PHYS 100 EXPERIMENT 7 (week 8)
Predictions

Name: _____ Student #: _____ Section: ____ Date: _____

Overview:
- *Going over HW (5 min)*
- *Introduction (10 min)*
- *Data collection (25 min)*
- *Make predictions (20 min)*
- *Test predictions (15 min)*
- *Summary (10 min)*

Introduction (10 min, entire class)

So far our conclusions were applicable only to situations we tested. For example, we know our own walking speed for the terrains we checked, but cannot predict our walking speed on a new terrain. Today we will try to extend our conclusions to data that was not collected yet. To do that, we will learn to make predictions outside the range of the available data.

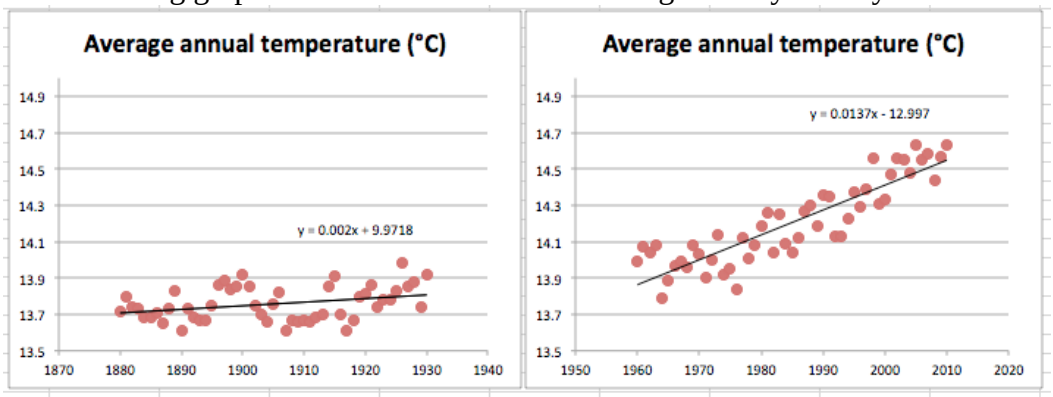
Can you think of situations in which collecting data is difficult and predictions are required?

Topic: Making predictions.

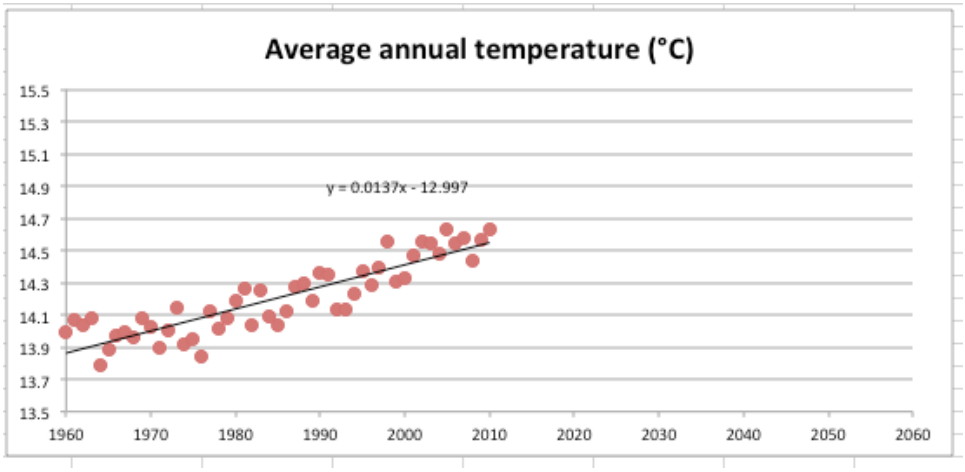
☞**clicker 1:** Look at the two graphs that you made for homework. What can you say about the temperatures between 1961-2010, compared with the temperatures between 1881-1930?

A. They increased more rapidly
B. The increased at the same rate
C. They increased at a slower rate
D. They did not increase
E. Can't judge without error bars.

The following graphs show the same data that was given to you for your HW.



☞**Clicker 2:** Based on data from the last 50 years, what will be the temperatures in 2050?



A.13.9-14.7
B.14.7-15.1
C.15.1-15.5
D.15.5-15.9
E. 15.9-16.3

Problem set up

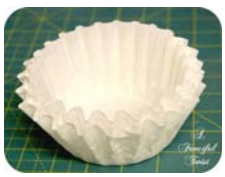
As most of you may have heard, on Oct 14, 2012, Felix Baumgartner jumped from a height of 39 kilometers (24 mi), reaching an estimated speed of 1,342 kilometers per hour. He free-fell for 4 minutes and 19 seconds, and then opened his parachute and gilded down to earth.



