Squigly's Brain Teasers

I live where light is but die if light touches me.
What am I?

Squigly's Brain Teasers

I live where light is but die if light touches me.
What am I?

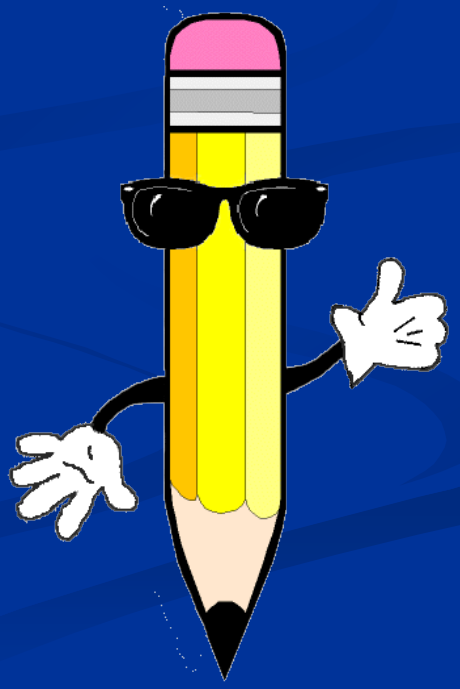
YOUR SHADOW

Squigly's Brain Teasers

What gets smaller when ideas grow?

Squigly's Brain Teasers

What gets smaller when ideas grow?



Squigly's Brain Teasers

I travel around the world but never leave the corner. What am I?

Squigly's Brain Teasers

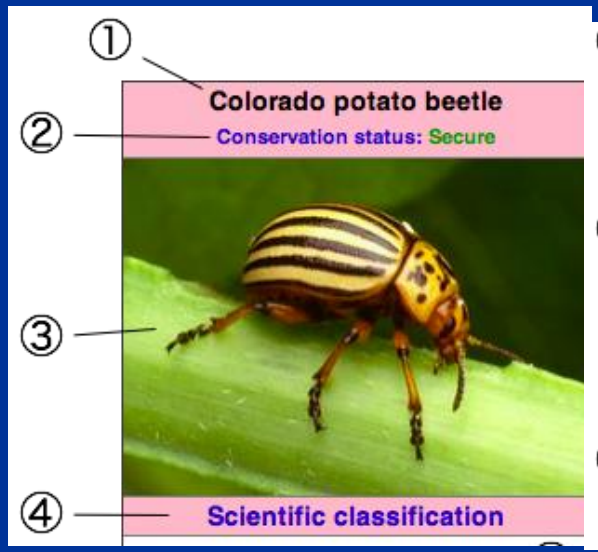
I travel around the world but never leave the corner. What am I?

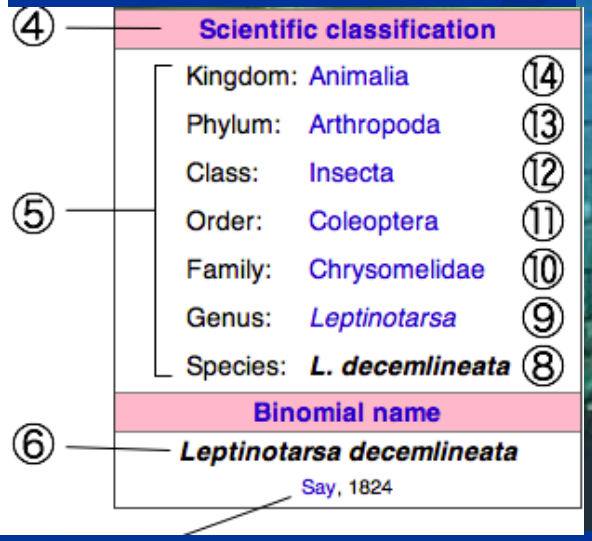
DATA

Metric System (SI)
Taking Measurements
Organization
Presentation

Data

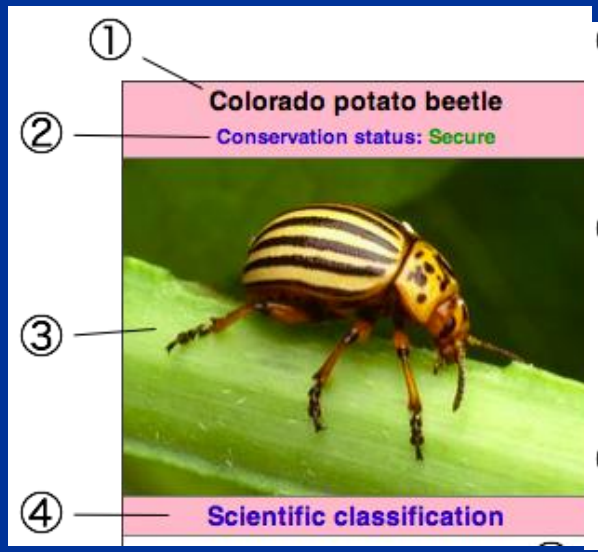
- Your data are all the records you have gathered from an investigation.
- The types of data collected depend on the activity.
- Data may be a series of weights of volumes, a set of color changes, or a list of scientific names.
- No matter which types of data are collected, all data must be treated carefully to ensure accurate results.

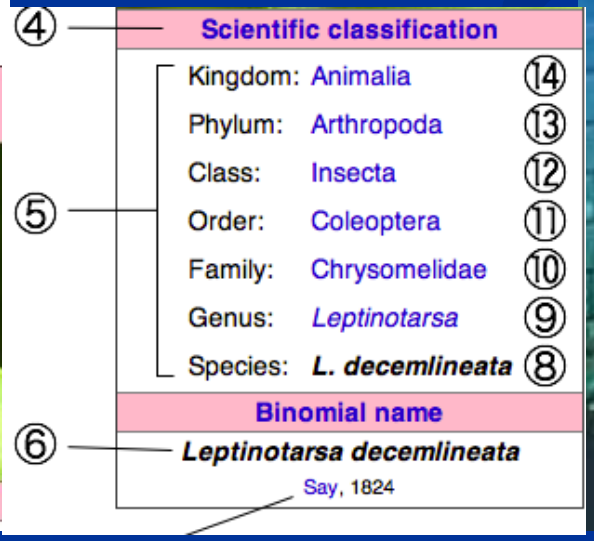




Data

- Sometimes the data seem to be wrong, but even then, they are important and should be recorded accurately.
- Remember that nature cannot be wrong, regardless of what you discover in the laboratory.
- Data that seem to be “wrong” are probably the result of the experimental error.

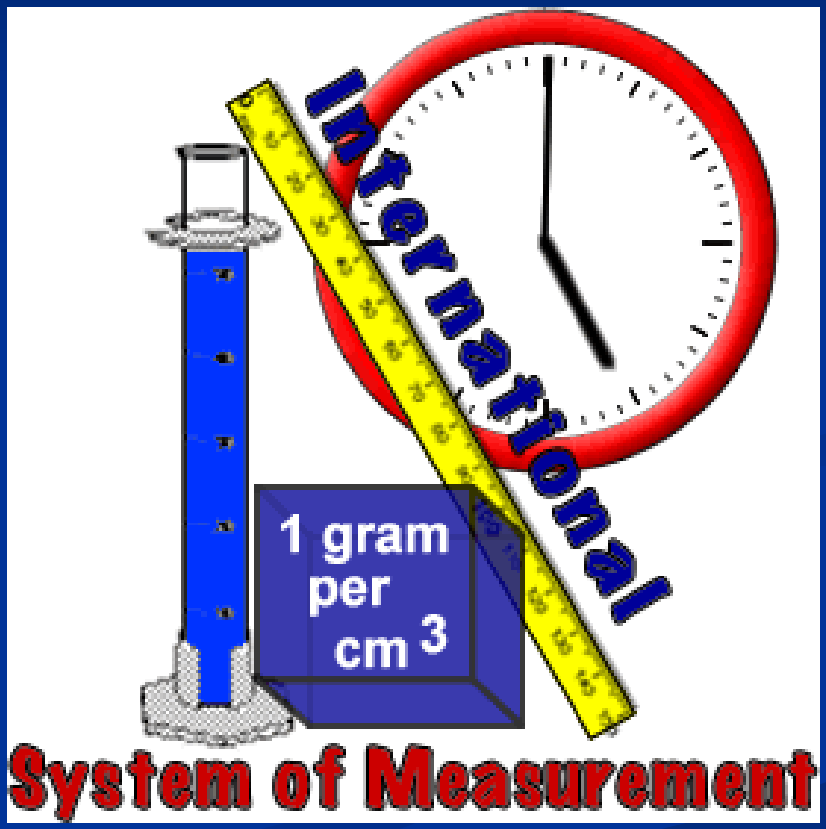




Measurement in Biology

- Scientists use a revised form of the metric system called

  Le Systeme International d'Unites
  (International System of Units)
  or SI Units



S.I. Base Units

The **International System of Units (S.I.)** defines seven base units for the seven base quantities:

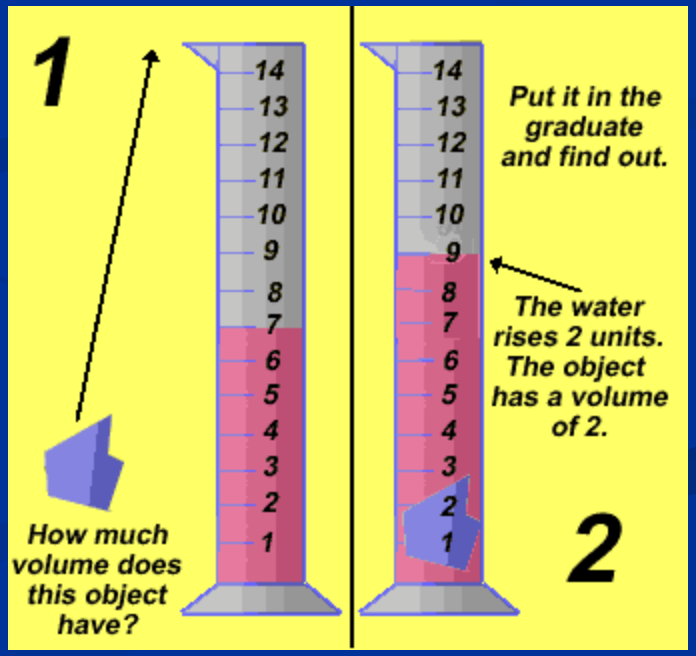
Quantity	Name	Symbol
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
luminous intensity	candela	cd
amount of substance	mole	mol

Water Displacement

- Some solid samples, such as an irregularly shaped rock cannot have their volume measured easily by using the volume equation (length x width x height)
- For these solids, scientists use a technique called **Water Displacement**

