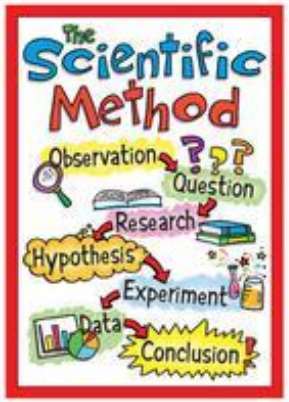
OBSERVATION

WONDER

RESEARCH

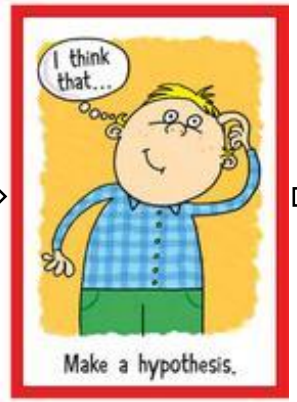
HYPOTHESIZE



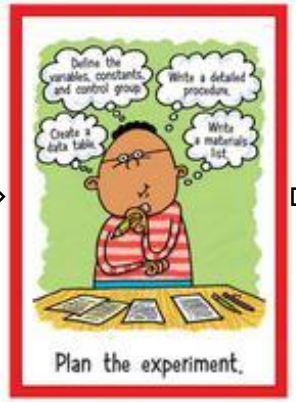
Make observations.

Think of a question.

Research the topic.



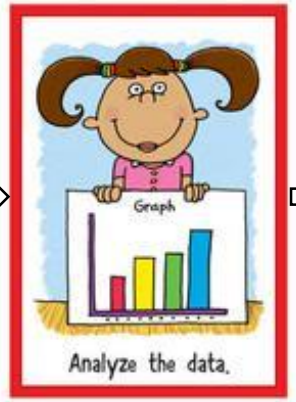
Make a hypothesis.



Plan the experiment.

Conduct the experiment.

Record the data.



Analyze the data.

Make a conclusion.

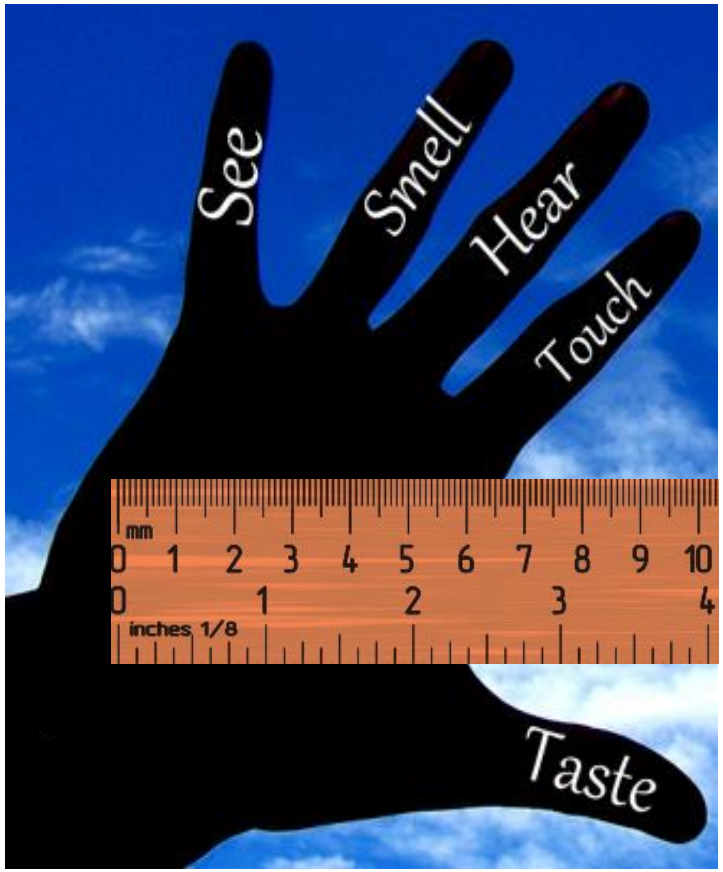
PLAN

EXPERIMENT

DATA, its PRESENTATION and ANALYSIS

CONCLUSION

Observation



- **<u>Observation</u> is describing an object or event using your five senses (*what you see, hear, smell, taste, touch*) or measurement (*numbers*).**
- **<u>Information gathered</u> during an observation is called data (sing. *datum*).**

<u>Observation</u> does not include opinion (how you *feel* or what you *think*)!

Describe the Baby Elephant

It weighs 480 kilograms.

It has large ears and long trunk.

It has gray wrinkly skin.

