Part 5 The Scientific Method

Name:
Due:

Part 5 Lesson 1 Intro to Science

Science is…

-A study of _____ phenomenon.
-A systematic study and _____.
-Knowledge through _____.

A good Scientist is….

Is _____!
Is _____, precise and methodical.
Is _____, a seeker of the truth.
Can observe and _____.
Can find _____, reasons, and research.
Works in all weather conditions if safe.
Can _____ obstacles.
_____ (talks) with others.

A bad scientist is one who… - Tell me about this "Evil Scientist" below with examples.

Science is a systematic attempt to get around human limitations.
Science tries to remove personal experience from the scientific process.

TRY AND WRITE WITHOUT _____ PRONOUNS.
DO NOT USE…I, me, you, he, she, we, you, they, them, theirs, names, etc

Please pass three items around the table three times.

-Then write about your experience without using any personal pronouns

Part 5 Lesson 2 Procedure

Procedure: A series of actions conducted in a certain _____ or manner

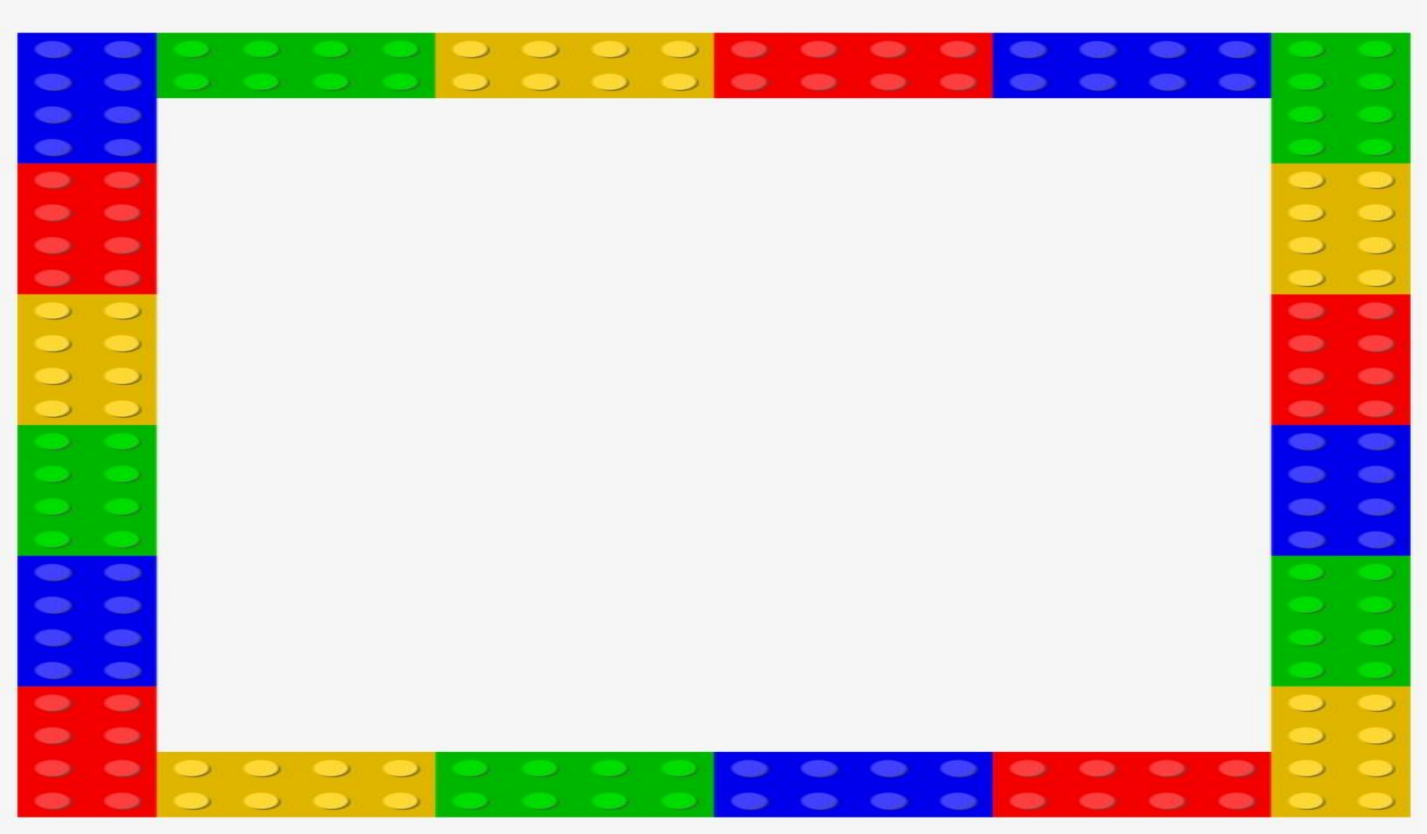
Writing a procedure.

The entire paragraph is in the past tense.

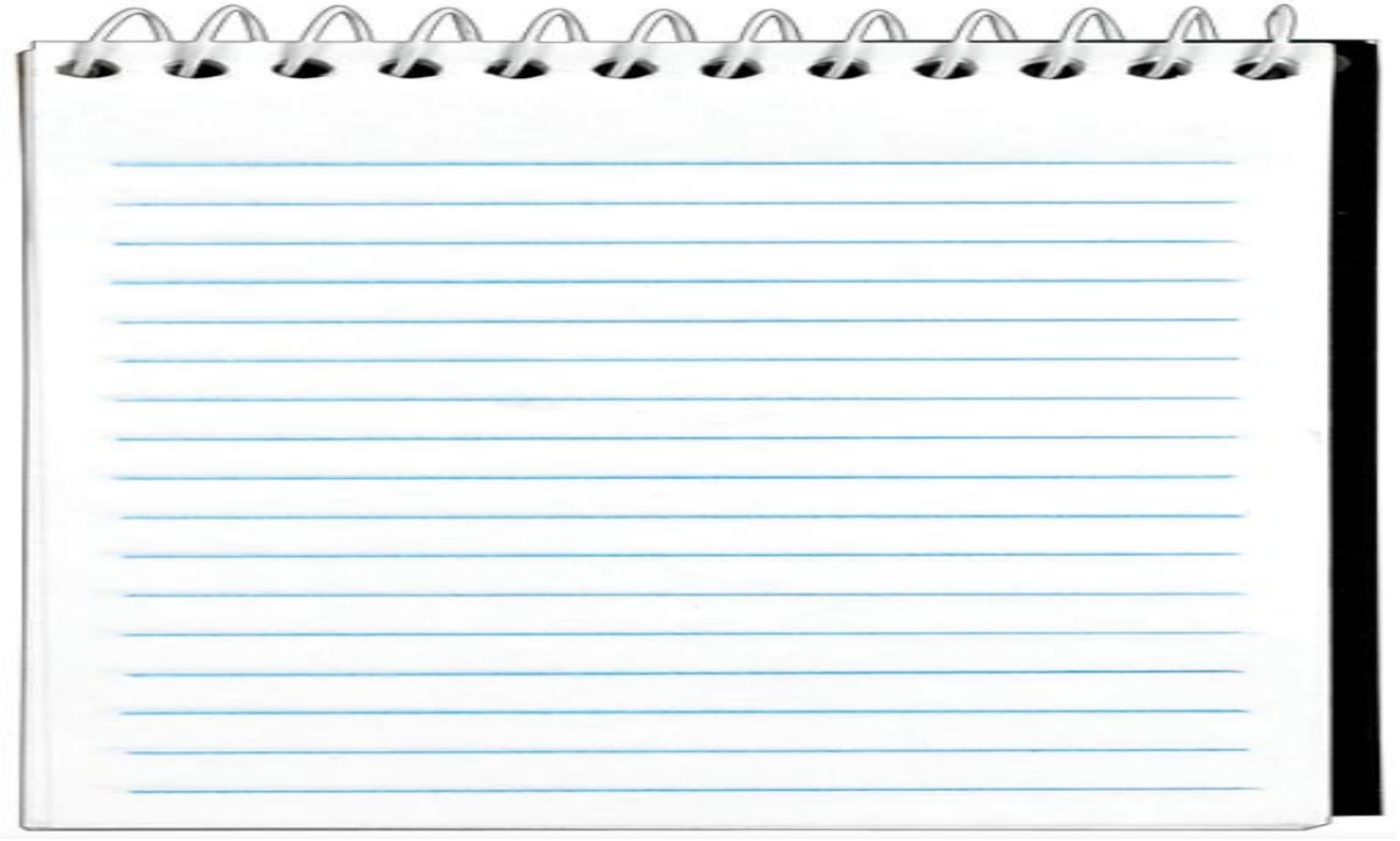
Write chronologically from beginning to the end. (Paragraph or bullet list) teacher will decide.

