

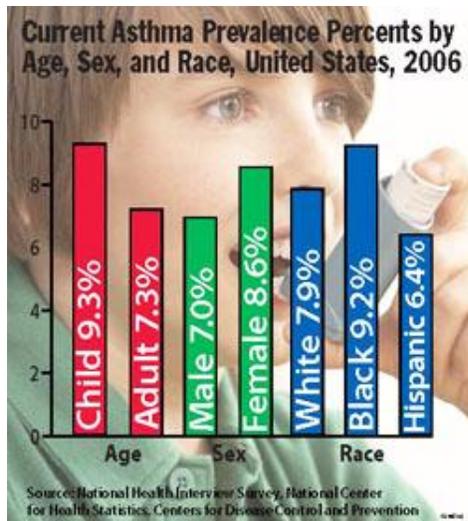
## GEOL 1100: General Geology 1

### HOW HEALTHY ARE YOUR LUNGS?

#### Learning objectives:

- Students will be able to explain why data sets have different precisions.
- Students will be able to explain the difference between accuracy and precision.
- Students will be able to understand the importance of spreadsheets in scientific research.
- Students will be able to enter, organize, and analyze data, and create graphs in Excel.

Have you had difficulty breathing? Is this often? How about a family member or friend? How do you feel when you can not breathe easily? When and where has it been difficult to breathe?



Although not all breathing difficulties necessarily indicate a disease, there is a good chance that you or someone you know has asthma or COPD (Chronic Obstructive Pulmonary Disease). Pulmonary diseases are fairly common in the United States and elsewhere in the world. The graph to the left shows the percent prevalence of asthma in the United States. Environmental factors as well as genetics are thought to cause many pulmonary diseases.

In this activity you will share two Peak Flow Meters among each other. These devices are used to measure characteristics of your breathing including FEV and PEF (see definitions below). The procedure for collecting data with these instruments is fairly quick so that you should not have to wait very long to use the meter. You will discuss and learn how to interpret these values by using different techniques.

**Forced Expiratory Volume (FEV)** is the maximum volume of air that can be forced out after taking a deep breath.

**FEV1** is the forced expiratory volume of air in the first second.

**Peak Expiratory Flow (PEF)** is the maximum rate of airflow achieved during expiration.

**PART 1**  
**Determining FEV1**

The apparatus that you will use measures the volume of air that is exhaled from one deep breathe. Unlike the apparatus used during the last lab, this device provides a digital readout of both PEF and FEV1. After you blow into the meter, the first value that shows is PEF and the second is FEV1.



Your instructor will demonstrate the proper use of the equipment as described below.

**Step 1:** Insert a clean mouth piece. Turn the meter on and hold firmly in your hands.

**Step 2:** Stand up straight. Remove gum or any food from your mouth. Take a deep breath (as deep as you can). Put the mouthpiece of the peak flow meter into your mouth. Close your lips tightly around the mouthpiece. Be sure to keep your tongue away from the mouthpiece. In one breath blow out as hard and as quickly as possible. Blow a "fast hard blast" rather than "slowly blowing" until you have emptied out nearly all of the air from your lungs, and bend over to help force any remaining air from your lungs.

**Step 3:** Read the FEV1. It will appear after the PEF value. You can scroll through the values with the arrow button below the display.

Choose a member of your group to go first. After the first trial, record the FEV1 value in the table. Repeat two more times.

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6		Average	Max	Range
Student 1										
Student 2										
Student 3										
Student 4										

Do you think you need to take another trial? Why or why not?

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After deciding that you have taken enough measurements, place the mouthpiece in alcohol.

How would you know if you have done the procedure correctly?

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What could result in a low reading?

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What could result in a high reading?

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What value do you think you should use – maximum or average?

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If you were monitoring your FEV1 on a regular basis, what considerations would you have to make a comparable dataset?

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Repeat the data collection process until each person has recorded three values with similar values.

Report the peak values of each person in your group to the instructor for compilation.

How do the values between group members compare? How can you account for any variation? What is your evidence?

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Discussion

Why is there variation?  
Why use the maximum value?  
What is different from the last class?

**PART 2:**

**Accuracy vs. Precision**

Discussion on accuracy and precision

How would you describe the accuracy and precision of your data today? Explain

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How would you explain the accuracy and precision of the data from the last class?

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How would you determine the accuracy of last day's instrument?

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### PART 3: Comparing observed values with predicted normal values

How does the value indicate the condition of your lungs? Below are tables with predicted normal FEV1 values based on height and age. One table is for men and the other is for women.

