auscultation Assistant – Breath Sounds (www.med.ucla.edu/wilkcs/lungintro.htm)
How does a normal breath sound compare to breath sounds that are not normal? (2 marks)



PART B – Measuring Lung Capacity

1. Measure 100 mL of water and pour it into the milk jug. Draw a horizontal line on the jug with the marker at the 100 mL mark.
2. Repeat step 1 until you have added 500 mL of water. Beside the fifth horizontal line, write '500 mL' with the marker.
3. Repeat steps 1-2 until you have filled the jug to 3500 mL.
4. Fill a sink half full with water.
5. Place your hand directly over the mouth of the milk jug, turn the jug upside down and put it beneath the surface of the water in the sink. Note that the whole jug does not need to be submerged in the water – only the mouth.
6. Keeping the jug upside down and with the mouth of the jug in the water, put one end of the rubber tubing into the mouth of the milk jug.
7. Put the straw in the other end of the rubber tubing.
8. Breathe in and out normally four times. When you breathe out, blow into the straw. Record the total volume of air in the milk jug in table 1.
9. Refill your milk jug to the 3500 mL line and set up your milk jug in the sink with the tubing inside, just as before.
10. Take in the deepest breath that you can, exhale as much air into the straw as you can and record the volume of air in the milk jug in table 1.

Table of Lung Capacity for Normal Breathing vs. a Deep Breath

TRIAL	VOLUME OF AIR (mL)
Four exhalations	
Exhalation after a deep breath	

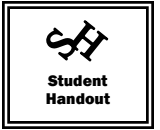
Chart – 2 marks

Analysis

1. a) From your results in table 1, how would you determine the amount of air that you normally exhale in one breath? (1 mark)

- b) Determine how much air you normally exhale in one breath. *Show your work.*(1 mark)

2. a) How would you determine the class average of the volume of air exhaled after a deep breath? (1 mark)



b) If you have classmates in Science 21, find the class average for your sex only of the volume of air exhaled after a deep breath. Show your work. If you do not have classmates in Science 21, research online the average volume of air exhaled after a deep breath for your age and sex. Be sure to list the website or other resource used. (2 marks)

c) How does your lung capacity after a deep breath compare with the average? (1 mark)

d) List three factors that you think could influence how much air you are able to inhale and exhale. (3 marks)

3. a) How do you think your lung capacity differs from a marathon runner? (1 mark)

b) Why? (2 marks)

Adapted from *Getting Enough Oxygen*, Isis

LESSON 3.3 - A CLOSE-UP LOOK AT YOUR RESPIRATORY SYSTEM

Overview:

Students examine some of the parts of their own respiratory systems and use online resources to learn more about the respiratory system.

Suggested Timeline: 1 hour

Materials:

- A Close-Up Look at Your Respiratory System (Student Handout)
- The following materials per lab group:
 - tongue depressor (1 per person)
 - small mirror
 - flashlight
 - small wooden block
 - microscope slide
 - tape
 - popsicle stick (1 per person)
 - petroleum jelly
 - compound microscope
 - computer with internet access
 - prepared slide of cilia

Method:

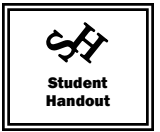
1. Allow students to use their materials, computers with internet access and other resources from the library to complete their laboratory investigation.
2. Have students submit their lab handout for grading.

Evaluation:

Student grade on lab

Extensions:

- Show the respiratory section of *The Incredible Machine* video from National Geographic
- Show a virtual clip of a tracheotomy. There are many available online. Note: Some school servers may block sites.
- Ask a physician or nurse to come to the classroom to discuss emergency procedures involving the respiratory system (ex: tracheotomy, choking).
- Find air quality monitoring sites for your location. Have the students monitor air quality for a period of time.
- Have students research what happens to a person during an allergic reaction.
- Investigate what allergy policies are in place in the school and evaluate their effectiveness.



Name: _____ Partner(s): _____ Date: _____
Period: _____

A Close-Up Look at Your Respiratory System

Purpose: To explore the parts and functions of the respiratory system and to consider some respiratory issues and procedures.

Materials:

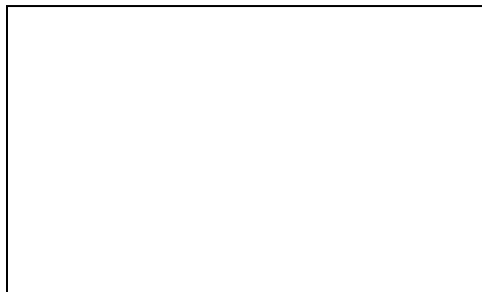
- The following materials per lab group:
 - tongue depressor (1 per person)
 - small mirror
 - flashlight
 - small wooden block
 - microscope slide
 - tape
 - popsicle stick (1 per person)
 - petroleum jelly
 - compound microscope
 - computer with internet access
 - prepared slide of cilia