Continue to avoid personal pronouns.

Draw your Lego Anything Below. Don't show this picture to the person who will build it



Disassemble and then reassemble writing a procedure in the box below. When complete, try and build it following only your procedure. Next, have a peer try and do it.



How did it go? Was your peer able to build your Lego creation? Where did it go wrong if it did?

Types of scientists…

- _____ – The study of life.
- _____ – The study of earth.
- _____ – The study of Matter.
- _____ – The study of matter and energy.
- Many more...

Take a guess as to what is in each of the boxes. You're not allowed to open the boxes.

Please Sketch.

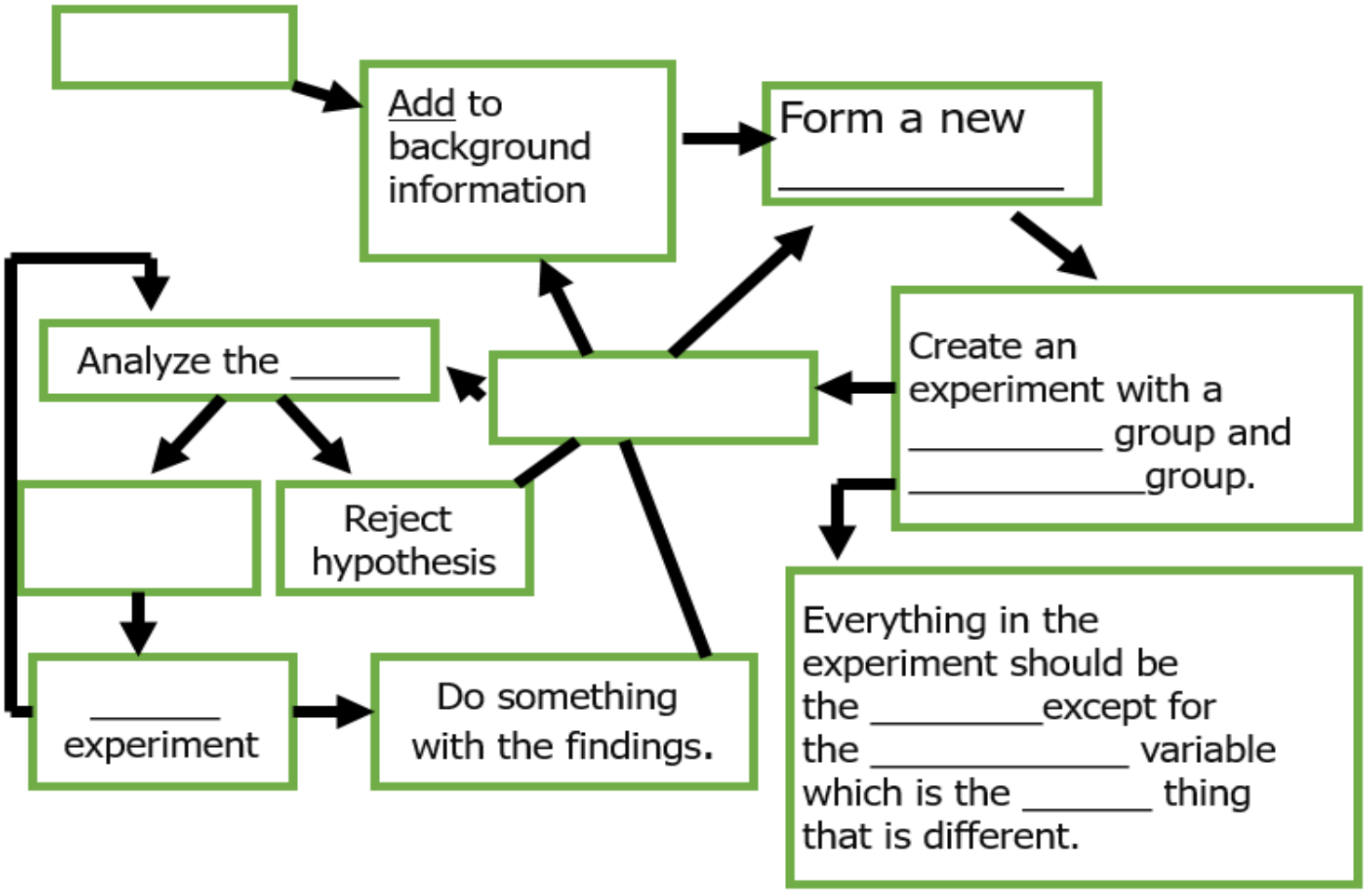
1 2 3

4 5 6

Part 5 Lesson 3 The Scientific Method

Scientific method: A process that is the basis for scientific inquiry (questioning and experimenting).

THE SCIENTIFIC METHOD



Variable: _____ quantity of something.

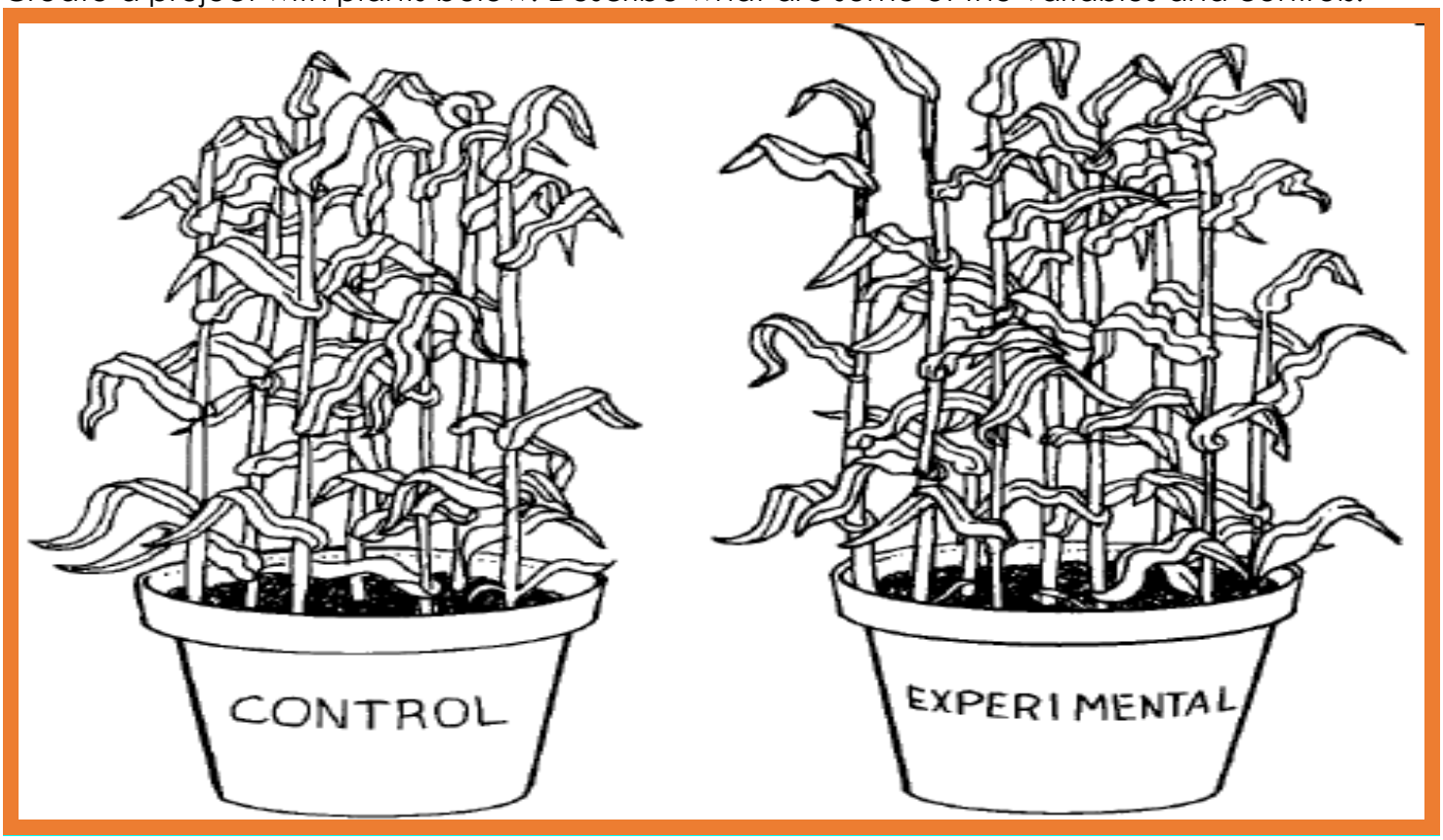
Independent: (Change) The variable you have control over, what you can choose and _____.