FEV1 Predicted Normal Values for Males

	Age											
Height (cm)	15	20	25	30	35	40	45	50	55	60	65	70
<b>140</b>	3.32	3.16	2.99	2.83	2.66	2.50	2.33	2.17	2.00	1.84	1.67	1.51
<b>150</b>	4.67	4.50	4.34	4.17	4.01	3.84	3.68	3.51	3.35	3.18	3.02	2.85
<b>160</b>	4.01	3.84	3.68	3.51	3.35	3.18	3.02	2.85	2.69	2.52	2.36	2.19
<b>170</b>	4.35	4.19	4.02	3.86	3.69	3.53	3.36	3.20	3.03	2.87	2.70	2.54
<b>180</b>	4.70	4.53	4.37	4.20	4.04	3.87	3.71	3.54	3.38	3.21	3.05	2.88
<b>190</b>	5.04	4.88	4.71	4.55	4.38	4.22	4.05	3.89	3.72	3.56	3.39	3.23
<b>200</b>	5.39	5.22	5.06	4.89	4.73	4.56	4.40	4.23	4.07	3.90	3.74	3.57

Predicted FEV1 Normal Values for Females

	Age											
Height (cm)	15	20	25	30	35	40	45	50	55	60	65	70
<b>140</b>	2.78	2.64	2.50	2.36	2.22	2.08	1.94	1.80	1.66	1.52	1.38	1.24
<b>150</b>	3.05	2.91	2.77	2.63	2.49	2.35	2.21	2.07	1.93	1.79	1.65	1.65
<b>160</b>	3.31	3.17	3.03	2.89	2.75	2.61	2.47	2.33	2.19	2.05	1.91	1.77
<b>170</b>	3.58	3.44	3.30	3.16	3.02	2.88	2.74	2.60	2.46	2.32	2.18	2.04
<b>180</b>	3.85	3.71	3.57	3.43	3.29	3.15	3.01	2.87	2.73	2.59	2.45	2.31
<b>190</b>	4.11	3.97	3.83	3.69	3.55	3.41	3.27	3.13	2.99	2.85	2.71	2.57
<b>200</b>	4.38	4.24	4.10	3.96	3.82	3.68	3.54	3.40	3.26	3.12	2.98	2.84

What units are used for height? \_\_\_\_\_

What is your height in cm? If you do not know your height, there are measuring sticks on the wall in the room near the door. \_\_\_\_\_

What is the predicted FEV1 normal value for you? \_\_\_\_\_

How did you determine the predicted value?

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\_\_\_\_\_

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How precise is your predicted value from the table?

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The tables on the previous page of FEV1 normal values were calculated with a research derived equation. Use these formulas to calculate your personal predicted FEV1 based on exact age and height.

Females:  $FEV1 \text{ predicted} = 0.0267 \times \text{height (cm)} - 0.028 \times \text{age (years)} - 0.54$

Males:  $FEV1 \text{ predicted} = 0.0344 \times \text{height (cm)} - 0.033 \times \text{age (years)} - 1.00$

How does your measured value compare to the predicted value for your age and height?

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What are the advantages or disadvantages of using these tables vs. calculations?

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To determine if your lungs have normal capacity, use this table. You need to calculate your percent predicted FEV1.

<b>FEV1</b>	<b>Interpretation</b>
>80% predicted	normal
66-80% predicted	mild obstruction
50-65% predicted	moderate obstruction
<50% predicted	severe obstruction

What is your percentage FEV1 predicted normal?

$\% = (FEV1 \text{ measured} / FEV1 \text{ predicted}) \times 100 =$  \_\_\_\_\_

What is the interpretation of your lung health? \_\_\_\_\_

For all the students in the class, calculate the FEV1 predicted normal values percentages, and determine which category (normal, mild obstruction, moderate obstruction, severe) each belongs. Graph the results.

## **PART 4**

### **Introduction to Excel 2007**

In this section, you will take all the data and enter the data into a spreadsheet. A spreadsheet template file is placed on each computer in a folder on the desktop labeled GEO1. The file name is FEV1.

Since the class members have a wide range of familiarity with Excel, the instructor will go over the basics of Excel as a whole class and then assist students individually as needed to perform the tasks below. If you have experience with Excel, please feel free to assist those with less experience.

The instructor will provide the following tutorial hand outs with step by step instructions for using features in Excel. Copies may be obtained from the course website.

#### **Tutorials:**

- Excel Basics and Terminology
- Inserting and Organizing Data in Excel
- Inserting Formulas and Functions
- Making a Bar Chart

#### **Tasks:**

1. Create a spreadsheet with the student data
2. Calculate FEV1 values, percentages and classify according to the interpretation table
3. Create a graph showing the count of each category (normal, mild, moderate, and severe).
4. Describe the graph.
5. Bring the graph into Powerpoint or Word.
6. You have information about age, height, and sex for the FEV1. Make another graph exploring a relationship between two or more variables. Is there a pattern?