Procedure and Observations:

Part A – Your Nose

1. Use your finger to pull your nose up slightly. Examine the inside of your nose by using a flashlight and a mirror.
 - a) Draw a picture of the inside of your nose. (1 mark)



- b) Describe what the inside of your nose looks like. (2 marks)



c) Suggest a function for each of the following parts of your nose. (3 marks)

hair _____

moisture _____

mucus (snot) _____

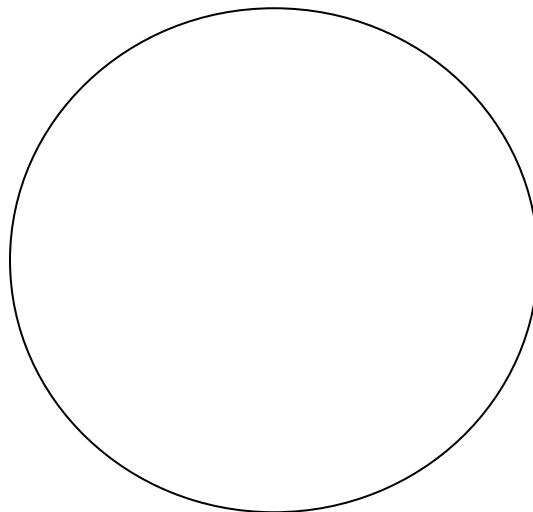
2. Tape a microscope slide to a wooden block, using one piece on each of the two ends. Leave the centre of the slide free of tape.
3. Using a popsicle stick, smear a thin layer of petroleum jelly onto the centre of the microscope slide.

4. Put the wooden block at a location of your choice (e.g., window sill, corner of the floor).

Reminder: Location of my microscope slide - _____

5. Leave the slide undisturbed for 24 hours.
6. Carefully untape the slide from the block, being sure not to touch the petroleum jelly.
7. View the slide with your naked eye. Describe what you see. (1 mark)

8. Examine the slide under a compound microscope. Using a pencil, sketch what you see in the circle below. (1 mark)



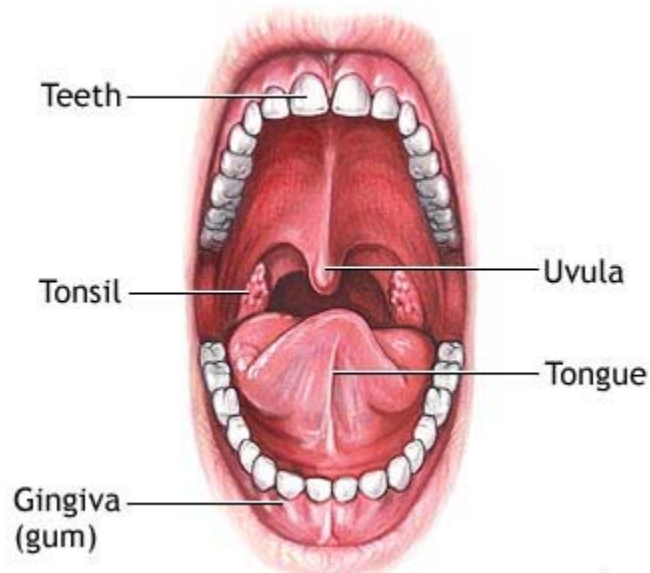
9. Think about what you have observed. Answer the following questions:

- a) From a health perspective, do you think that it is a good idea to eat your own snot? Why or why not? (2 marks)

- b) When one is in a large city in the summertime, one may hear about a smog or index. Why would such a warning be of interest to people with asthma? (Hint: If you do not know what asthma is, you may have to do some research first!)

Part B – The Mouth

1. Stand in front of a mirror. Insert the tongue depressor into your mouth and hold down your tongue.
2. Using the flashlight, examine the inside of your mouth. You should be able to see the following parts:





Part C – The Passageway to the Lungs

1. If food can go in through the mouth, what prevents food from entering the lungs? If you have ever laughed when drinking something, you have probably felt the drink ‘going the wrong way.’ Watch the following animation of a person swallowing:
www.penhealth.com/health_info/animationplayer/swallowing.html

a) What structure normally stops food from entering the lungs? _____

b) How does it work? _____

2. Run your fingers up and down your neck. You can probably feel the rings of cartilage of your **trachea**. Use the internet to find the answers to the following questions.