Dependent: (Observe) What you _____ in the experiment and what is affected during the experiment.) (Ex, color change, change in mass)

Control: (Same) Quantities that a scientist wants to remain _____ so it a fair test.

A student wants to find out what minerals melt ice the fastest. So the student places halite, calcite, hematite, and pyrite on equal sized cubes of ice on her counter in the kitchen. The student times how long it takes each mineral to melt completely through the ice cube. She records the minutes it takes for each one to melt in her science journal. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____	A student wants to find out how cigarette smoke blown into a small greenhouse of plants damages the plant. The student grows two small plants in separate clear plastic soda bottles. The student injects one with cigarette smoke periodically. Both are watered and given the same light conditions. The student records the height, number of leaves, and flowers of both plants every day for one month. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____
A student wants to find out if an egg will crush more easily standing straight-up or on its side. The student creates a chamber that allows weights to be placed on a board that lies on top of the egg. The student places weights in grams on the board with an egg standing straight, and then on its side. The student records the total weight that was on the board when the egg crushed. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____	A student wants to determine if varying levels of fertilizer will increase the fitness of a plant. She sprays each plant every day with low, medium, and high levels of fertilizer. The plants are given the same soil, water, and light for one month. At the end she measures the number of leaves, plant height, and number of flowers. Problem? =_____ _____ Independent Variable = _____ Dependent Variable = _____ _____ Control =_____ _____

Create a project with plants below. Describe what are some of the variables and controls.



Part 5 Lesson 4 Graphing

Word Bank: Bar, Area, Pie, Line, XY Plot

_____Best to use when you are trying to compare parts of a whole that add up to 1% or 100%. They do not show changes over time

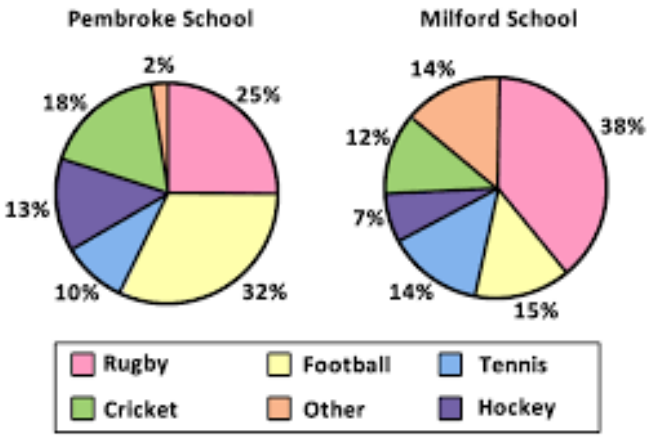
_____Track changes over time for one or more groups. Useful when changes occur in two or more related groups.

_____Used to track changes over short and long periods of time. They can also compare changes over the same period of time for more than one group

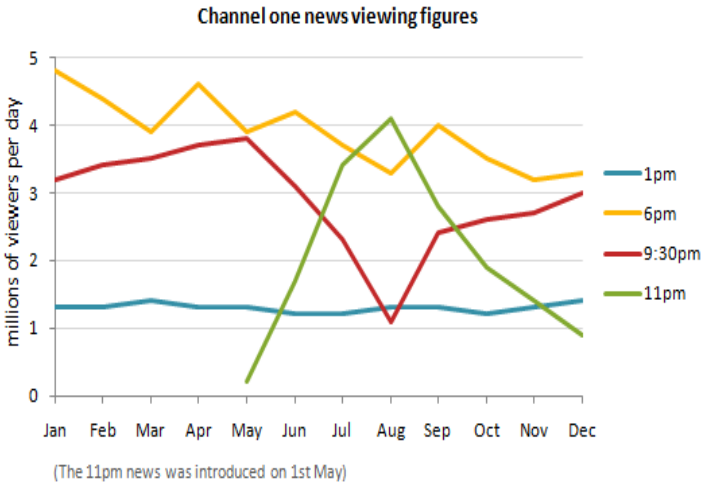
_____Plots are used to determine relationships between the two different things. One axis is used to measure one event (or variable) and the other axis is used to measure the other

_____Used to compare things between different groups. Works best with large differences

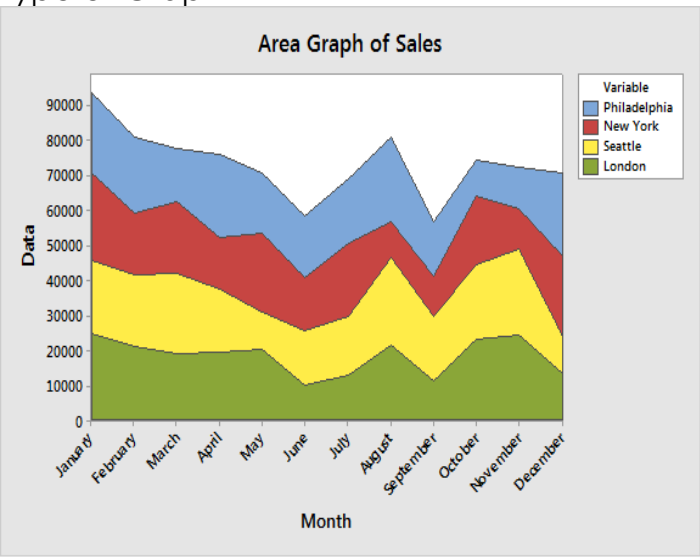
What sport is the most popular at Milford School and Pembroke School?
Answer=
Type of Graph=



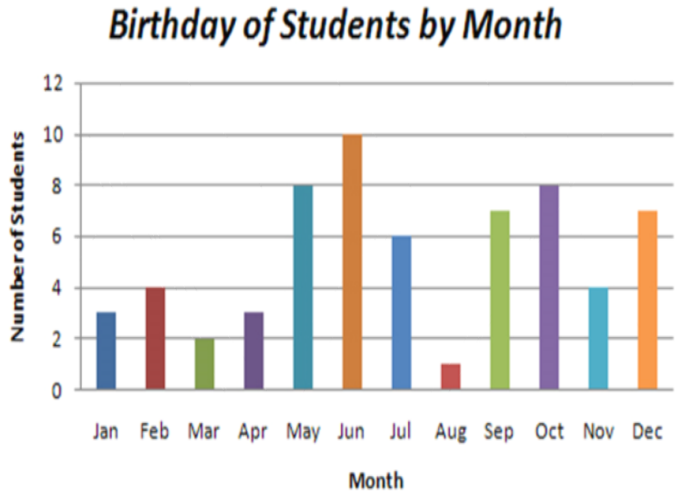
Which time slot was the most popular for watching the news?
Answer=
Type of Graph=