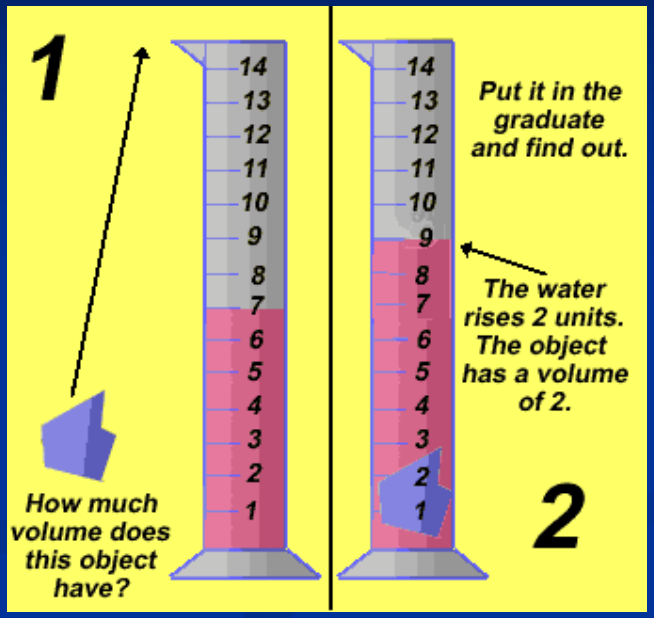
Water Displacement

- Steps of Water Displacement
- 1. Add water to a graduated cylinder and record its volume (ex: 7 ml)
- 2. Place the irregularly shaped solid into the graduated cylinder already containing water and record the new volume (ex: 9 ml)



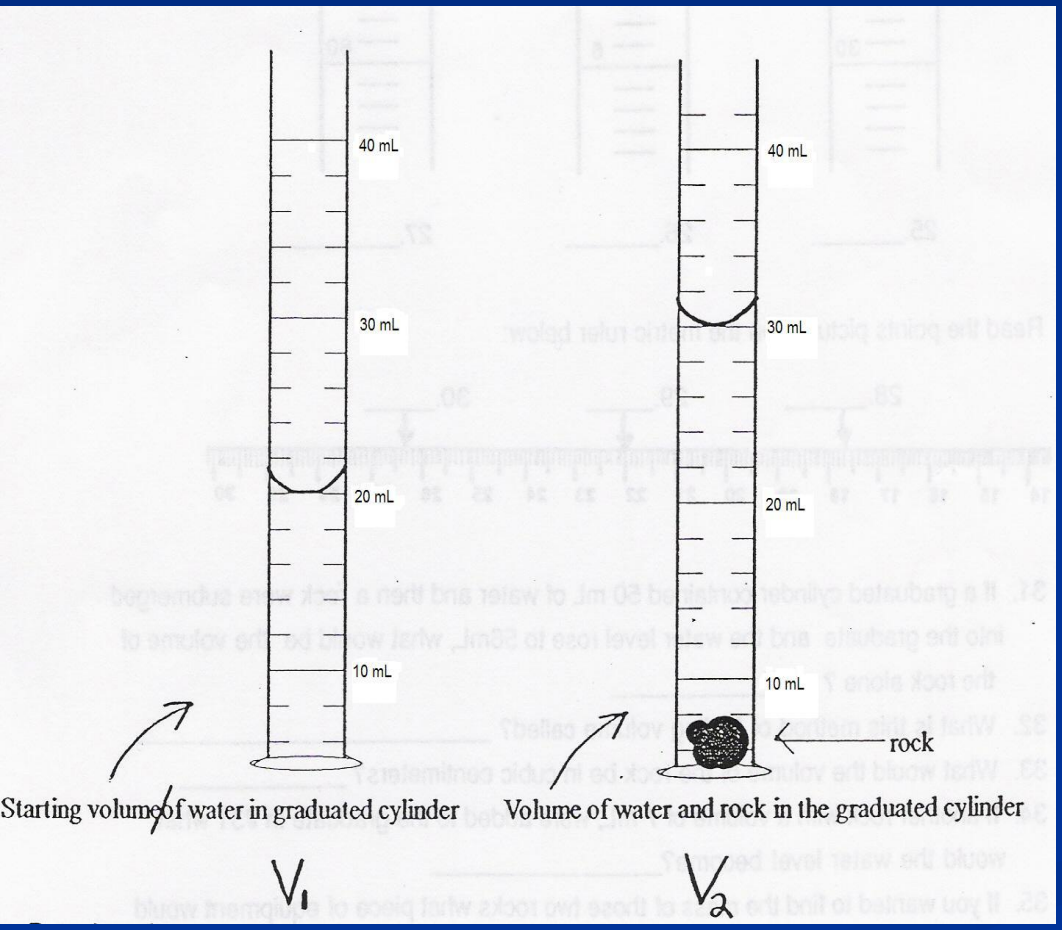
Water Displacement

- 3. Subtract the smaller volume (combined volume) from the larger volume (water only) to get the volume of the irregularly shaped solid.
  (ex: 9 ml – 7 ml = 2 ml)



- 4. We would say that the irregularly shaped solid takes up 2 ml of space. Since it is a solid, we need to state the volume using cm^3 so we would say that its volume is 2 cm^3

Water Displacement



Volume = $V_2 - V_1$

Volume = 30 – 20

Volume = 10 mL

= 10 cm^3

Recording and Organizing Laboratory Data

- There are many ways to record and organize data, including:
  - data tables, charts, and graphs.
- It is important to include the appropriate units when you record data.
- Remember that DATA are measurements or observations, not merely numbers.
- Data tables, graphs, and diagrams should have *descriptive titles* to ensure that another person can understand them without having been present during the investigation.

Many important scientific discoveries *have been made accidentally in the course of an often* unrelated laboratory activity. *Scientists who keep very careful and* complete records *sometimes notice* unexpected trends *in and relationships among data long after the work is completed. The laboratory notebooks of working scientists are studded with* diagrams and notes*; every step of every procedure is* carefully recorded.

Data Tables and Charts

Data tables are probably the most common means of recording data. Although prepared data tables are often provided in lab manuals, it is important that you be able to construct your own. The best way to do this is to choose a title for your data table and then make a list of the types of data to be collected. This list will become the headings for your data columns.

For example, if you collected data on plant growth that included both the length of time it took for the plant to grow and the amount of growth, you could record your data in a table (as shown below).

Plant Growth Data

Time in Days	Height of Plant (cm)
1	10
3	12
5	15
7	18
9	20

Example Data Table

These data are the basis for all your later interpretations and analyses. You can always ask new questions about the data, but you cannot get new data without re-peating the experiment.

Ways to Record Data

Data Tables:

- ✓ Must have a title
- ✓ Must include relevant data
- ✓ Must have labeled columns

Number of Flies on Meat per Day	
Day	Number of Flies
1	10
2	50
3	160
4	40
5	0
6	0

Graphs

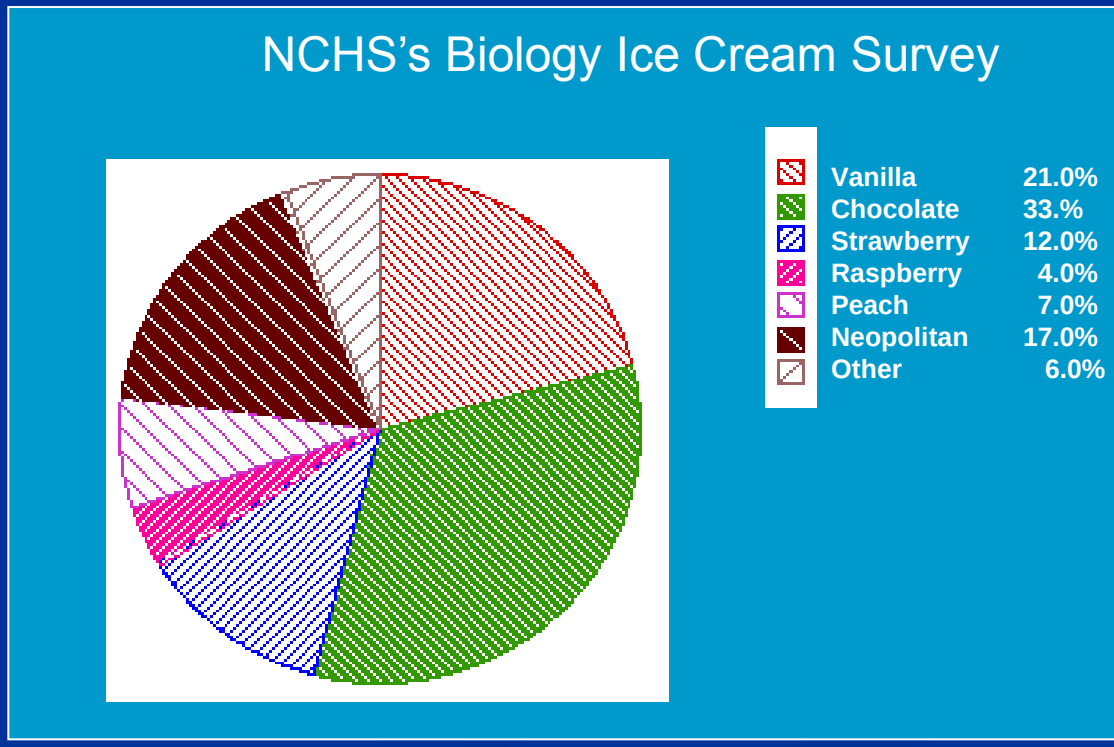
- After data are collected, you must determine how to display them
- One way of showing your results is to use a graph
- Three types of graphs are commonly used
  - **Pie (circle) graphs**
  - **Line graphs**
  - **Bar graphs**

Ways to Graph Data

Pie Graph:

Used to show how a part relates to the whole

Needed to show percentages effectively

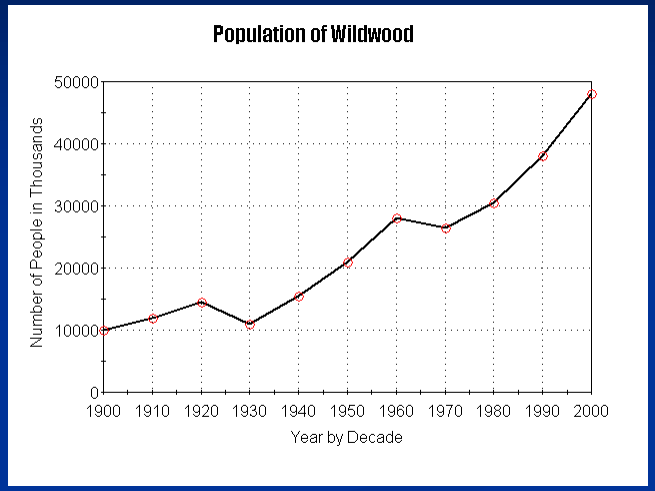


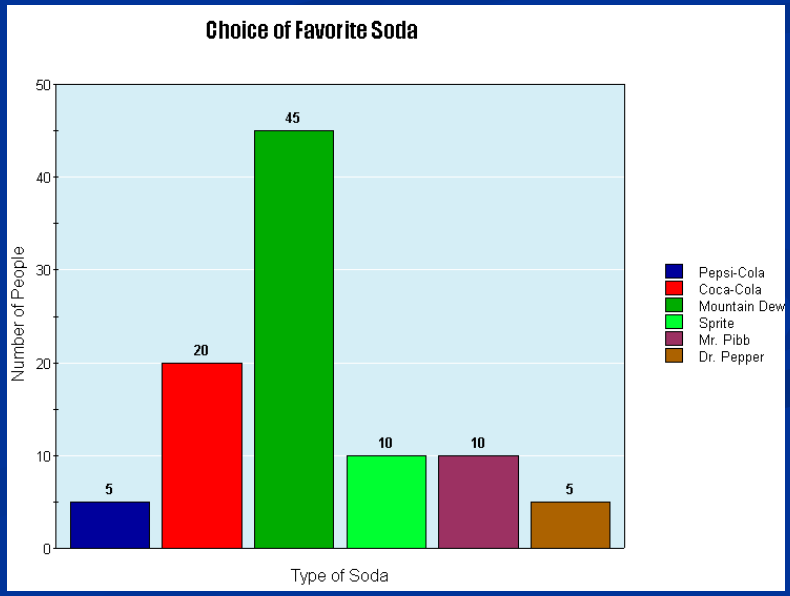
Ways to Graph Data
(Continued)