It is obvious that his calculations and testing needed to be accurate….

Since testing parachutes under realistic conditions was impractical, Baumgartner and his team had to test the parachute from lower heights, and make predictions for the full height.

You are in charge of the initial testing. The initial testing will use a model: instead of the actual parachute, you will test a stack of two coffee filters (see image). **Your task is to predict how long it will take the coffee filters to fall from 3 meters. However, you can only test them up to 1.5 meters or lower.**



Tasks

Task 1: Data collection (25 min, groups of 2)

On the bench you can find coffee filters. Stack two coffee filters. This is your model-parachute.

Your research question is the following:
How long will it take the model parachute to fall from a height of 3m?

Collect data that will help you determine this.
Drop the filters facing up, as in the image above, and not facing down (that is, they should look like a bowl, not a hat). When facing up, their velocity is more consistent and measurements are more accurate.

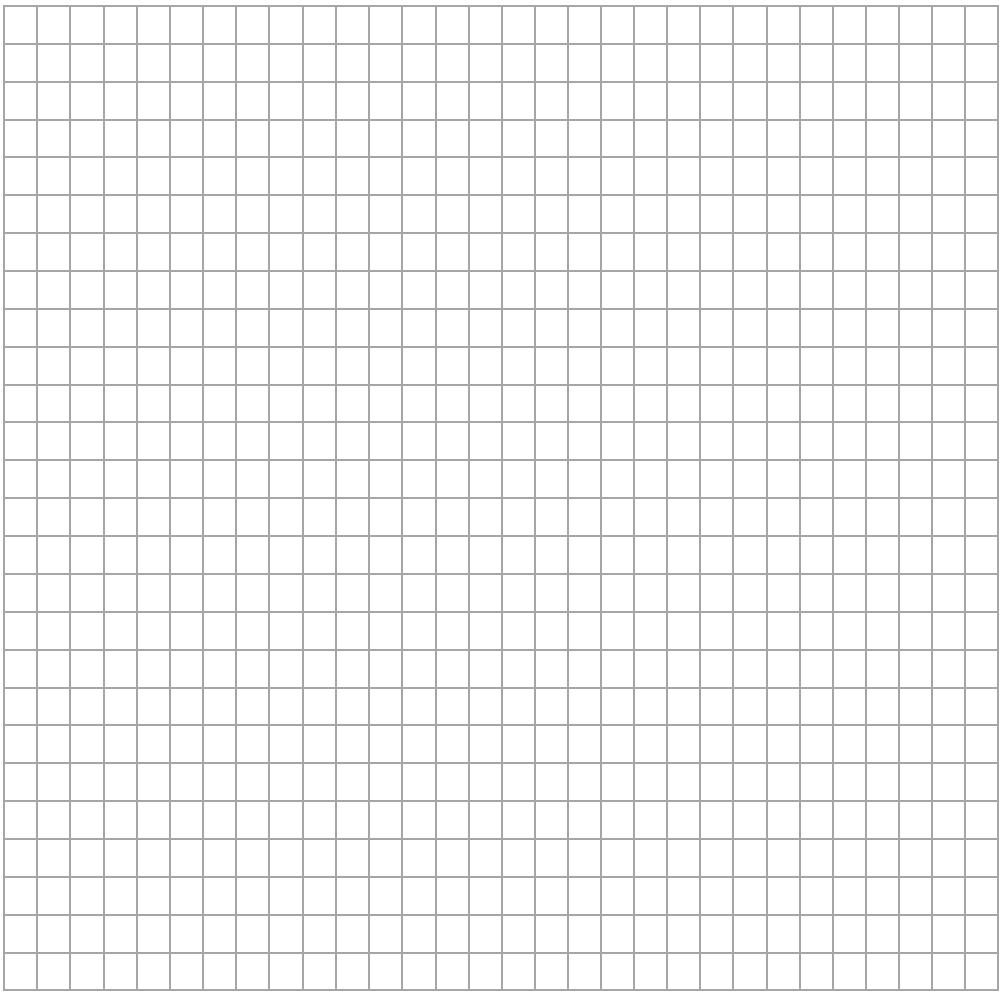
You need to collect enough data to make predictions:

- How many heights will you collect data from? Which heights will you choose?