What variable (City) had the most and least sales? Answer=
Type of Graph=



What month had the most and least numbers of birthdays.
Answer=
Type of Graph=



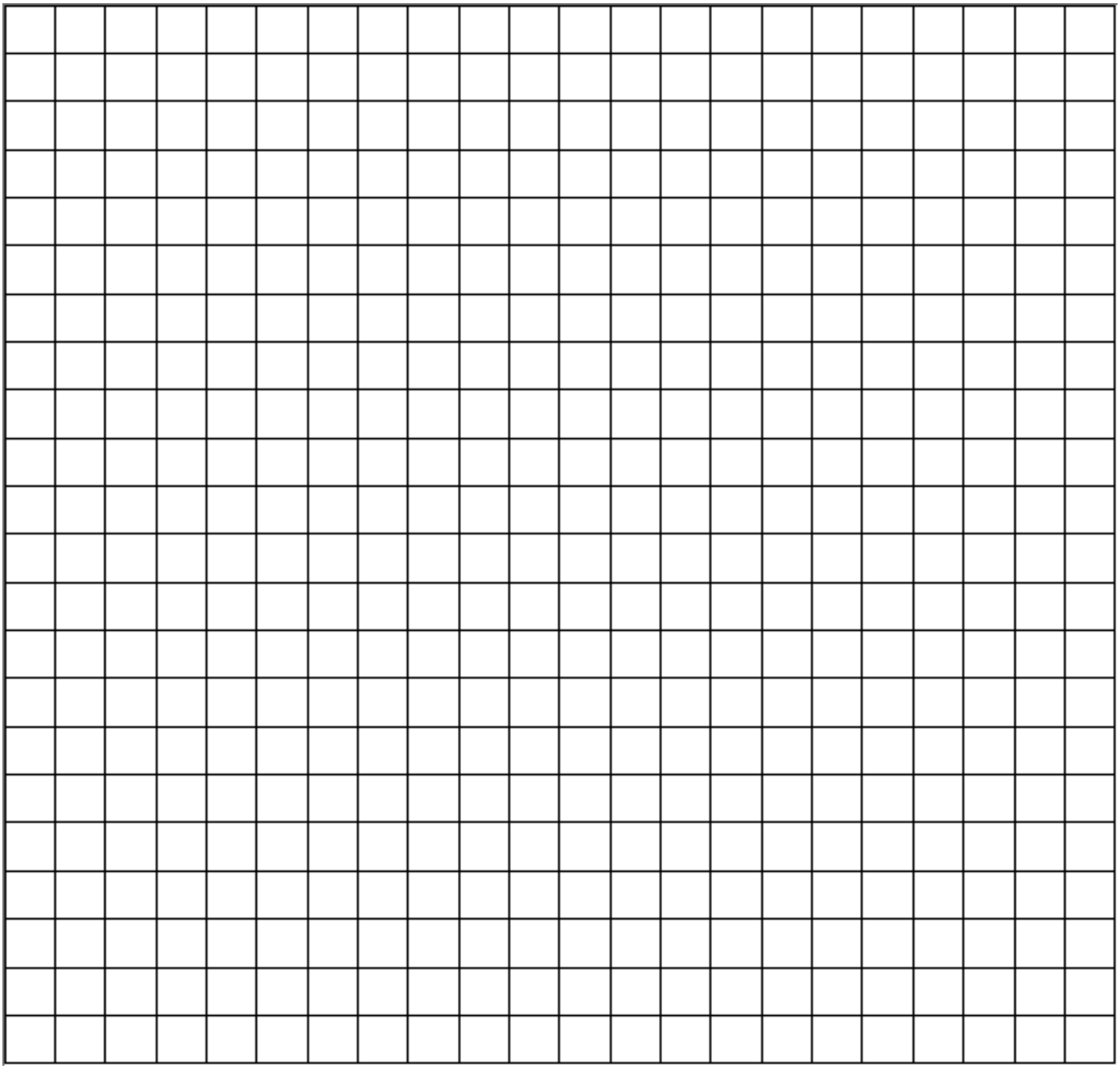
Data Collection and Graphing

Please complete the survey on the last page. Rip the sheet off and hand to the teacher. Teacher will cut each question and hand your group all of the class data for one question. Please create a spreadsheet to organize your data and then graph it. Please choose the correct type of graph and be prepared to share with the class.

Spreadsheet to organize your data

Other Notes about the data

Graph your data and then create an electronic version of your graph



Part 5 Lesson 5 Observation Skills

Observation: Anything you can_____, (Using your senses).

Our perceptions are not photographs, they are _____- something that our minds manufacture.

-What we perceive is partially determined by what we _____ or _____.
-Constructive perception has survival value - it helps us make sense of the world.
-So, seeing is not necessarily believing. USE YOUR JOURNAL!

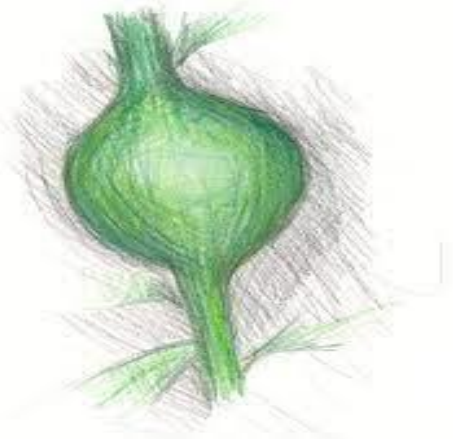
Part 5 Lesson 6 Observation Continued

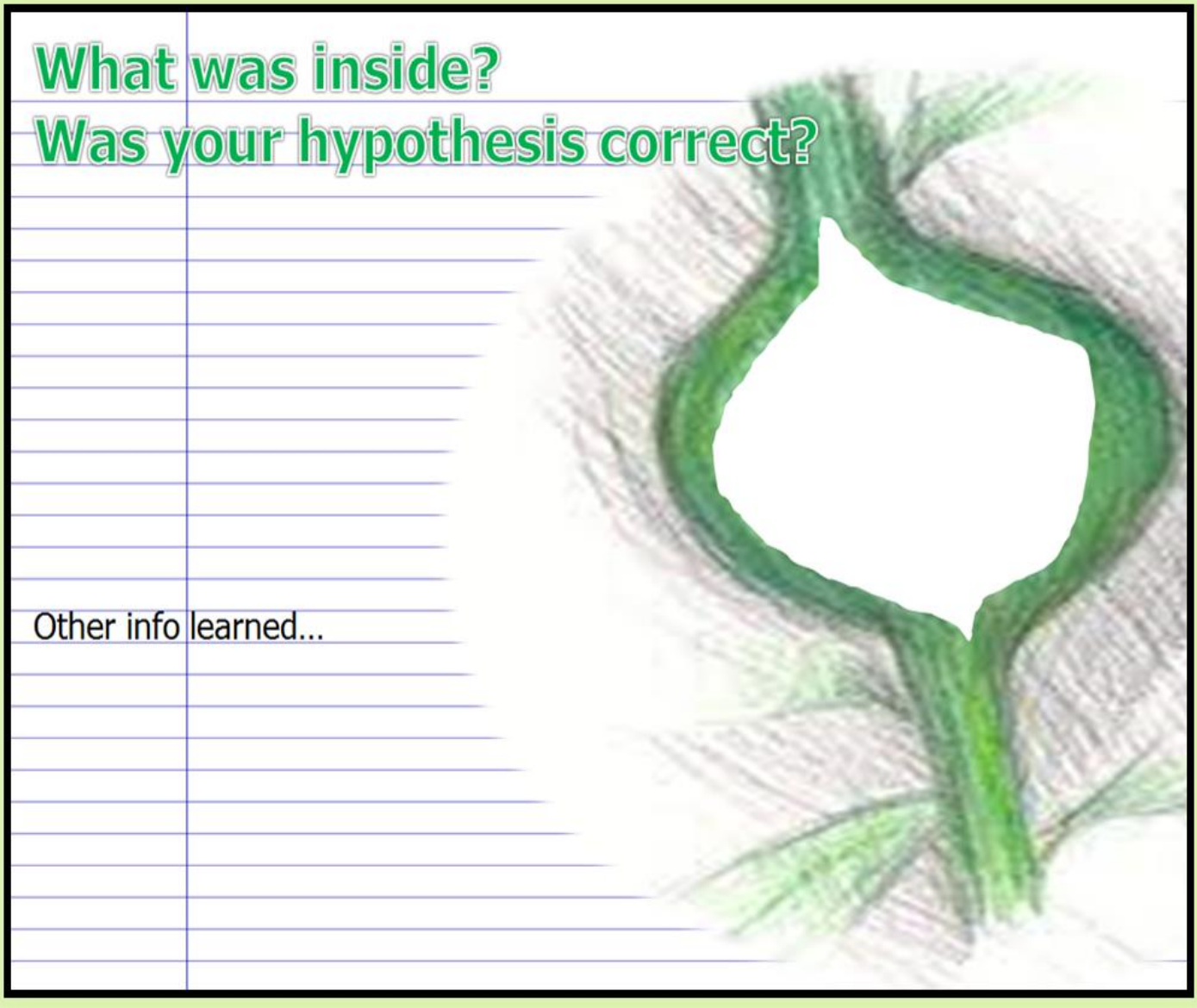
Please make some notes in the boxes below about each of the pictures in the short 30 seconds you have to observe.