- **Line graph**: used to show change over time

- **Bar graph**: used to compare quantities in different categories

- Be sure to include:
  - ✓ Title
  - ✓ Axis labels
  - ✓ Key





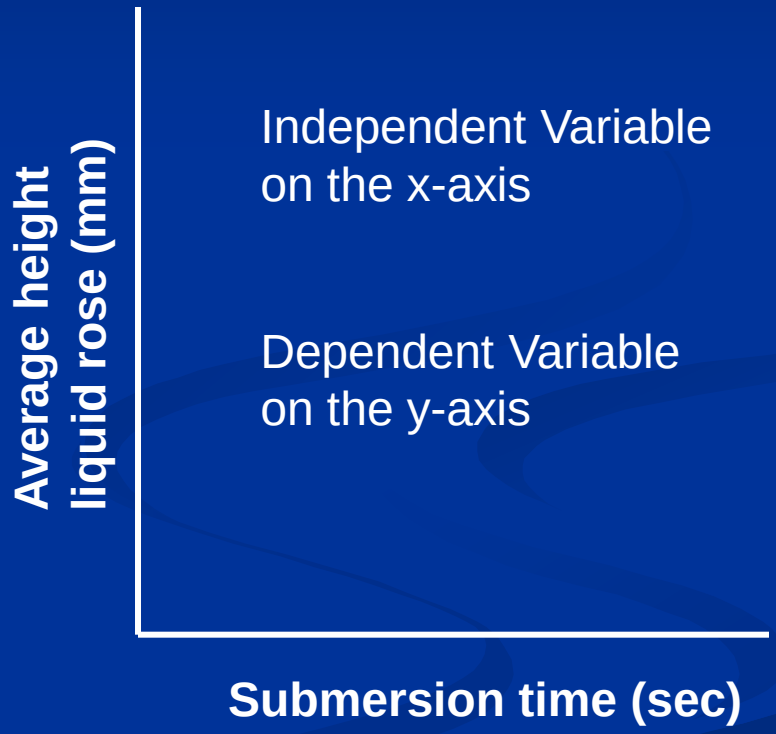
Making a Line Graph

Start with your data table

Experimental Data

Independent Variable **Submersion time (seconds)**	*Dependent Variable* **Average height liquid rose (mm)**
10	**11**
15	**14**
20	**14**
25	**15**
30	**16**
35	**17**
40	**19**

Draw and Label Axes



Would help to know that this experiment was done with paper towels

Making a Line Graph
(Continued)

Experimental Data

Independent Variable **Submersion time (seconds)**	*Dependent Variable* **Average height liquid rose (mm)**
10	11
15	14
20	14
25	15
30	16
35	17
40	19

Using your data table, write data pairs

(10, 11)
(15, 14)
(20, 14)
(25, 25)
(30, 16)
(35, 17)
(40, 19)

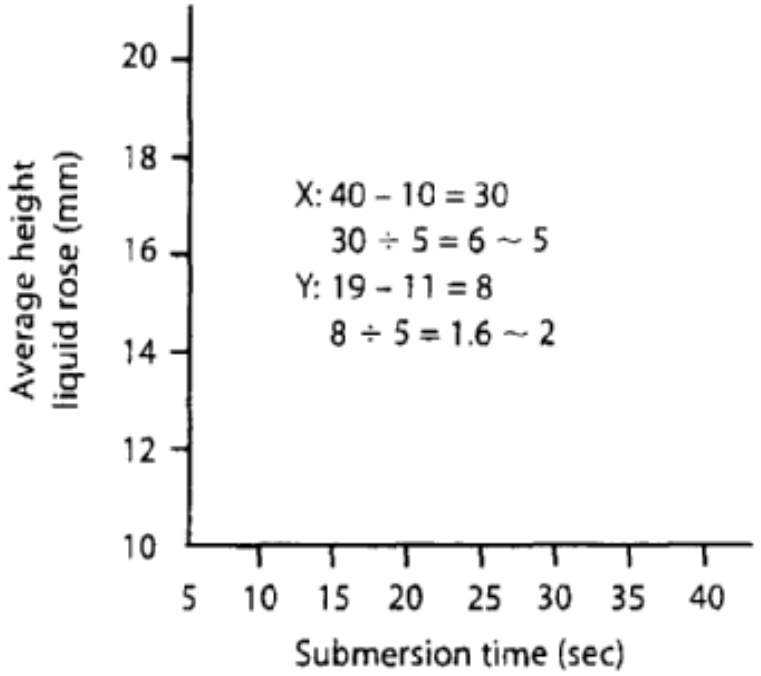
Making a Line Graph
(Continued)

Use your data pairs to determine the scales for the axes

2. Write Data Pairs

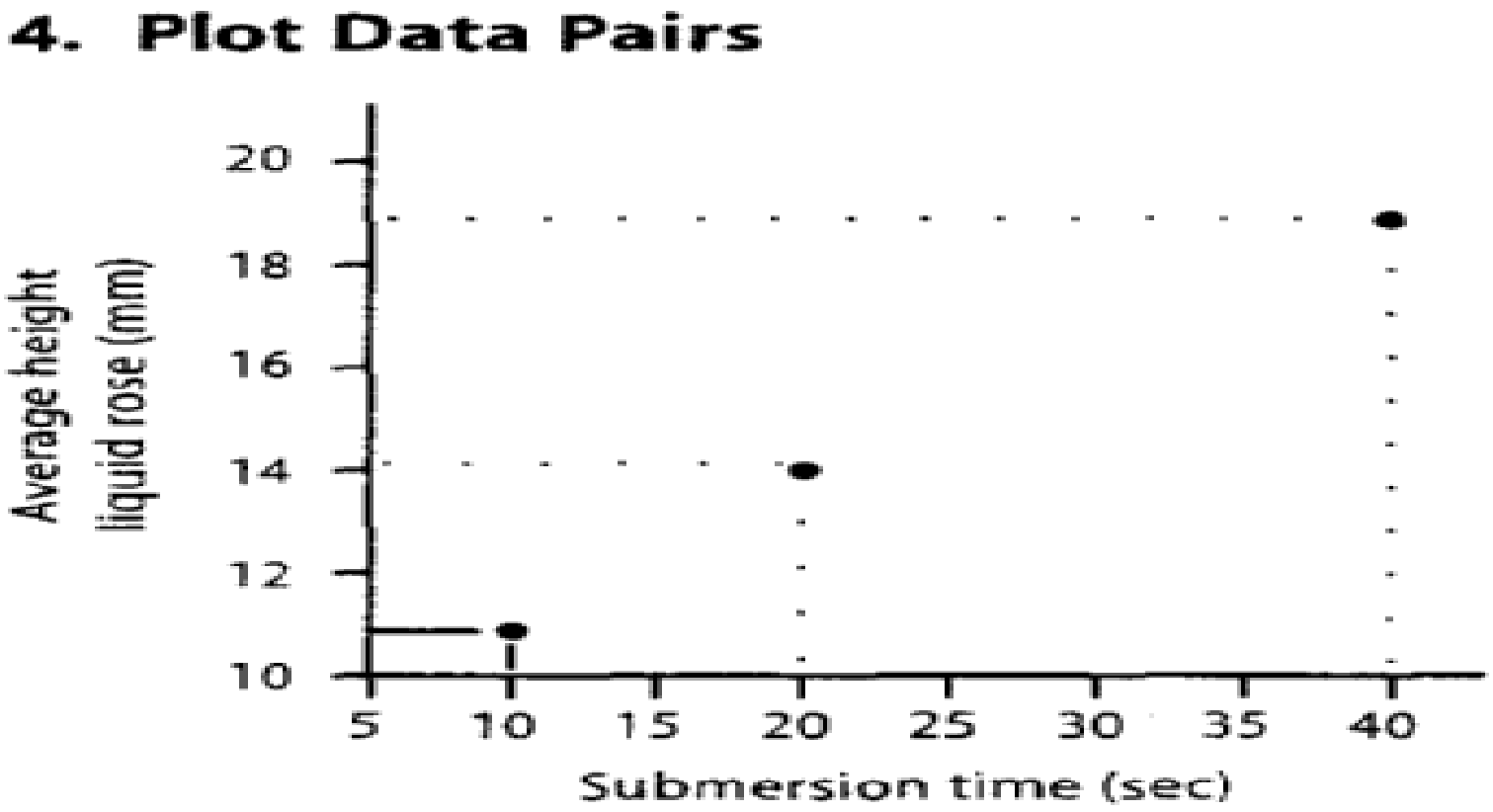
(10, 11)
(15, 14)
(20, 14)
(25, 25)
(30, 16)
(35, 17)
(40, 19)