- How many measurements will you take in each height?

A hint: the answer is not straightforward. Twice the fall from 1.5 m will not give you the fall from 3.0 m.

Document your measurements on the other side of this page.



Task 2: predictions (20 minutes, groups of 3)

Using the data you collected, estimate the duration it would take the parachute to fall from 3m.

You may choose a numeric or a graphical way to make your prediction. **Notice the time limitation, and make sure to have a value at the end of the 20 minutes.** As in real life, tasks always have constraints.

What is your predicted value?

Explain in detail how you reached this prediction.

Task 3: Measuring the predicted value (15 min, entire class)

TAs will now distribute stop watches and have volunteers measure the duration it takes the coffee filters to fall from 3m.

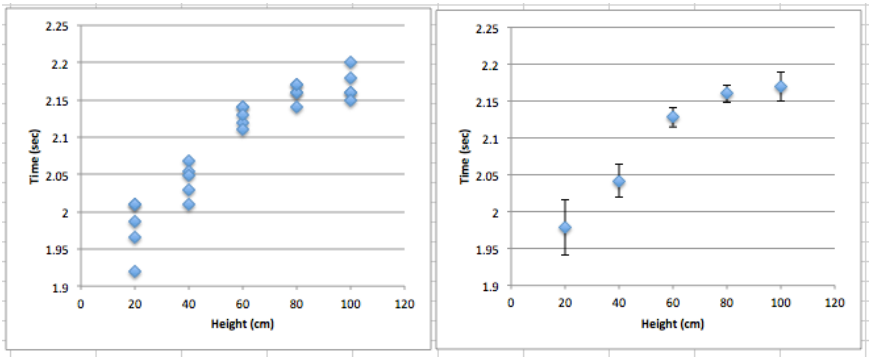
What was the average of the 3m measurements?

How close were you in your prediction?

Task 4: Error Bars (entire class, 10 min)

☞**clicker 3:** The two graphs below show the same data. What do you think the "error bars" (vertical black lines) on each point of the right graph mean?

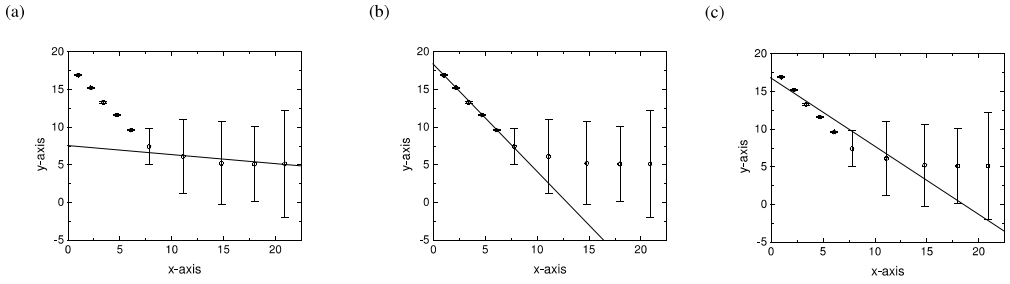
A. The overall SD of the entire measured data.
B. The SD of measurements in each height.
C. The errors as suggested by the equipment used.
D. The range of the measurements in each height.



☞**clicker 4:** According to the graph on the right, which of the heights gave the most *accurate* data?

A. 20 cm
B. 40 cm
C. 80 cm
D. 100 cm
E. Can't tell from the right graph

☞**clicker 5:** Which straight line best fits the data set in the graphs below?



PHYS 100 Homework 7 (for week 9)
Using error bars to improve the accuracy of predictions

Name: _____ Student #: _____ Section: ____ Date: _____

1. **Read carefully the error-bar document that is on Connect** (Lab7_homework_errorbars.pdf). This will help you complete the homework.
2. Fill in the table given below.
3. Plot a scatter plot of the data you collected in class on the other side of this sheet (time vs. height). Remember to plot the averages – not the raw data. Do not make a trendline yet.
4. Make sure to label the axes appropriately (with units) and to extend the x-axis to 200 cm, to allow you to make a prediction.
5. Add error bars to each point on your scatter plot. Each error bar is ±SD from each point.
6. Create a trendline that goes through all the error bars.
7. Using a ruler, update your prediction for 200cm. Show the predicted value on the graph and explain how you found it. Did it come closer to the actual result? Why or why not? (since not all coffee filters are the same, it may be that your data will give you a different prediction).