Street Scene with Van…	The Shed Scene / Crime Scene…
Messy Bedroom Scene…	Roadway Scene
Kids in the line…	Ocean view scene…
Big Scissors Scene…	Man with rubble…
Waterpark Scene…	Skittles…

Part 5 Lesson 7 Hypothesis and Rafting / Soda

Hypothesis: An educated _____ to your problem / question that is testable.

	What is your hypothesis about what is inside the goldenrod gall?



Soda and the Scientific Method.

Problem: What type of soda should we bring on a rafting trip?

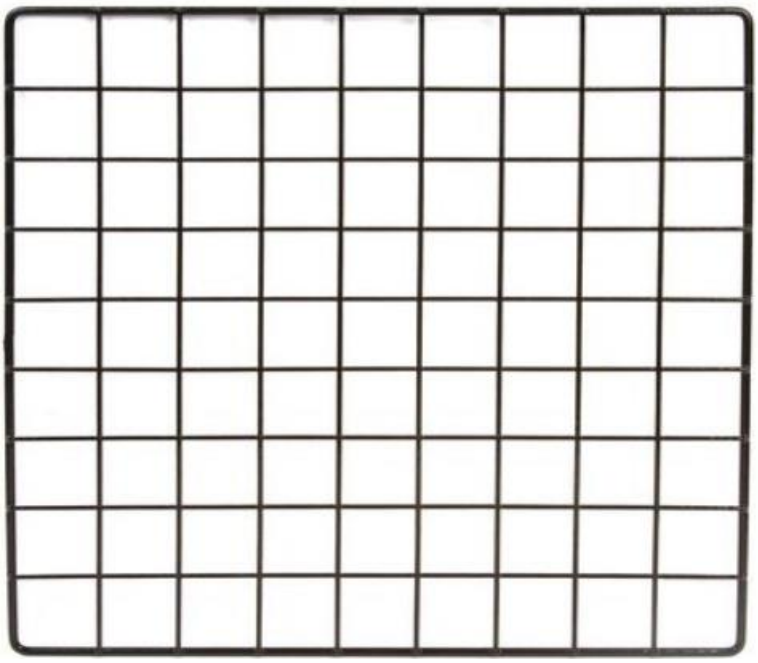
We are going rafting down a Class V section of whitewater.

The first rapid called "*The Turbine*" will flip the raft and everything on it.

Brand of Soda	Sodium mg	Calories	Sugar g	Mass g	Volume. ml	?
					Can you find?	

Which soda should we bring on the rafting trip? Explain below using data collected on the spreadsheet on the above page. Think Density

Graph your data and then create an electronic version of your graph



Optional – Make some notes about the crime scene below? What might have happened?

Part 5 Lesson 8 Times have Changed

-Choose a partner for this project that was not next to you during random order collection.
-Keep your random test order hidden from your new partner / listener.
-Listener should keep eyes closed during each drop and until pennies have been collected.
-Old and new pennies look differently.
-Tester and listener must communicate for each drop. Tester says "dropping" and listener says "drop away." -Listener can open eyes when tester says pennies have been collected and mark their guess on the listener spreadsheet.

Trials	1	2	3	4	5	6	7	8	9	10
Old										
New										
Correct √ Wrong X										

The correct number out of 10. ____ / 10

Collect the class data. Total score of class divided by the number of students.
Total Score _____ / number of students_____ = _____ Average

Did we answer the problem? Can you determine the age of a penny by the sound that it makes when dropped? **Use data in your response.**

Finding Standard Deviation and Variance.

- Standard variation is the square root on the variance.
- Variance: The average of the squared differences from the mean.
- The mean / average was… _____
- Everyone calculate how far away <u>their</u> data was from the mean / average.
  - Ex.) The mean was 80 and I got 60 so I was 20 from the mean.
- To calculate the variance, take each difference, square it, and then average the result as a class.
  - Ex) 22 + 4.52 + 1.52 + 3.52 + (rest of class)

Divide by total # of students = variance

- The Standard Deviation is just the square root of the Variance.
  - So square the variance that we found.

Example… $\sqrt{6523}$ = 80.76%

Class data Variance

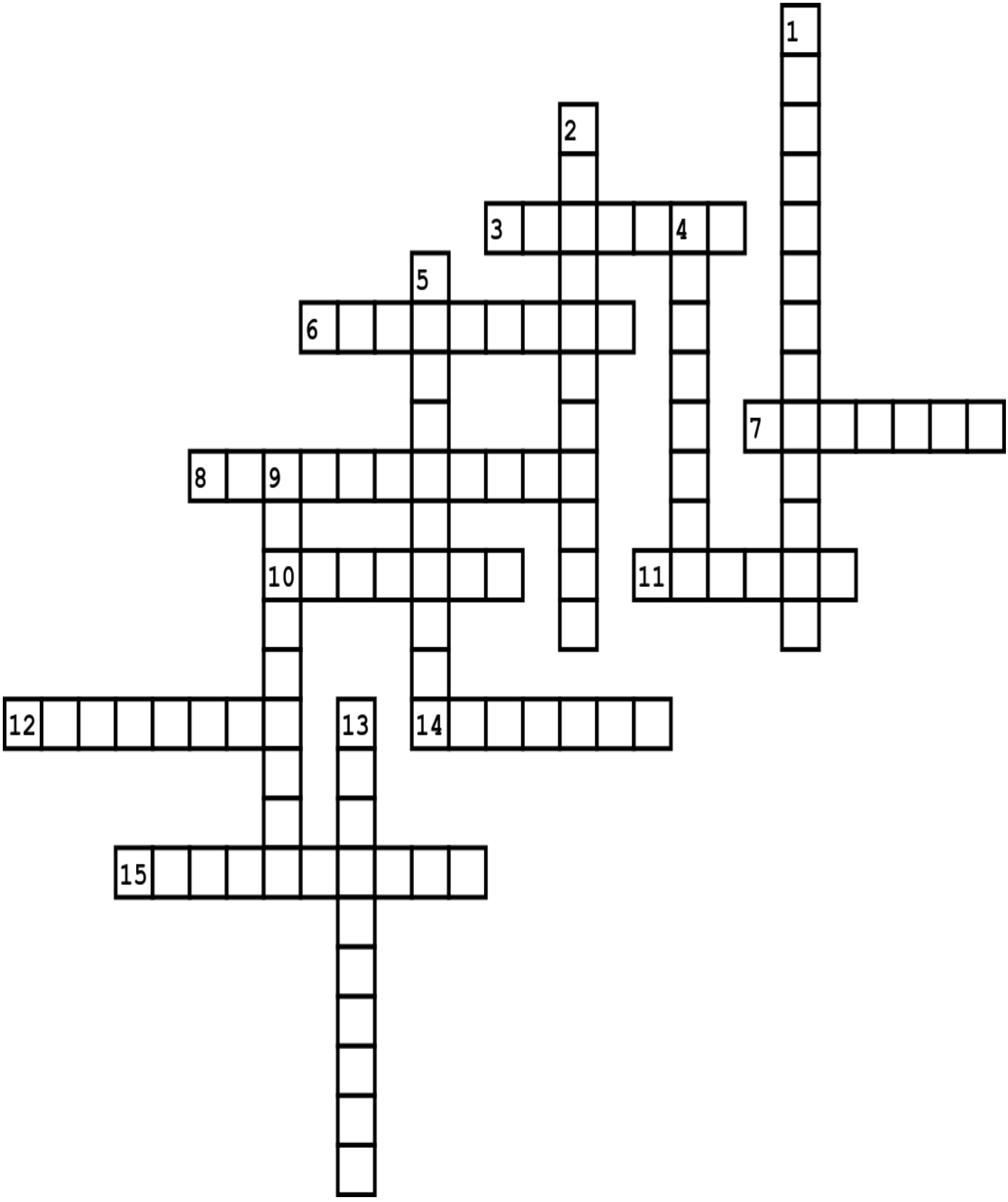
Total from above _____ / number of students_____ =_____Variance

√_____ Variance = _____ % Standard Deviation

We now have a standard to show which scores are high and low and to help answer our problem.