~~It is very cute!~~

It is young.

It is about 1.5 yards tall.

Qualitative vs Quantitative Data

QuaLitative (letters)

- **Descriptions** using **words**.
- Data which can be **observed** but **not measured**.
- What the object is *like*: colors, texture, smell, taste, appearance, etc.
- ***Subjective, relative***

QuaNtitative (numbers)

- Specific **numbers**.
- Data which can be **measured**.
- Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, age, etc.
- ***Objective, specific***

Qualitative observations are subjective

Quantitative observations are objective

DIY: Monarch Butterfly

common morph (form)

rare Hawaiian white morph

Make one **qualitative** observation about each picture above.
Explain why this is a qualitative observation.

Make one **quantitative** observation about each picture above.
Explain why this is a quantitative observation.

Working with your observations

Excellent way to organize your data: a table.

Table 1. My School Nova classes enrollment.

YEAR	EARTH SCIENCE	SCIENCE
2014/2015	15	8
2015/2016	14	13
2016/2017	10	16
2017/2018	12	4
2018/2019	23	22
2019/2020	20	20

Famous Table:
The Periodic Table of Elements

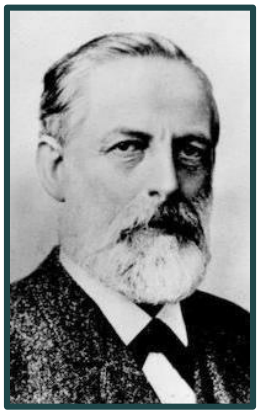
1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Unq	105 Unp	106 Unh	107 Uns	108 Uno	109 Une	110 Unn								

- hydrogen
- alkali metals
- alkali earth metals
- transition metals
- poor metals
- nonmetals
- noble gases
- rare earth metals

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

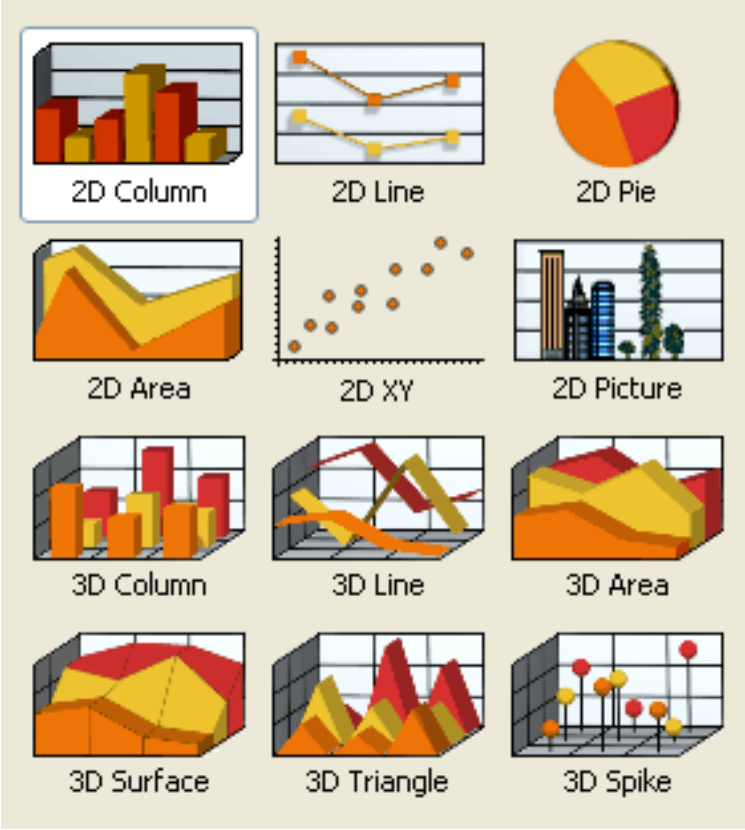
Dmitri Mendeleev (1869)

and Julius Lothar Meyer (1870)