3. Determine Scales for Axes



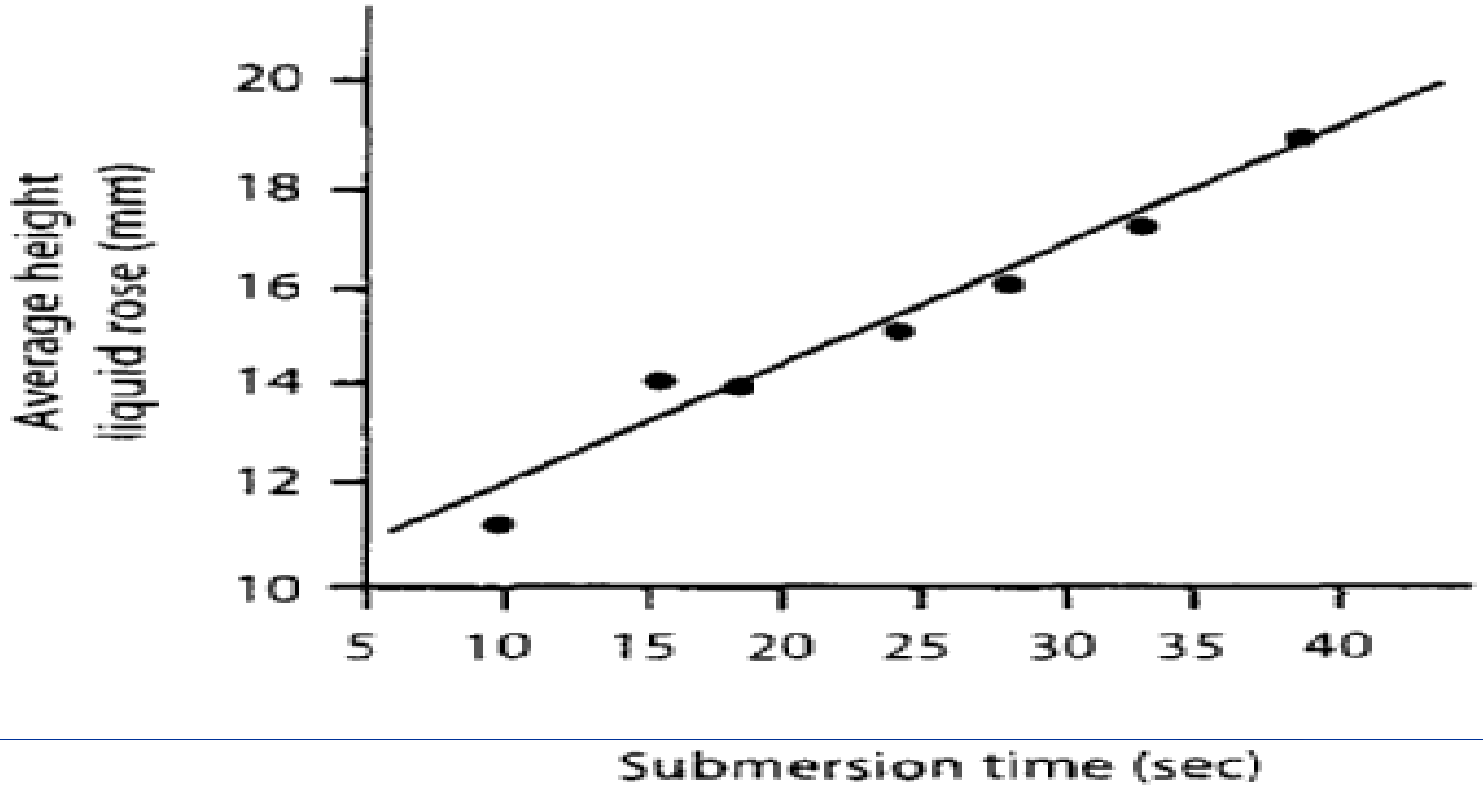
Making a Line Graph
(Continued)

Start plotting your data pairs



Making a Line Graph
(Continued)

After plotting data, draw a line “of best fit”

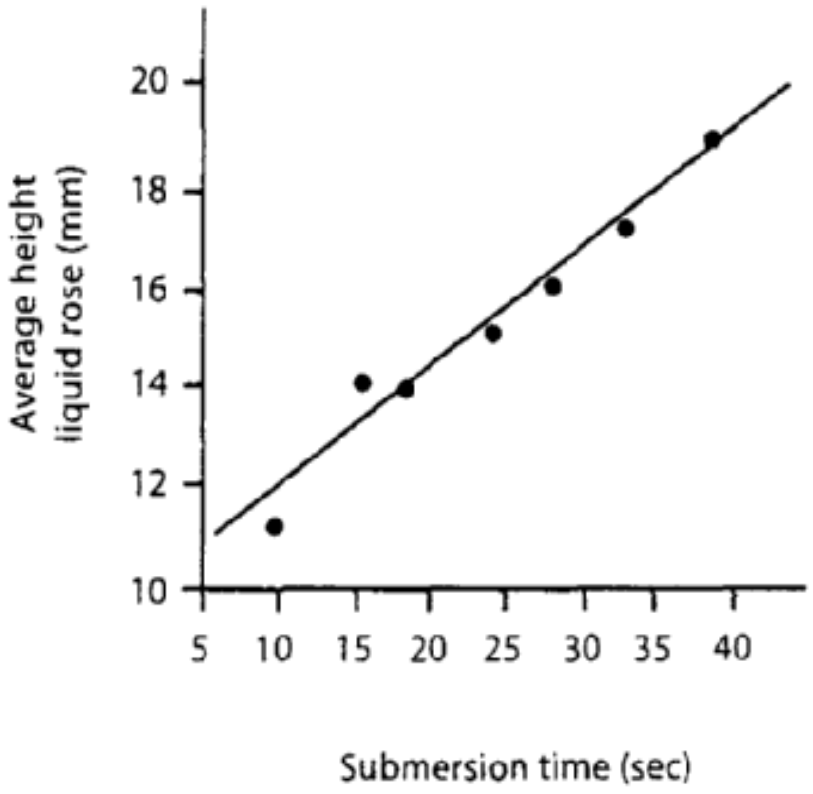


Making a Line Graph
(Continued)

Complete the graph by summarizing its findings

"As the length of time the paper towel was submerged increased, the height the liquid rose also increased."

5. Summarize Trends



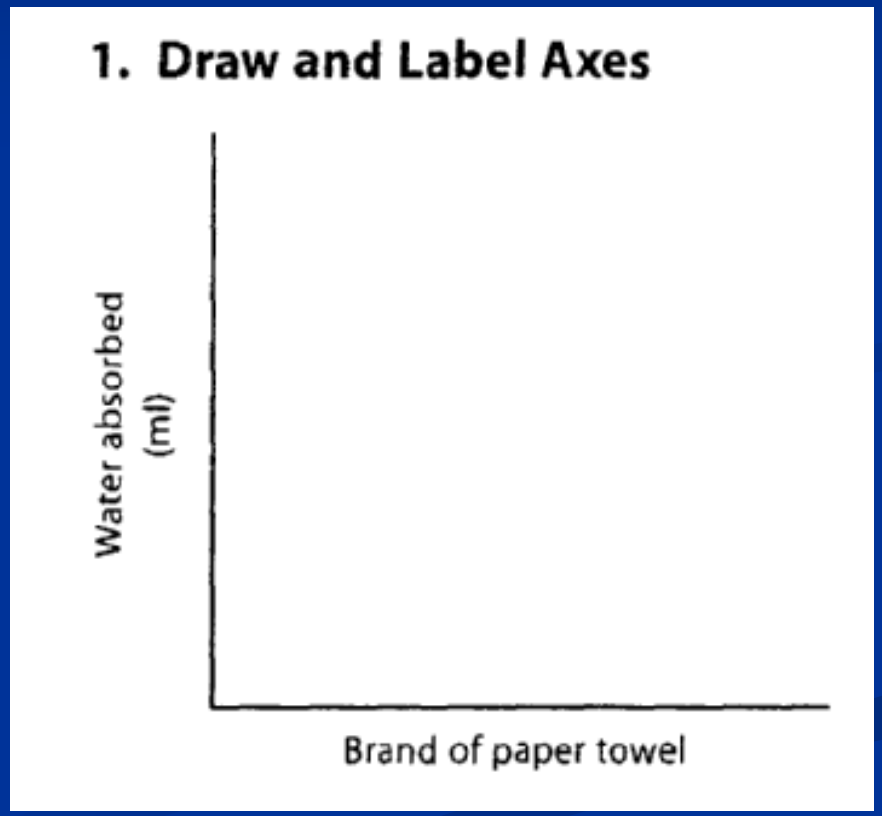
Making a Bar Graph

Again, Start with your data table

Draw and Label Axes

Experimental Data

Independent variable Brand of paper towel	Dependent variable Water absorbed (ml)
A	34
B	17
C	24
D	36
E	27
F	25



Making a Bar Graph
(Continued)

Experimental Data

Independent variable Brand of paper towel	Dependent variable Water absorbed (ml)
A	34
B	17
C	24
D	36
E	27
F	25

Using your data table, write data pairs

2. Write Data Pairs

(A, 34)
(B, 17)
(C, 24)
(D, 36)
(E, 27)
(F, 25)

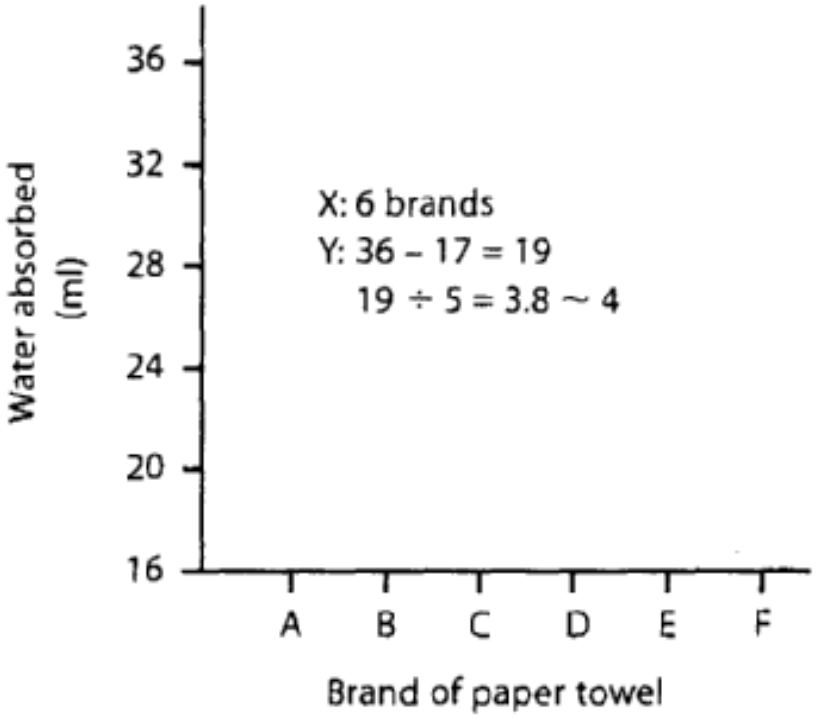
Making a Bar Graph
(Continued)