What was your score compared to the Standard Deviation? Were you above or below?

What problems did you encounter? Are your results accurate or should you throw them out?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Across

3. A good scientist can _____ and Question
6. A series of actions conducted in a certain order or manner
7. Science is a study of _____ phenomenon.
8. The variable you have control over, what you can choose and manipulate.
10. A good scientist is accurate, _____ and methodical.
11. Science is a systematic study and _____.
12. A good scientist is _____, a seeker of the truth.
14. Quantities that a scientist wants to remain constant so it a fair test.
15. An educated guess. Is a testable statement about the relationship between two or more variables or a proposed explanation for some observed phenomenon

Down

1. Talking with others
2. Anything you can see, hear, touch, taste. -Your Senses, (Using your senses).
4. Changing quantity of something.
5. _____ method: A process that is the basis for scientific inquiry (questioning and experimenting).
9. The variable that you measure in the experiment and what is affected
13. Science is learning through _____.

Class Data to graph. Please rip off once completed to be cut and sort by teacher.

What month is your birthday?

How many hours do you play video games on a school night/day?

How many pets do you have? What are they? Record below…	

How many brothers or sisters do you have? Step or biological. What are their ages?

How many screens do you have in your house? (TV, tablets, phones, etc.)

What color are your eyes? Brown, blue, hazel, green, other?

Part 5 The Scientific Method

Name:
Due:

Part 5 Lesson 1 Intro to Science

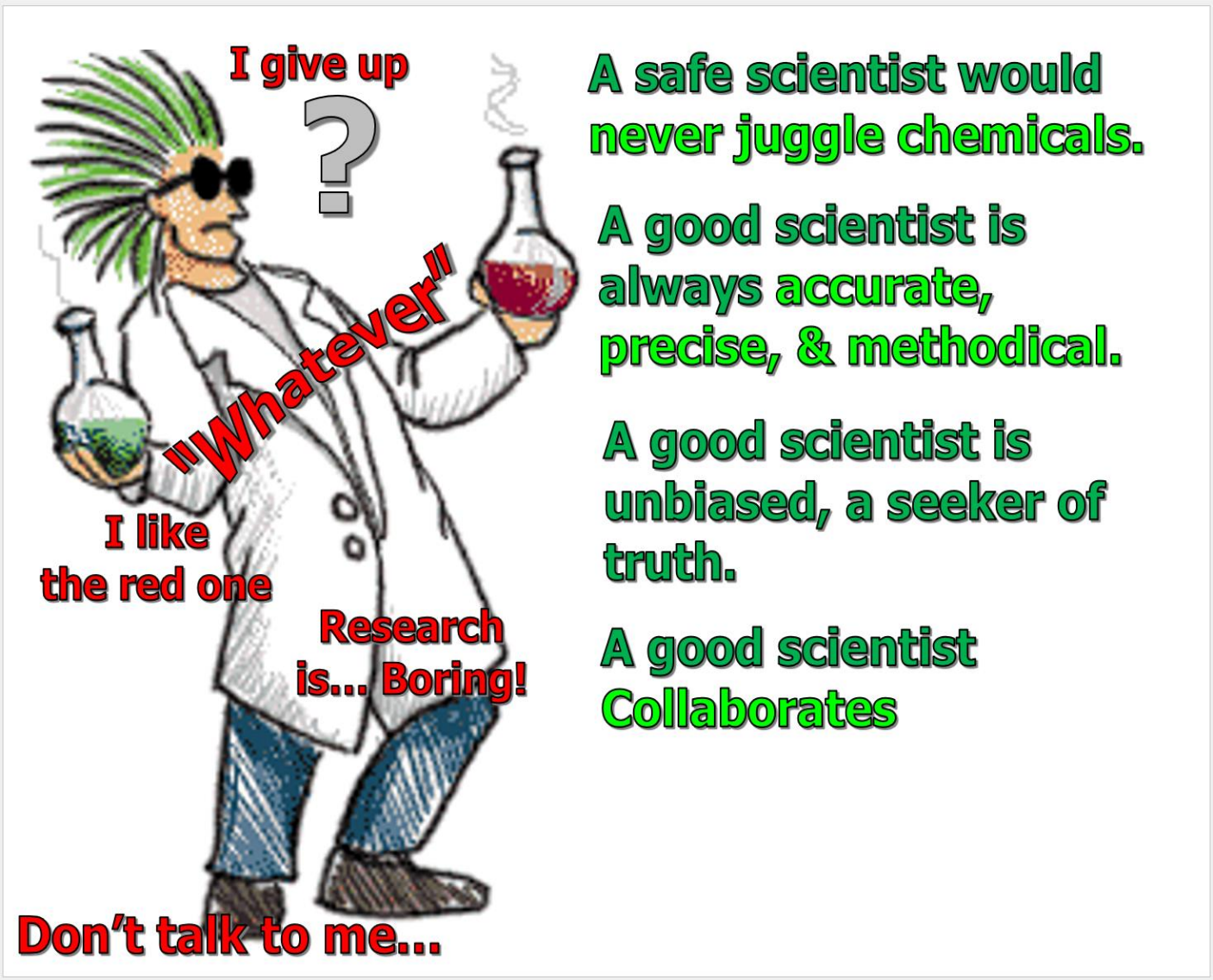
Science is…

-A study of natural phenomenon.
-A systematic study and method.
-Knowledge through experience.

A good Scientist is….

Is Safe!
Is accurate, precise and methodical.
Is unbiased, a seeker of the truth.
Can observe and question.
Can find solutions, reasons, and research.
Works in all weather conditions if safe.
Can overcome obstacles.
Collaborates (talks) with others.

A bad scientist is one who… - Tell me about this "Evil Scientist" below with examples.



Science is a systematic attempt to get around human limitations.
Science tries to remove personal experience from the scientific process.

TRY AND WRITE WITHOUT Personal PRONOUNS.
DO NOT USE…I, me, you, he, she, we, you, they, them, theirs, names, etc

Please pass three items around the table three times.
-Then write about your experience without using any personal pronouns
Three items were passed in a clockwise direction around the table. Each person in the study handled and passed the items. Items were held for roughly thirty seconds before being passed to the next person.

Part 5 Lesson 2 Procedure

Procedure: A series of actions conducted in a certain order or manner

Writing a procedure.
The entire paragraph is in the past tense.
Write chronologically from beginning to the end. (Paragraph or bullet list) teacher will decide.
Continue to avoid personal pronouns.

Draw your Lego Anything Below. Don't show this picture to the person who will build it

Disassemble and then reassemble writing a procedure in below. When complete, try and build it following only your procedure, then have a peer try and do it.
Answer will vary, but it should be an accurate procedure.

How did it go? Was your peer able to build your Lego creation? Where did it go wrong if it did?