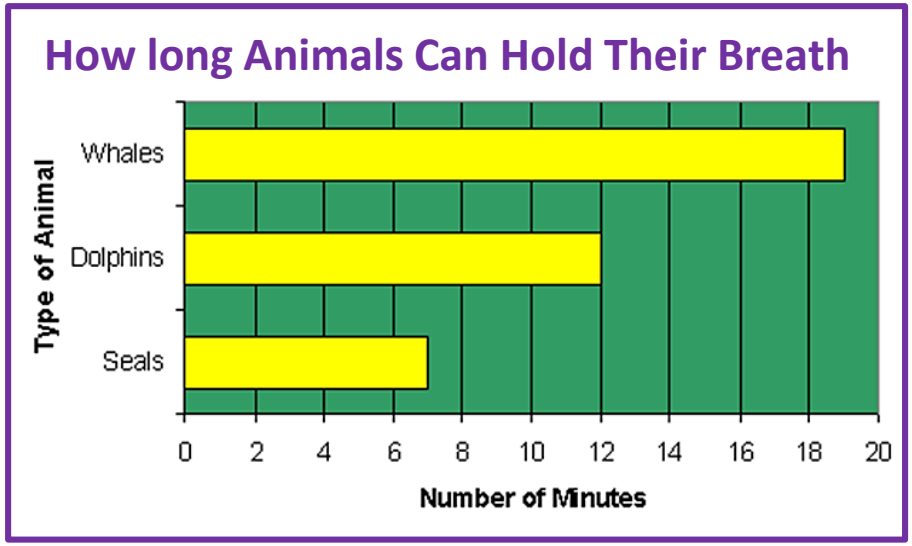
Working with your observations

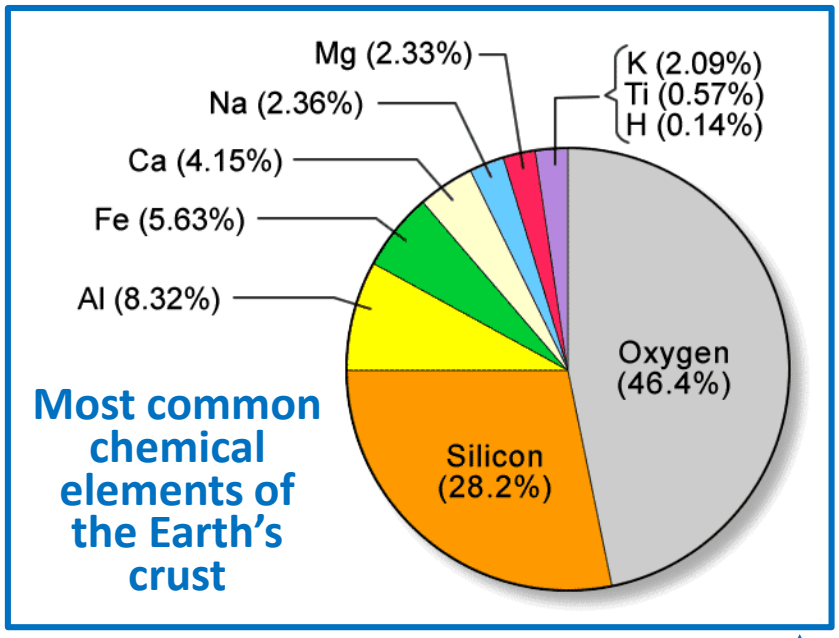
Excellent way to <u>display</u> your data: a graph.

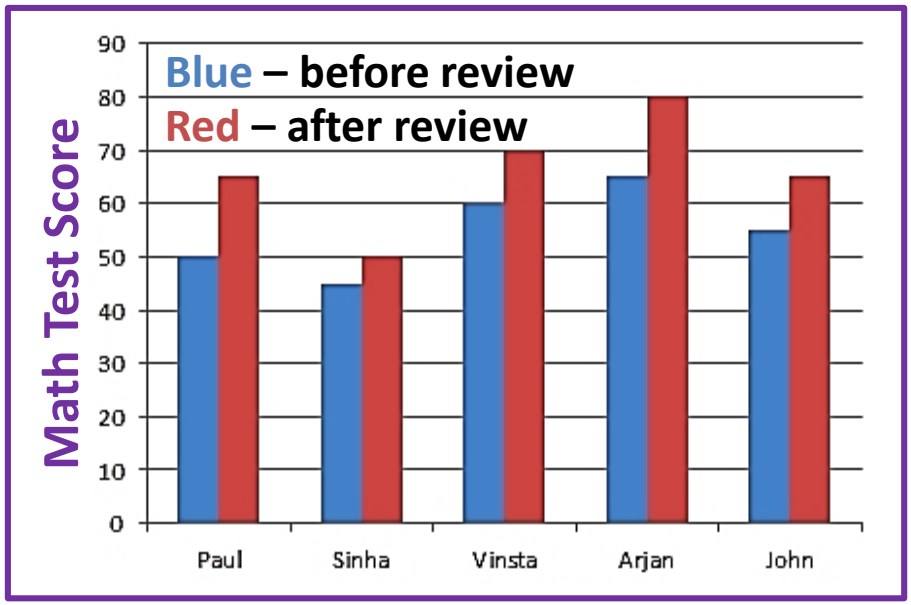


<u>Different types of graphs</u> are appropriate for <u>different experiments</u>!