Use your data pairs to determine the scales for the axes

2. Write Data Pairs

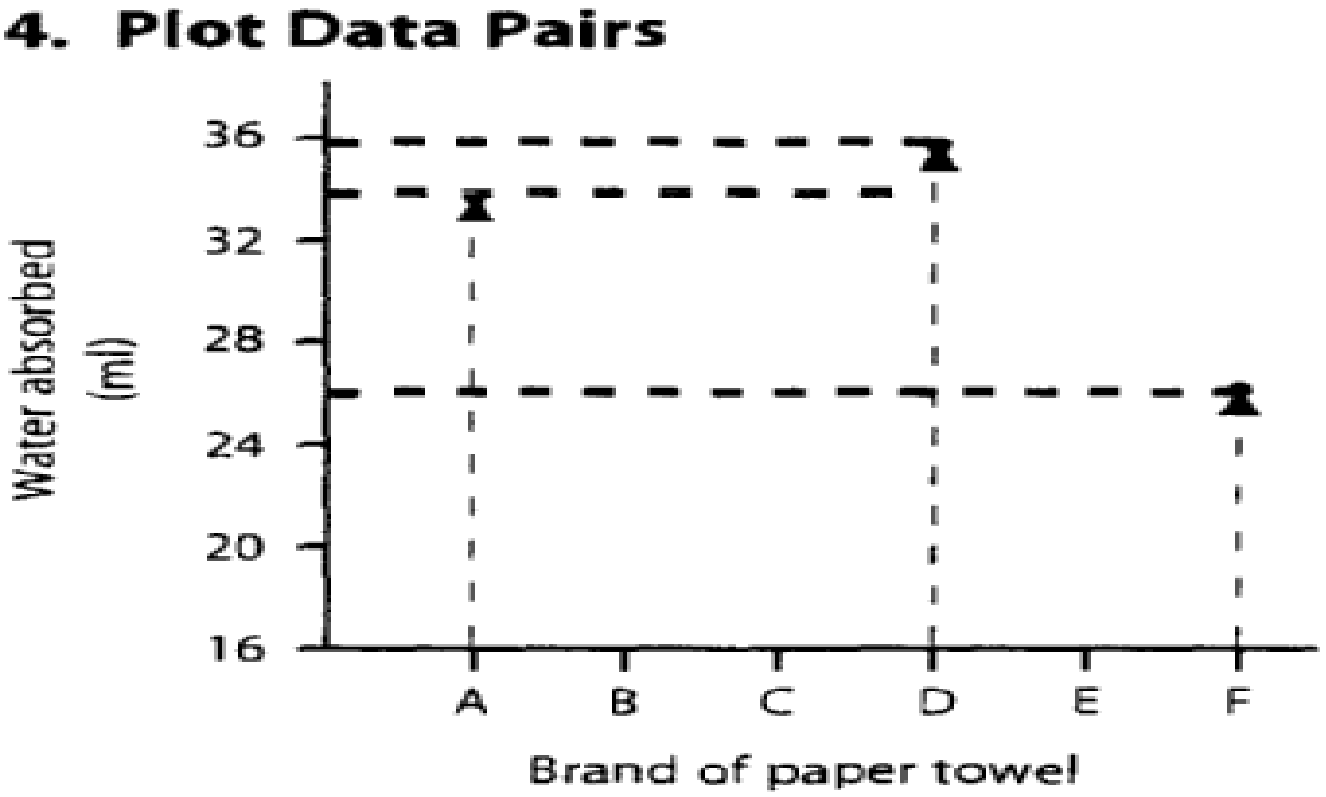
(A, 34)
(B, 17)
(C, 24)
(D, 36)
(E, 27)
(F, 25)

3. Determine Scales for Axes



Making a Bar Graph
(Continued)

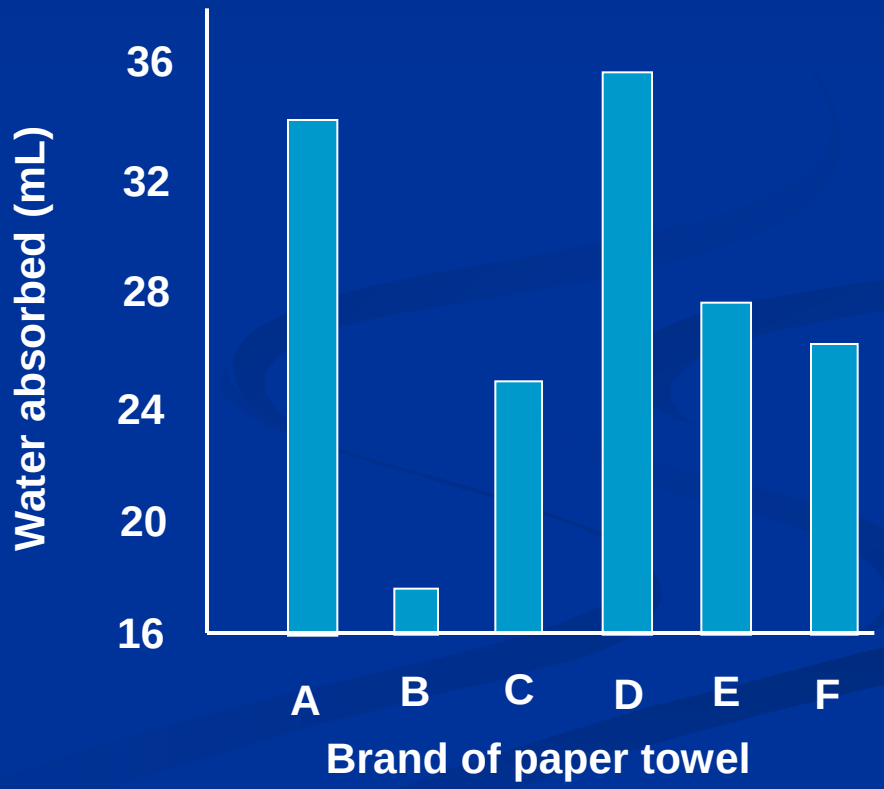
Start plotting your data pairs



Making a Bar Graph
(Continued)

After plotting data, fill in bars

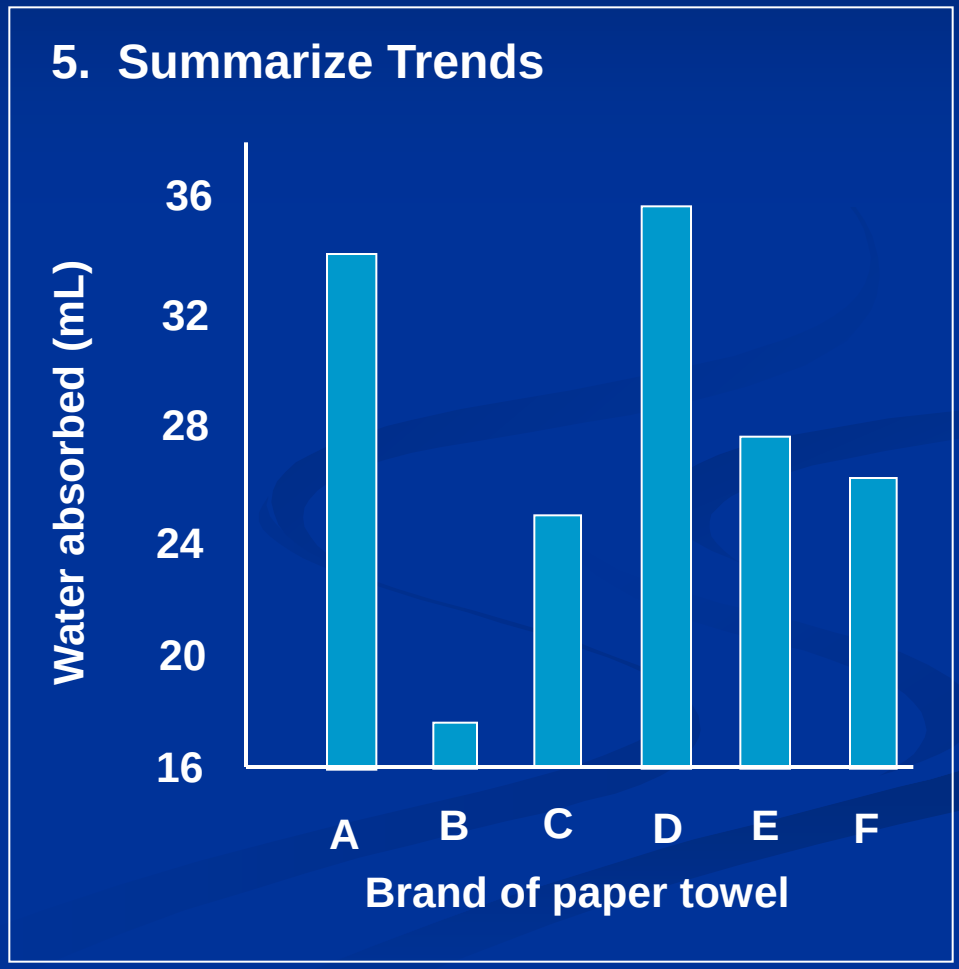
Include a key if needed



Making a Bar Graph
(Continued)

Complete the graph by summarizing its findings

- *Brands A and D were the most effective water absorbers.*
- *The least effective absorber was Brand B.*
- *Brands C, E, and F absorbed intermediate amounts of water.*



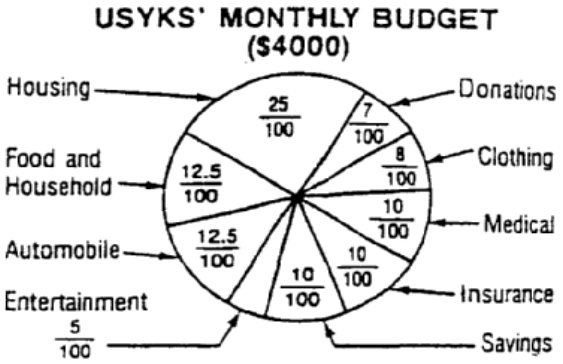
Graphing Review

- Purposes:
  - Organize and analyze data
  - Show patterns
  - Communicate information
  - Allow scientists to make predictions
- Components:
  - Appropriate title
  - Equal units on each axis with good use of spacing
  - Labels on each axis including units
    - (example, mm, sec., kg.)
  - Neatly created using a variety of color

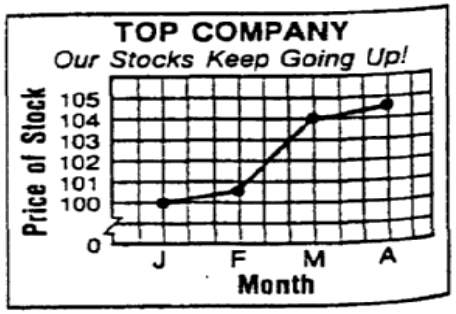
Types of Graphs

Graph Review

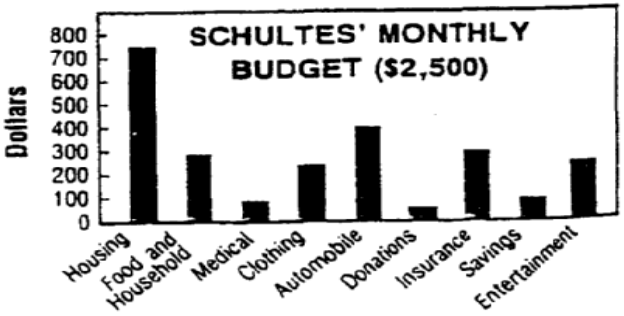
* Circle Graphs
  - Show the relationship of parts to a whole
  - Used to compare the parts
  - Good for percentages and fractions