Types of scientists…

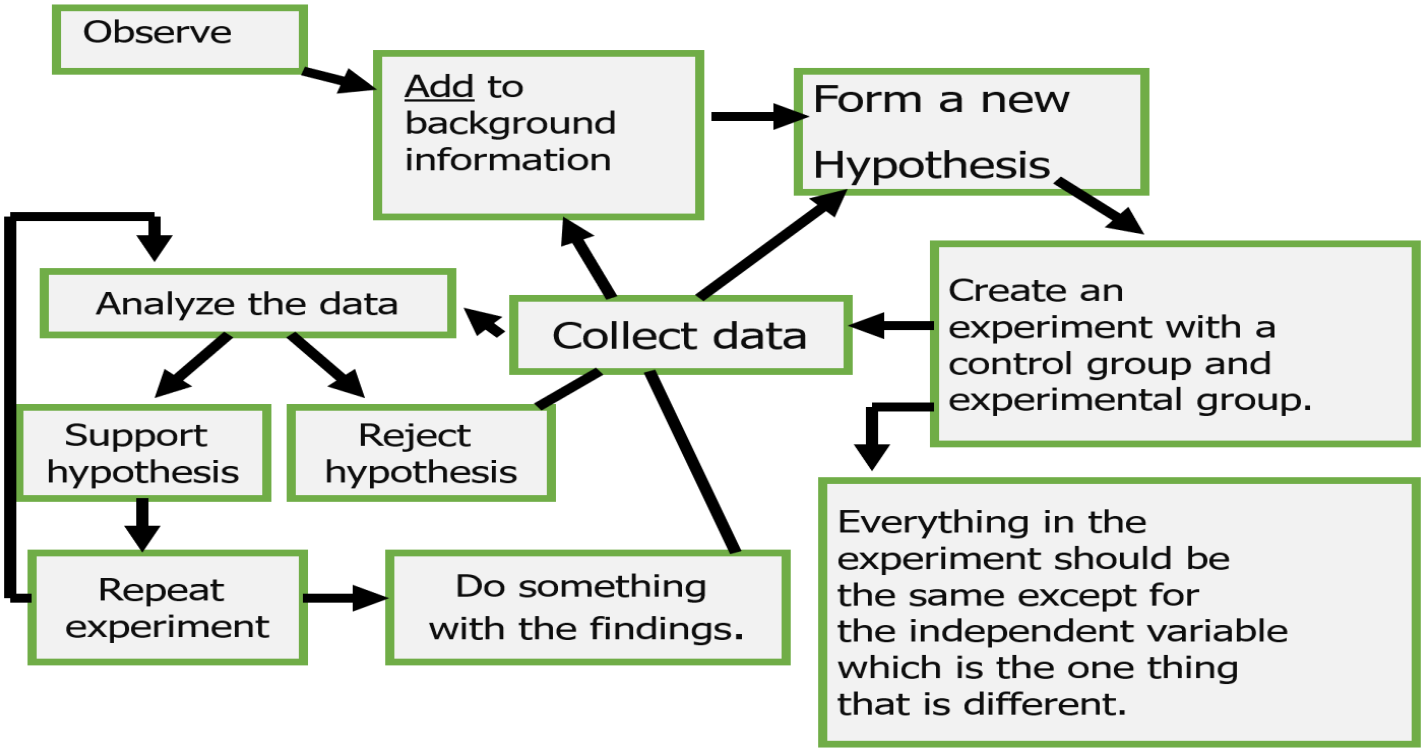
- Biologist – The study of life.
- Geologist– The study of earth.
- Chemistry – The study of Matter.
- Physics – The study of matter and energy.
- Many more…

Take a guess as to what is in each of the boxes. You're not allowed to open the boxes.

Part 5 Lesson 3 The Scientific Method

Scientific method: A process that is the basis for scientific inquiry (questioning and experimenting).

THE SCIENTIFIC METHOD



Variable: Changing quantity of something.

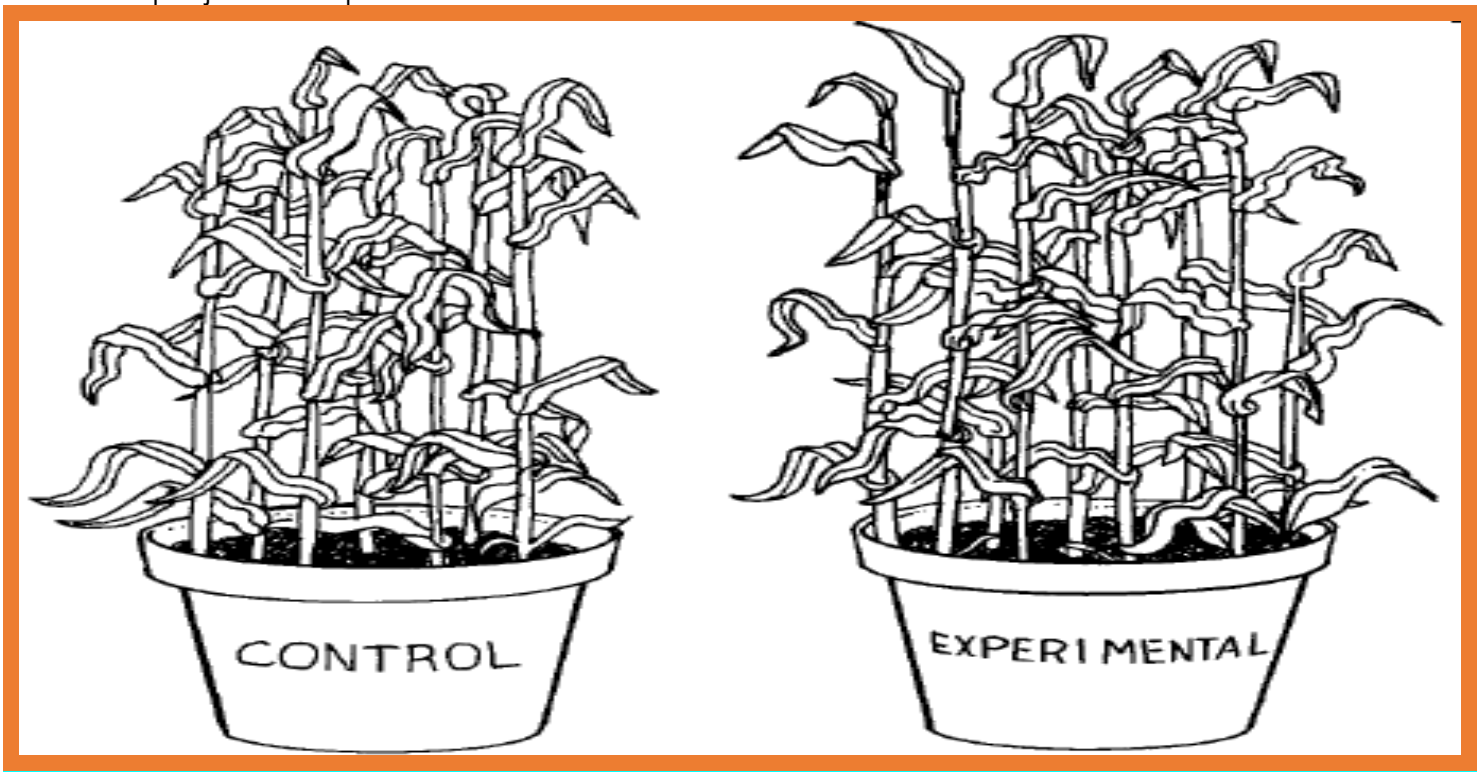
Independent: (Change) The variable you have control over, what you can choose and manipulate.

Dependent: (Observe) What you measure in the experiment and what is affected during the experiment.) (Ex, color change, change in mass)

Control: (Same) Quantities that a scientist wants to remain constant so it a fair test.

A student wants to find out what minerals melt ice the fastest. So the student places halite, calcite, hematite, and pyrite on equal sized cubes of ice on her counter in the kitchen. The student times how long it takes each mineral to melt completely through the ice cube. She records the minutes it takes for each one to melt in her science journal. Problem? = What minerals melt ice the fastest? Independent Variable = Type of mineral (halite, calcite, hematite, pyrite). Dependent Variable = Amount of time it takes for the ice to melt. Control = Each ice cube is the same size.	A student wants to find out how cigarette smoke blown into a small greenhouse of plants damages the plant. The student grows two small plants in separate clear plastic soda bottles. The student injects one with cigarette smoke periodically. Both are watered and given the same light conditions. The student records the height, number of leaves, and flowers of both plants every day for one month. Problem? = Does cigarette smoke damage plants? Independent Variable = Cigarette smoke Dependent Variable = Height of plants, leaves, flowers Control = Both containers were identical except one was given cigarette smoke (independent variable).
A student wants to find out if an egg will crush more easily standing straight-up or on its side. The student creates a chamber that allows weights to be placed on a board that lies on top of the egg. The student places weights in grams on the board with an egg standing straight, and then on its side. The student records the total weight that was on the board when the egg crushed. Problem? = Which resting position will crush an egg the easiest—on its side or straight up? Independent Variable = The position of the egg—either on its side or standing straight up. Dependent Variable = How much weight it takes to crush the egg. Control = The eggs used will be as identical as possible.	A student wants to determine if varying levels of fertilizer will increase the fitness of a plant. She sprays each plant every day with low, medium, and high levels of fertilizer. The plants are given the same soil, water, and light for one month. At the end she measures the number of leaves, plant height, and number of flowers. Problem? = Does amount of fertilizer affect plant fitness? Independent Variable = Amount of fertilizer sprayed. Dependent Variable = The number of leaves, plant height, and number of flowers at the end of one month. Control = Plants are given same soil, water, and light.