Types of graphs



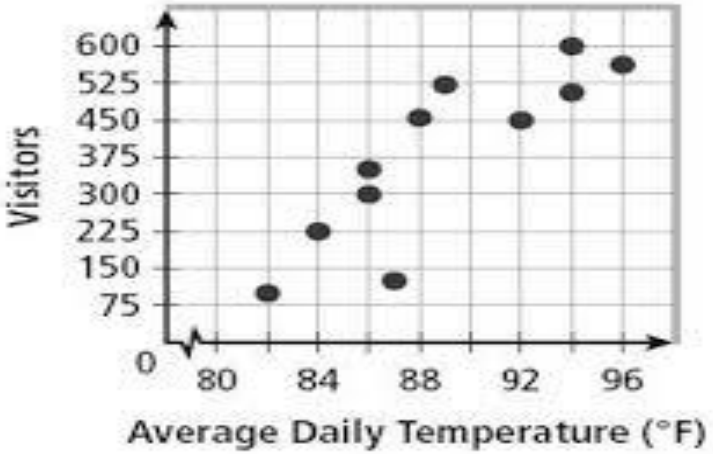




Bar graphs and circle graphs should be used to represent *categorical data* (comparison, sometimes called "side by side" data).

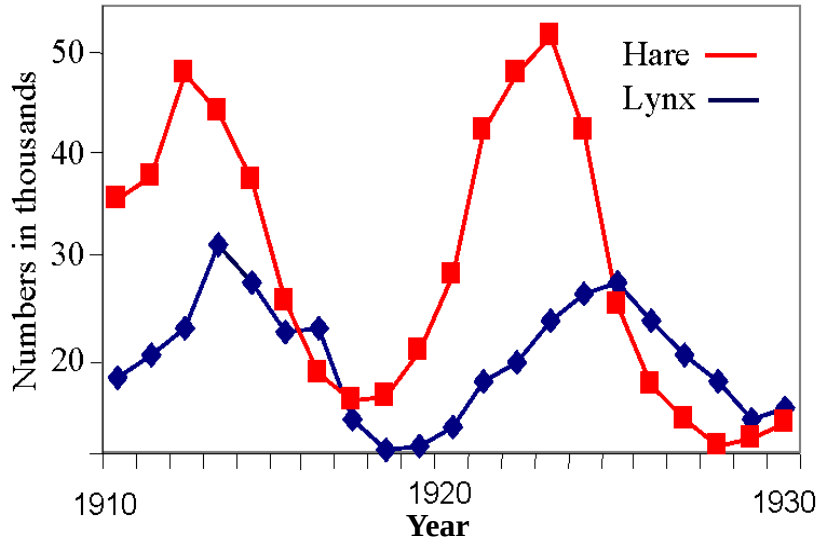
Types of graphs

Cedar Beach visitors

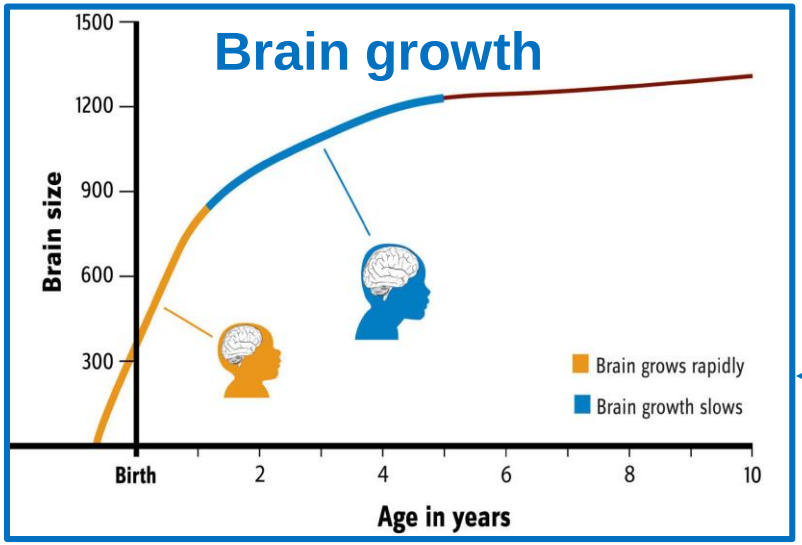


Scatter plots are used to show ***numerical*** data.

Prey-predator population dynamics



Brain growth



Line graphs are used to show ***how data changes over time***.