* Line Graphs
  - Show changes over time
  - Show trends
  - Show relationships of data



* Bar Graphs
  - Used for comparing quantities
  - Used when data is not connected to each other
  - Used when working with numbers not involving time



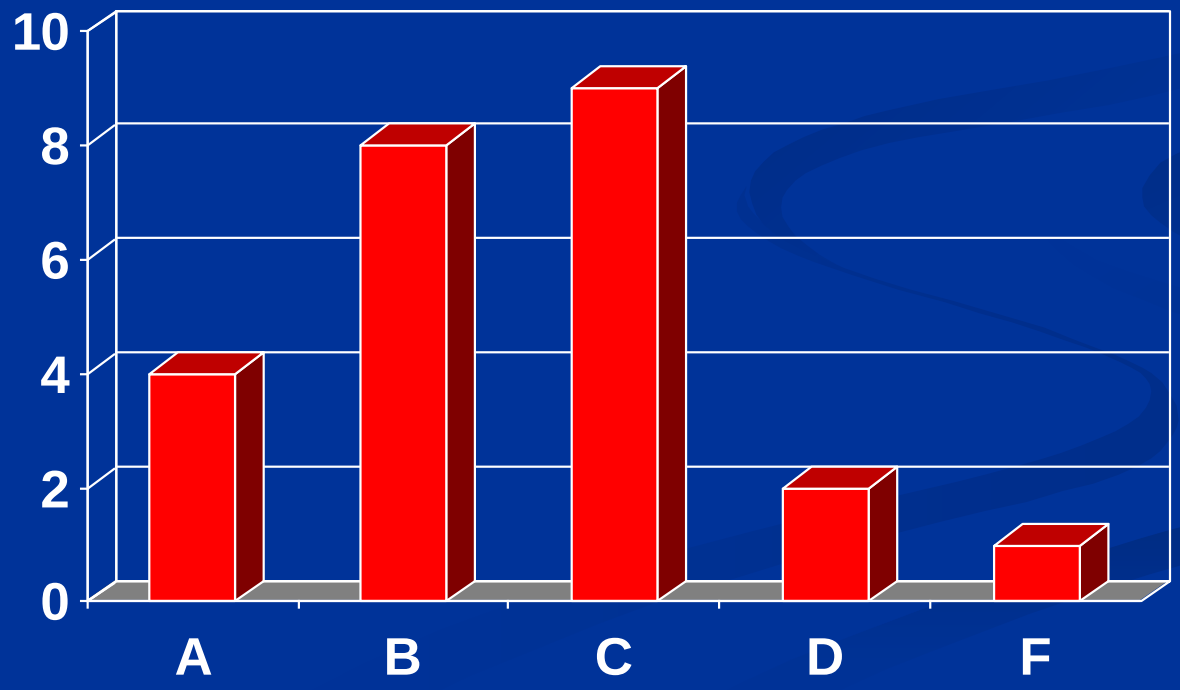
Graphs

Bar Graph

shows how many of something

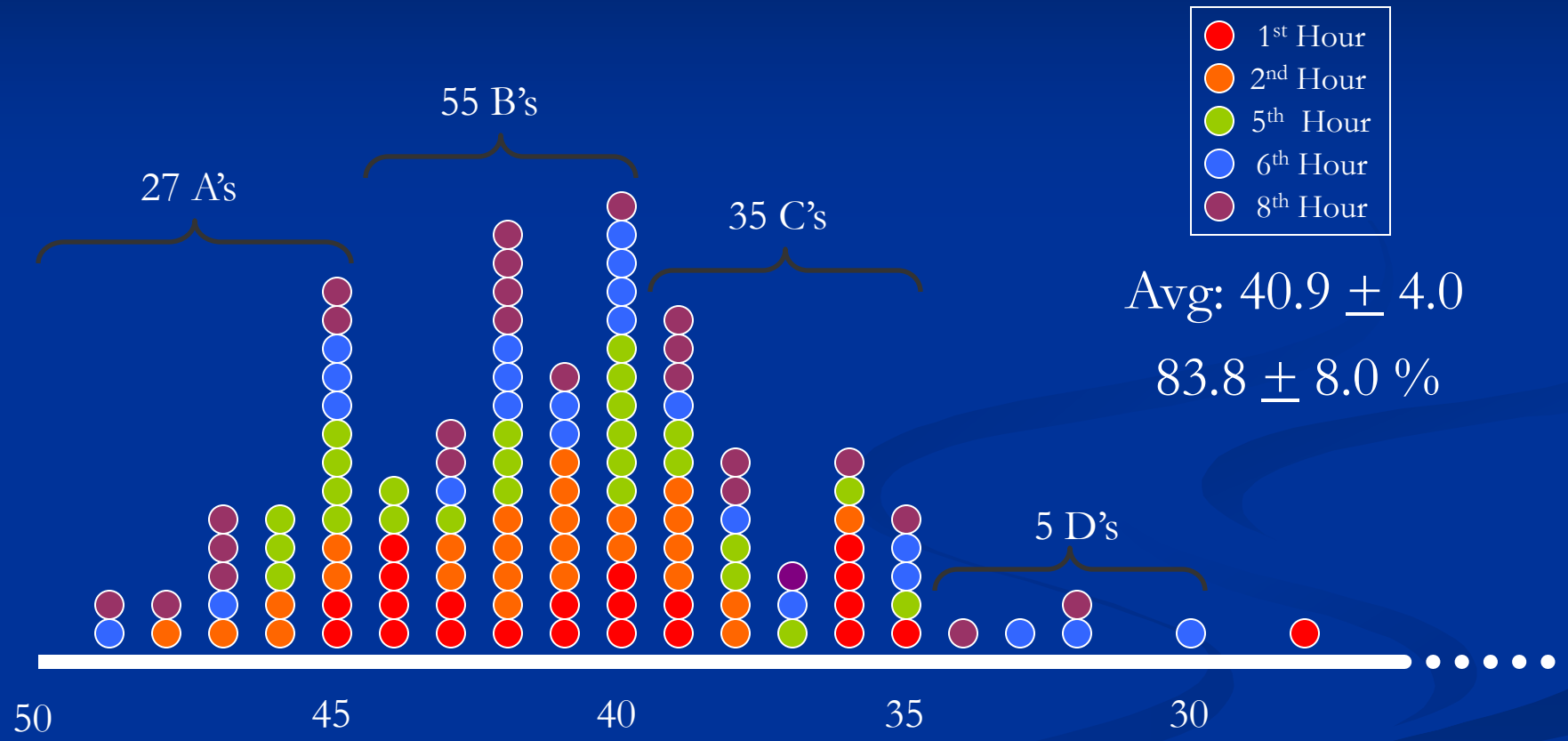
are in each category

Chemistry Grades



Unit 1 Test – Honor's Chemistry

Introduction to Chemistry

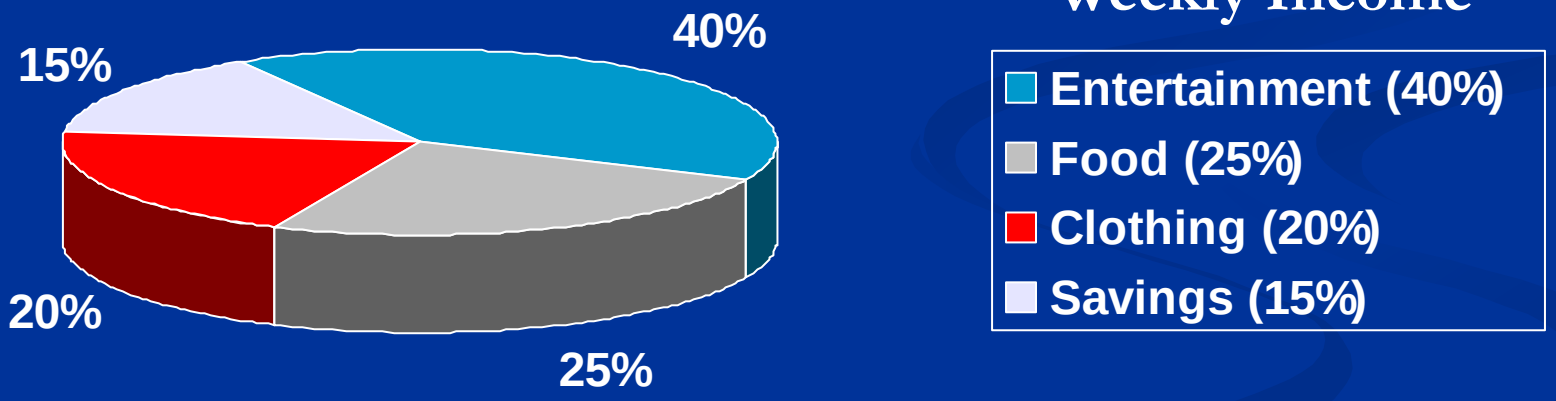


Avg: 40.9 ± 4.0

83.8 ± 8.0 %

Pie Graph

shows how a whole is broken into parts

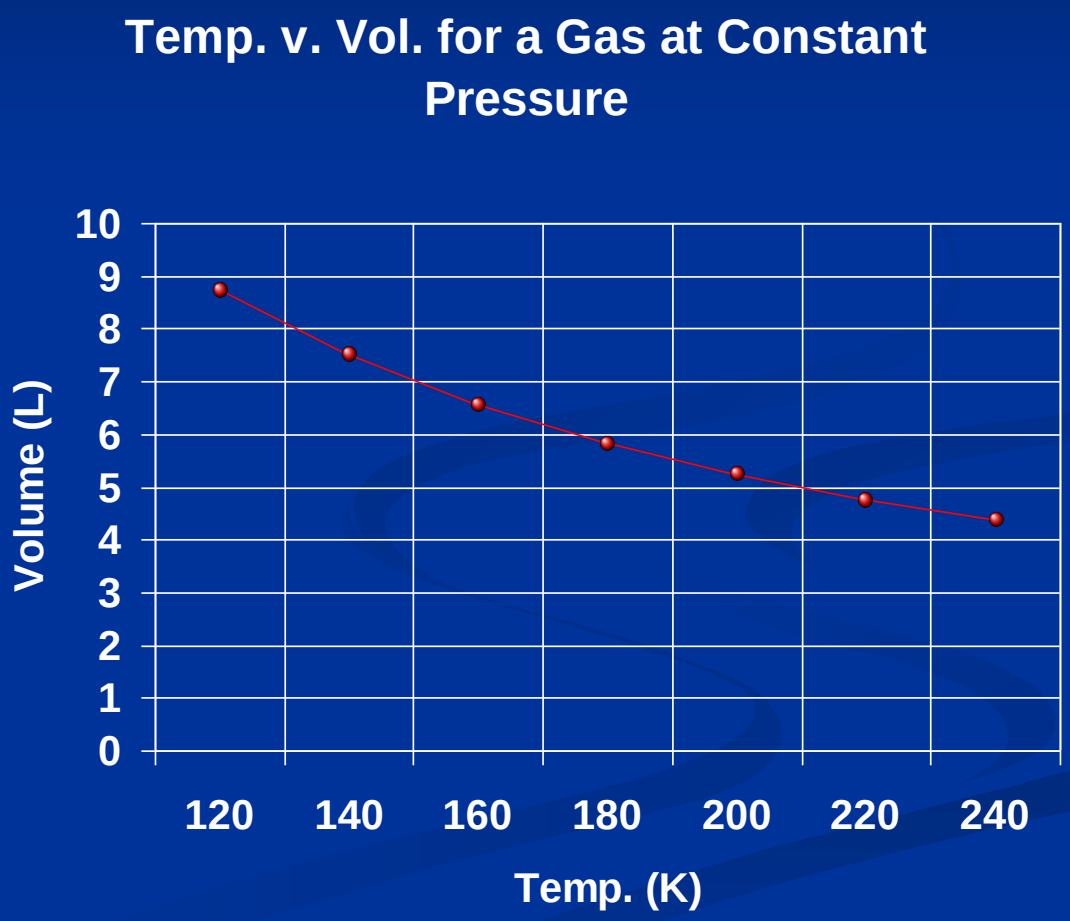


Line Graph

shows continuous change

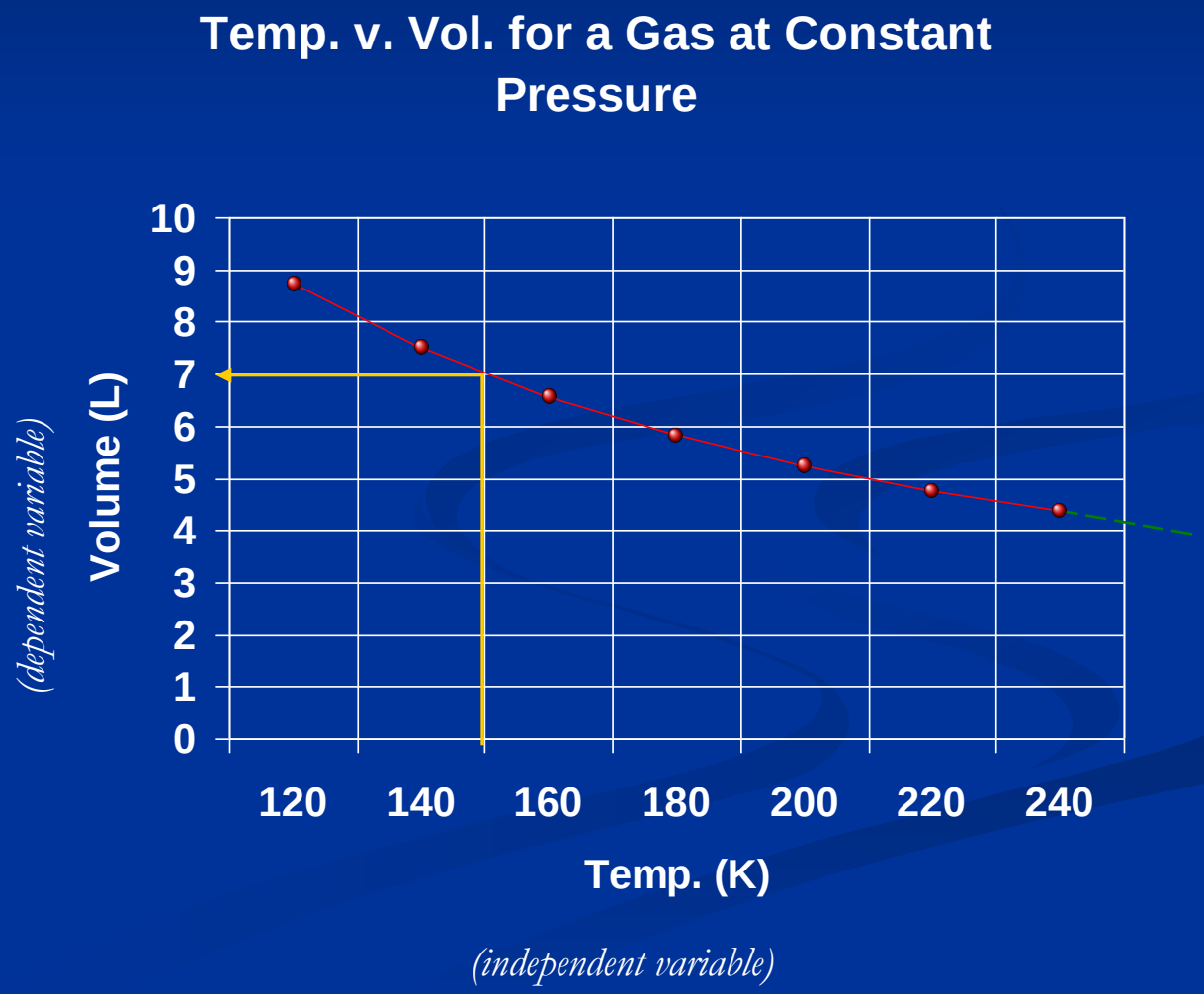
Elements of a "good" line graph

- axes labeled, with units
- use the available space
- title