Height (cm)	Average time (sec)	$SD = \sqrt{\frac{\sum(x_i - \overline{x})^2}{N}}$

Rubric

	Sufficient (✓)	Lacking (✓)	Insufficient (x)
Average and SD table is complete			
The histogram is correct and labeled .			
Error bars are correct.			
Trendline goes through error bars.			
The prediction is based on the graph, and is explained.			

Clicker resource page:

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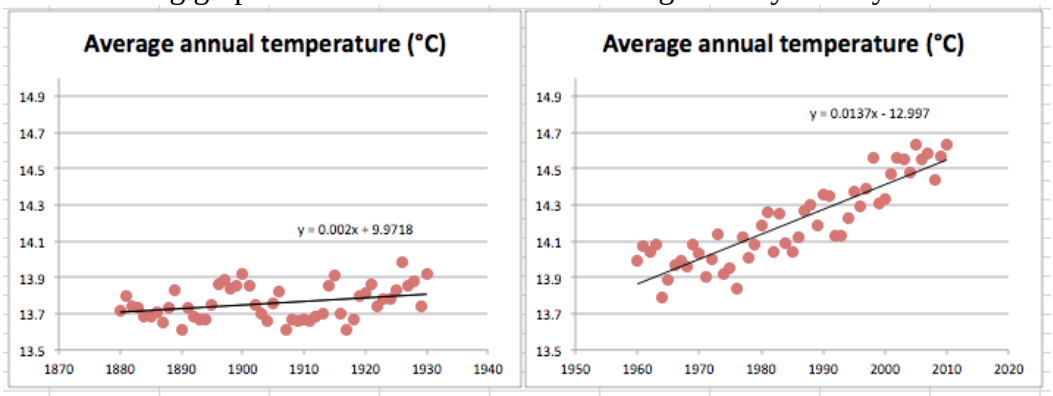

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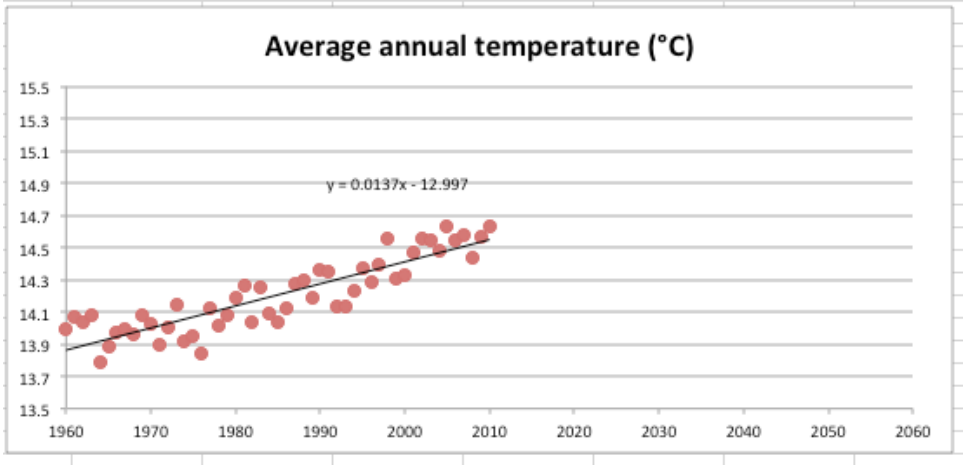

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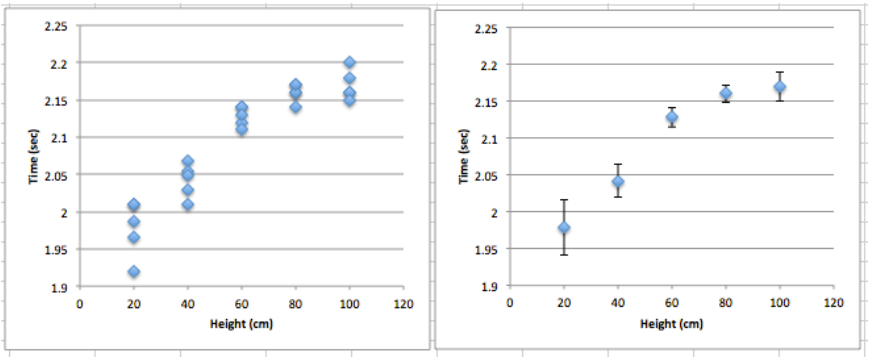

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