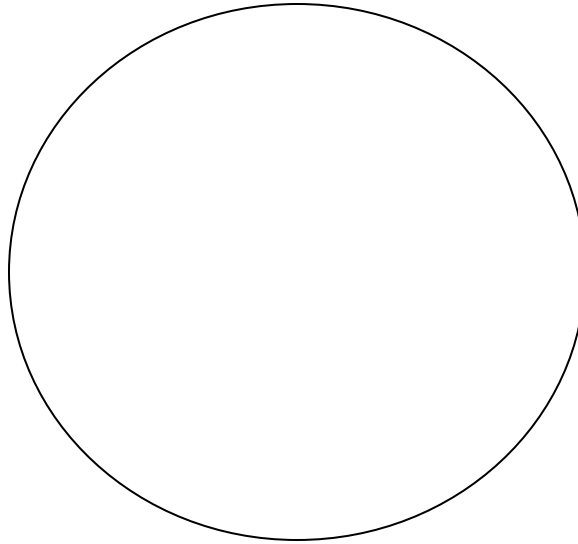
a) What is a tracheostomy? _____

b) Why might a tracheostomy be done? _____

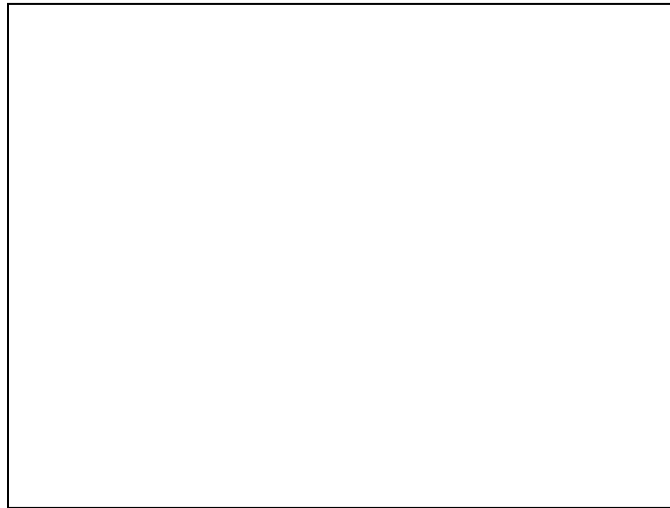
3. On the surface of the trachea are special hair-like **cilia**.

a) Find out the purpose of the cilia that line our trachea.

- b) If you have access to a prepared microscope slide of cilia, examine the slide and make a sketch.



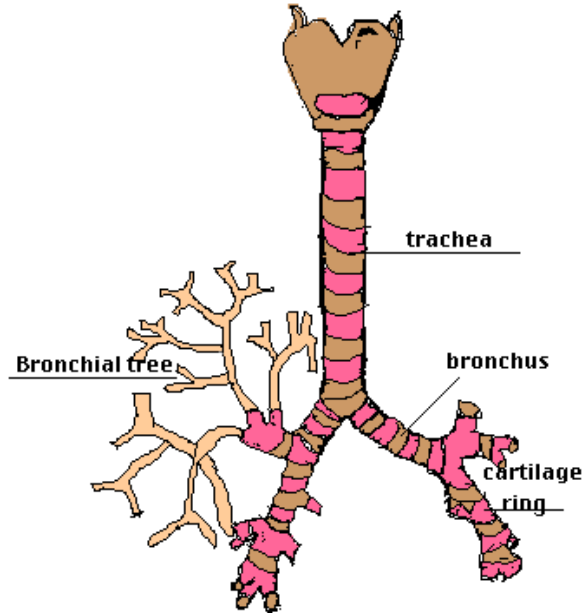
If you do not have access to a prepared microscope slide of cilia, find an image of cilia on the internet. Draw a sketch of what you find in the box below.



4. The trachea also has phlegm present. Find out the purpose of the phlegm in the trachea.

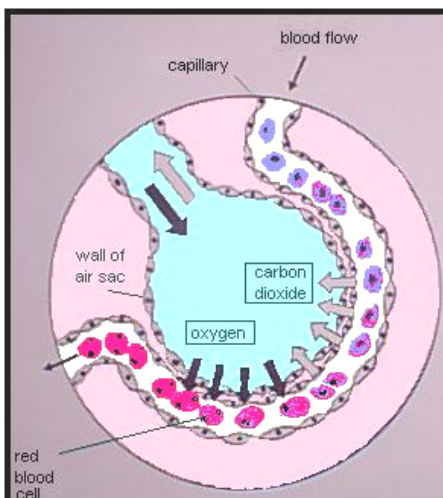
Part D – Into the Lungs

When the trachea reaches the lungs, it divides into two **bronchi**. Each bronchus divides into **bronchioles**. The bronchioles are the branches of the bronchial tree. Note this arrangement in the diagram below.



1. Find out what happens to a person with asthma when they have an asthmatic attack.

2. The bronchioles keep subdividing until blind ending sacs are reached. These are called the **alveoli**. In the alveoli, oxygen passes through the walls of the alveoli into the bloodstream. Carbon dioxide passes from the bloodstream to the alveoli.



a) Find out how smoking affects the alveoli in the lungs. _____

Putting the Parts of the Respiratory System Together