- neat



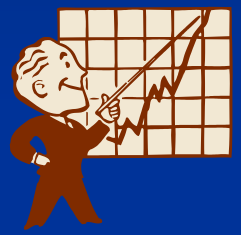
How to read a graph

- *Interpolate* - read between data points
- What volume would the gas occupy at a temperature of 150 K?
- *Extrapolate* - read data beyond data points
- What volume would the gas occupy at a temperature of 260 K?
- Which do you have more confidence in? Why?



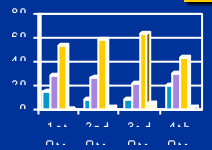
Graphs

- Line Graph



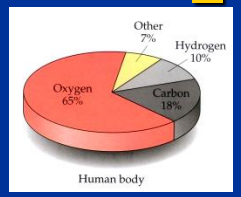
  - Used to show trends or continuous change

- Bar Graph

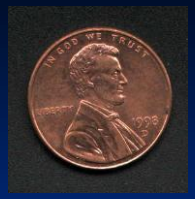


  - Used to display information collected by counting

- Pie Graph



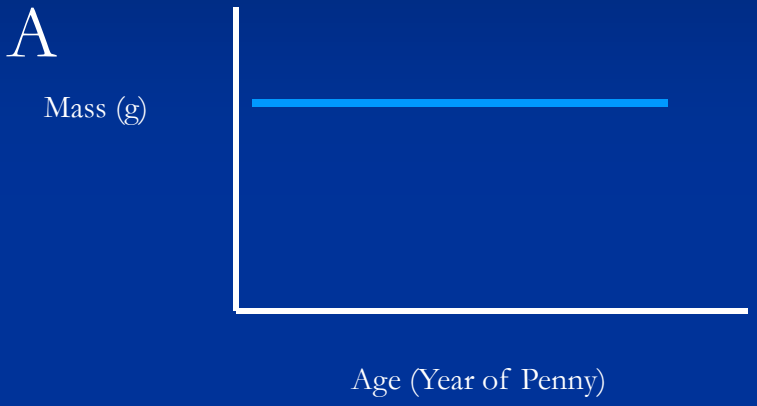
  - Used to show how some fixed quantity is broken down into parts



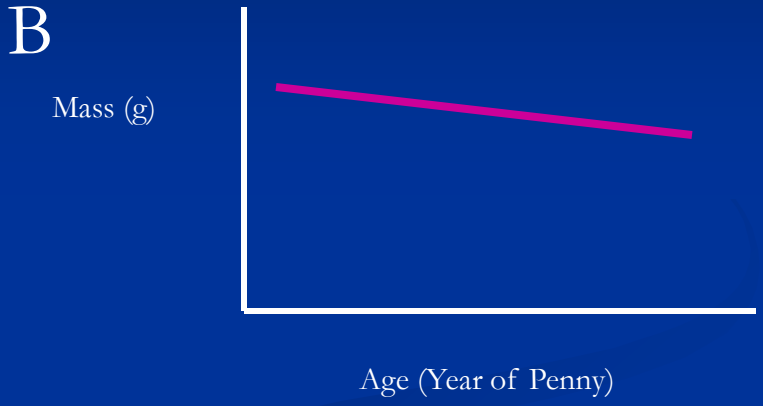
Line Graph

How does the mass of a penny change with age?

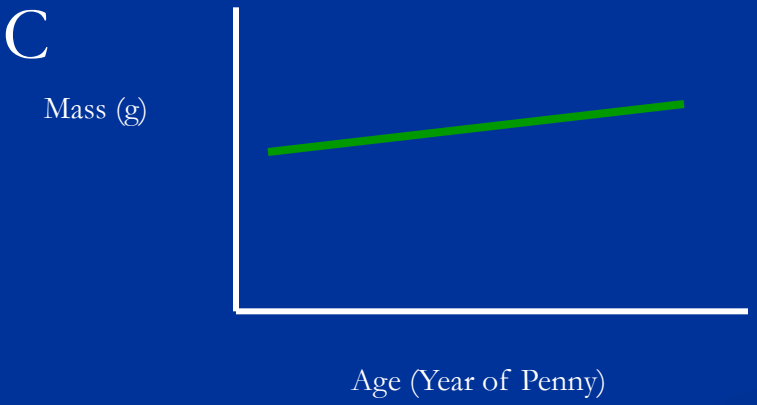
A



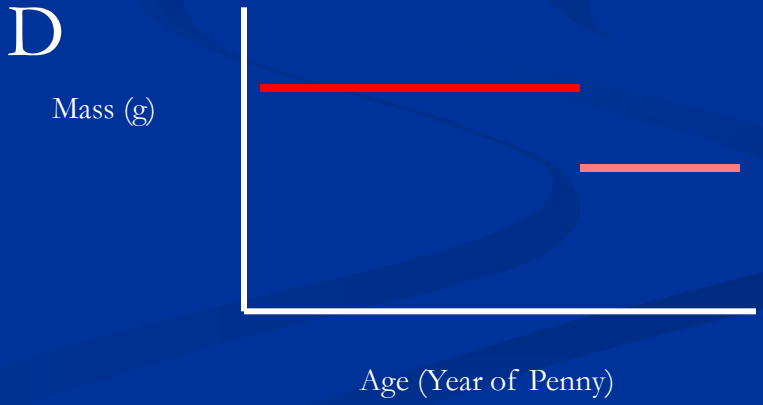
B



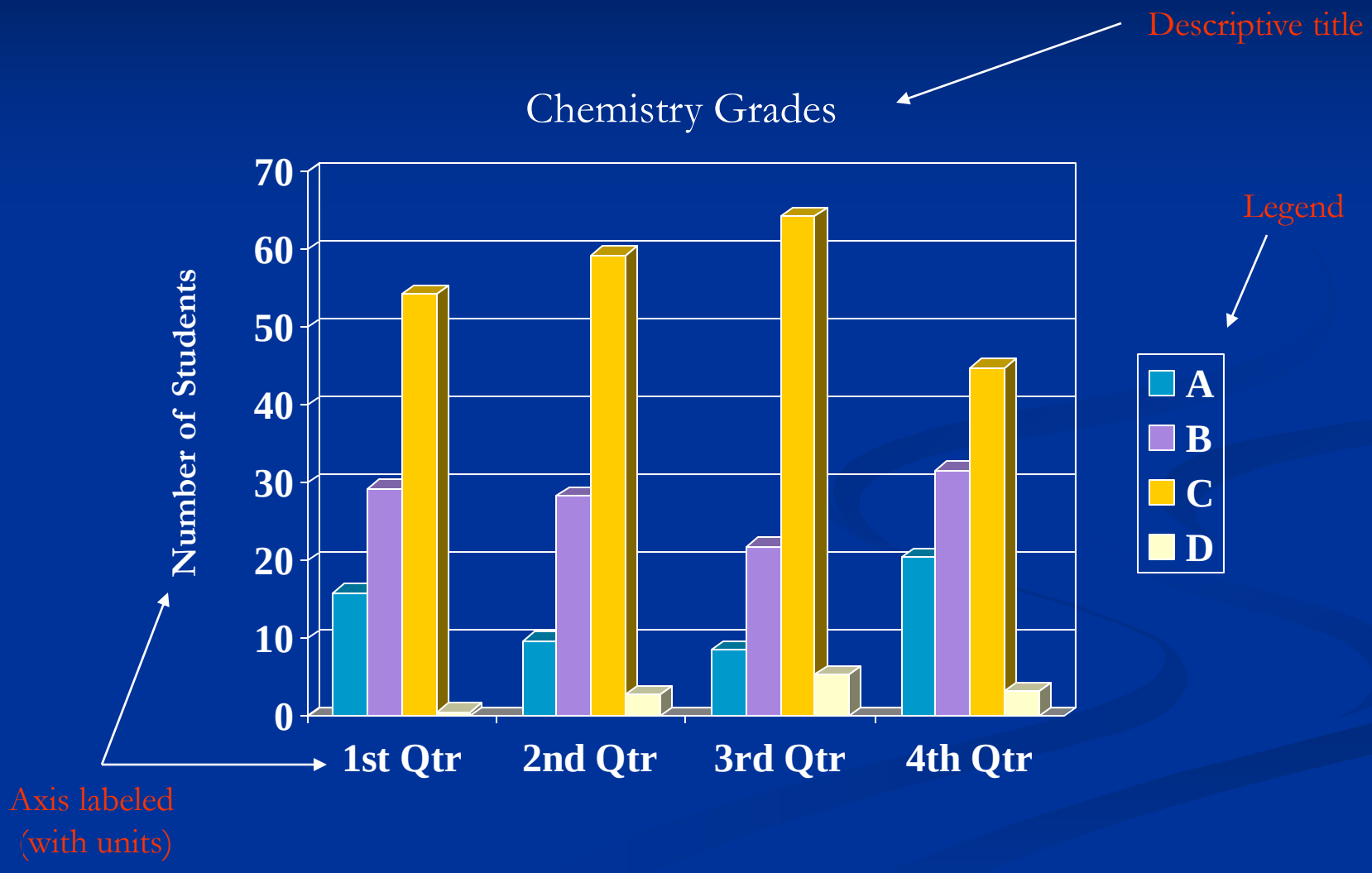
C



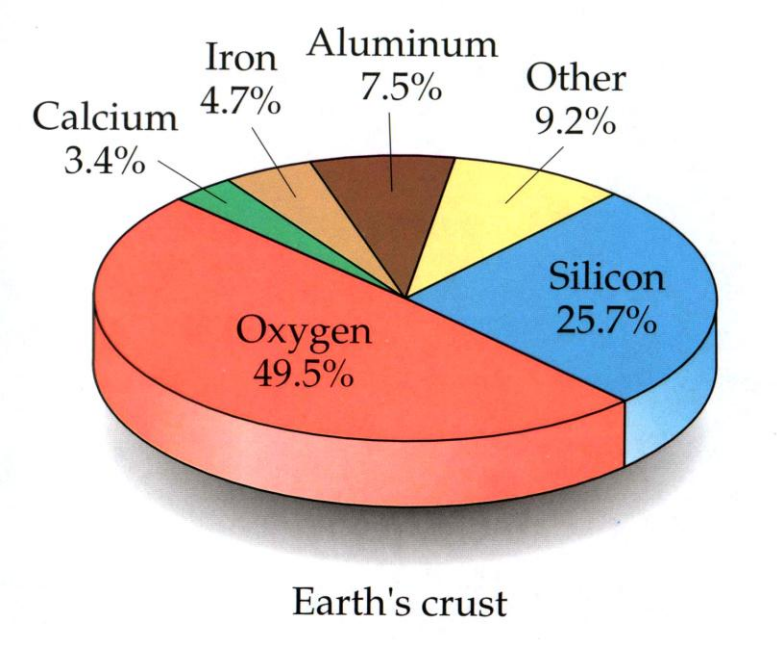
D

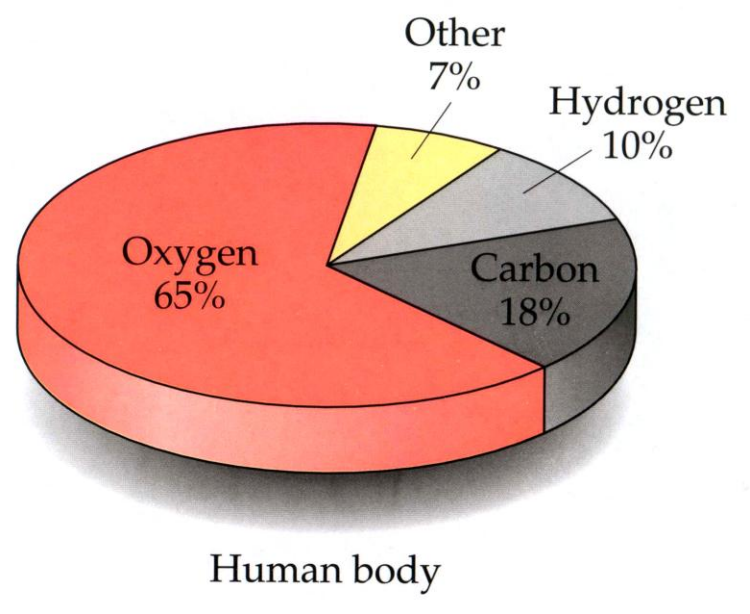


Bar Graph

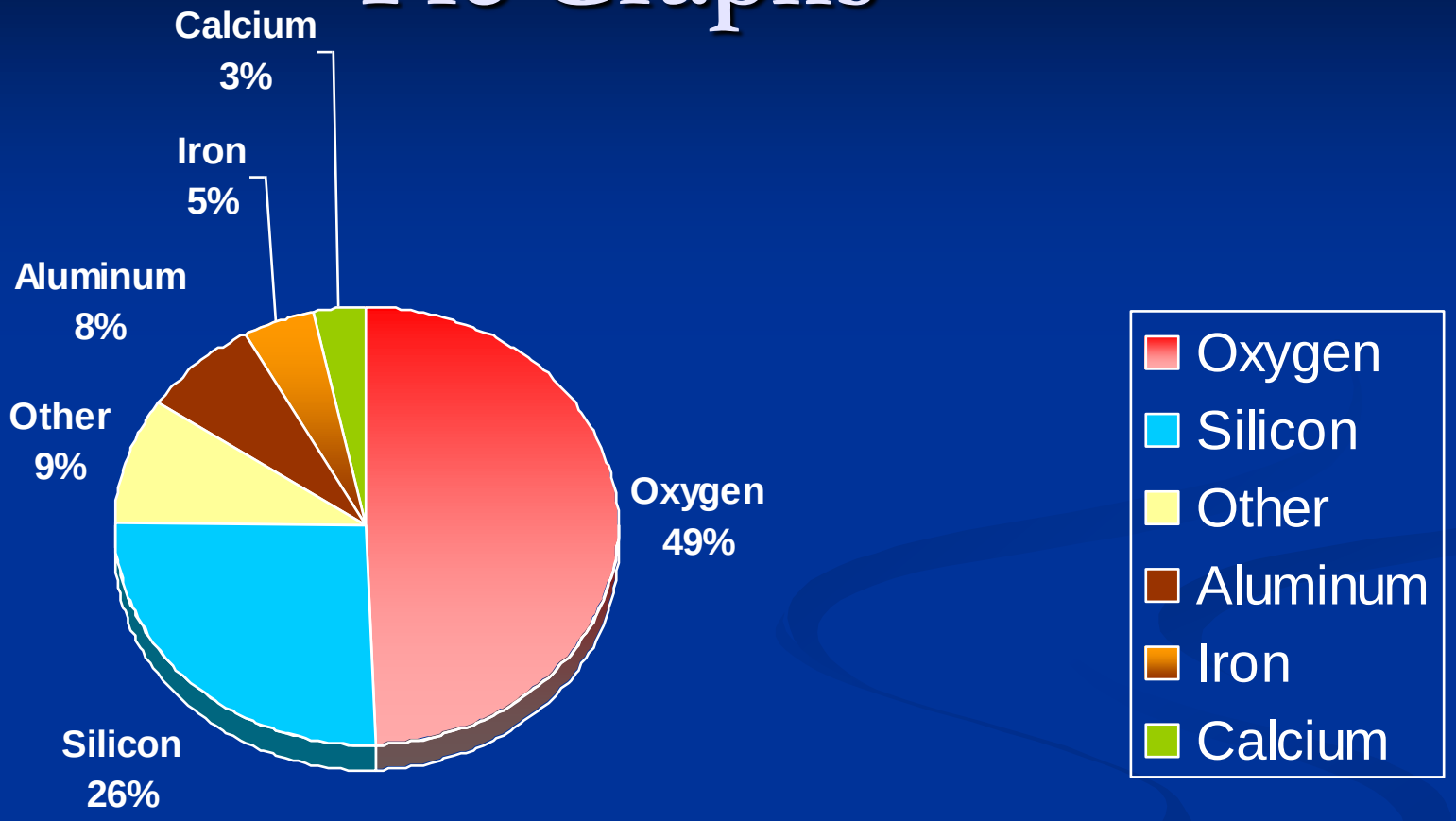

Descriptive title
Chemistry Grades
Legend
Number of Students
70
60
50
40
30
20
10
0
A
B
C
D
1st Qtr
2nd Qtr
3rd Qtr
4th Qtr
Axis labeled
(with units)

Pie Graph


Iron
4.7%
Aluminum
7.5%
Other
9.2%
Calcium
3.4%
Silicon
25.7%
Oxygen
49.5%
Earth's crust


Other
7%
Hydrogen
10%
Oxygen
65%
Carbon
18%
Human body

Pie Graphs



Earth's Crust