Create a project with plants below. Describe what are some of the variables and controls.



EXAMPLE (STUDENTS WILL CREATE THEIR OWN EXPERIMENTS)

Problem: Does fertilizer help a plant grow?

Independent variable (change): Amount of fertilizer (grams)

Dependent variable (observe): Growth of the plant, height, number of leaves, flowers, etc.

Control variable (same): Same amount of soil, light, water, space, all the same.

Part 5 Lesson 4 Graphing

Word Bank: Bar, Area, Pie, Line, XY Plot

Pie Graph: Best to use when you are trying to compare parts of a whole that add up to 1% or 100%. They do not show changes over time

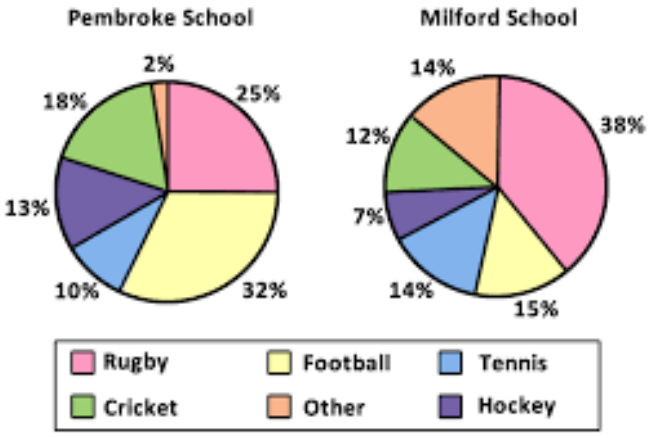
Line Graph: Track changes over time for one or more groups. Useful when changes occur in two or more related groups.

Area Graph: Used to track changes over short and long periods of time. They can also compare changes over the same period of time for more than one group

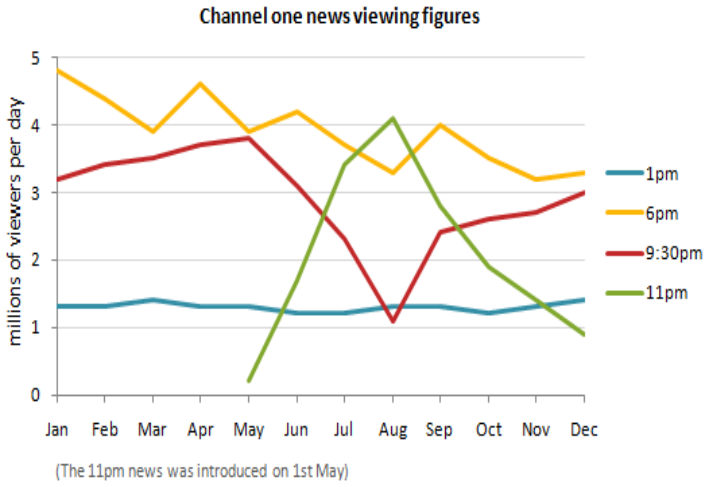
X-Y Plot Graph Plots are used to determine relationships between the two different things. One axis is used to measure one event (or variable) and the other axis is used to measure the other

Bar Graph: Used to compare things between different groups. Works best with large differences

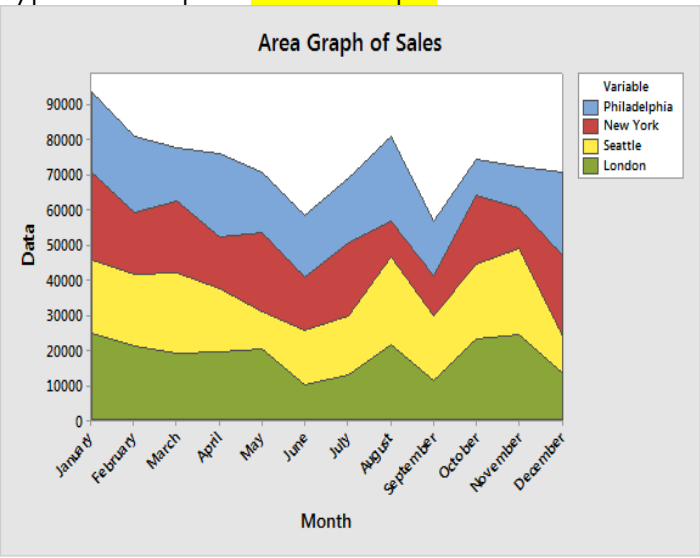
What sport is the most popular at Milford School and Pembroke School?
Answer= Pembroke School is soccer, Milford School is Rugby
Type of Graph= Pie Graph



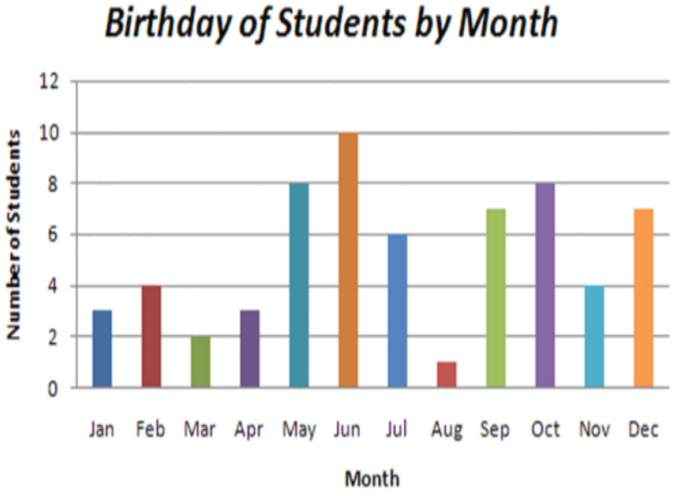
Which time slot was the most popular for watching the news?
Answer= The 6pm Time Slot
Type of Graph= Line Graph



What variable (City) had the most and least sales? Answer= Philadelphia had the most, London had the least.
Type of Graph= Area Graph



What month had the most and least numbers of birthdays.
Answer= June the Most, August the Least
Type of Graph= Bar Graph



Data Collection and Graphing
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Spreadsheet to organize your data

Other Notes about the data

Graph your data and then create an electronic version of your graph

Part 5 Lesson 5 Observation Skills

Observation: Anything you can see, hear, touch, taste. -Your Senses, (Using your senses).

Our perceptions are not photographs, they are constructions. - something that our minds manufacture.

-What we perceive is partially determined by what we believe or know.
-Constructive perception has survival value - it helps us make sense of the world.
-So, seeing is not necessarily believing. USE YOUR JOURNAL!

Part 5 Lesson 6 Observation Continued

Please make some notes in the boxes below about each of the pictures in the short 30 seconds you have to observe.

<table>
<tr>
<td>Street Scene with Van…
How many vehicles were driving?
Two were driving, two were parked.
What type of vehicles were they?
Utility van with no labels and small 4 door SUV.
What colors were they?
Utility van was white, SUV was dark blue with no license plate on the front.
Was it raining?
Answer: No. But the SUV's wipers were on, conditions were over cast and the SUV could have just possibly come from the rain or driven through a sprinkler.
What was the speed limit?
35 mph
What country is this picture in?
The United States most likely because 35 mph is not Metric. The U.S. is one of the few countries to use the Old English System.
How many witnesses were there, what were they doing?
One witness, he was mowing the lawn. (he?)
What season was it?
Summer, the leaves were well established and green.</td>
<td>The Shed Scene / Crime Scene…
Answer: You can't tell from the photograph. If you live in an area where the roofs are dark colored shingles that's what you construct in your head.

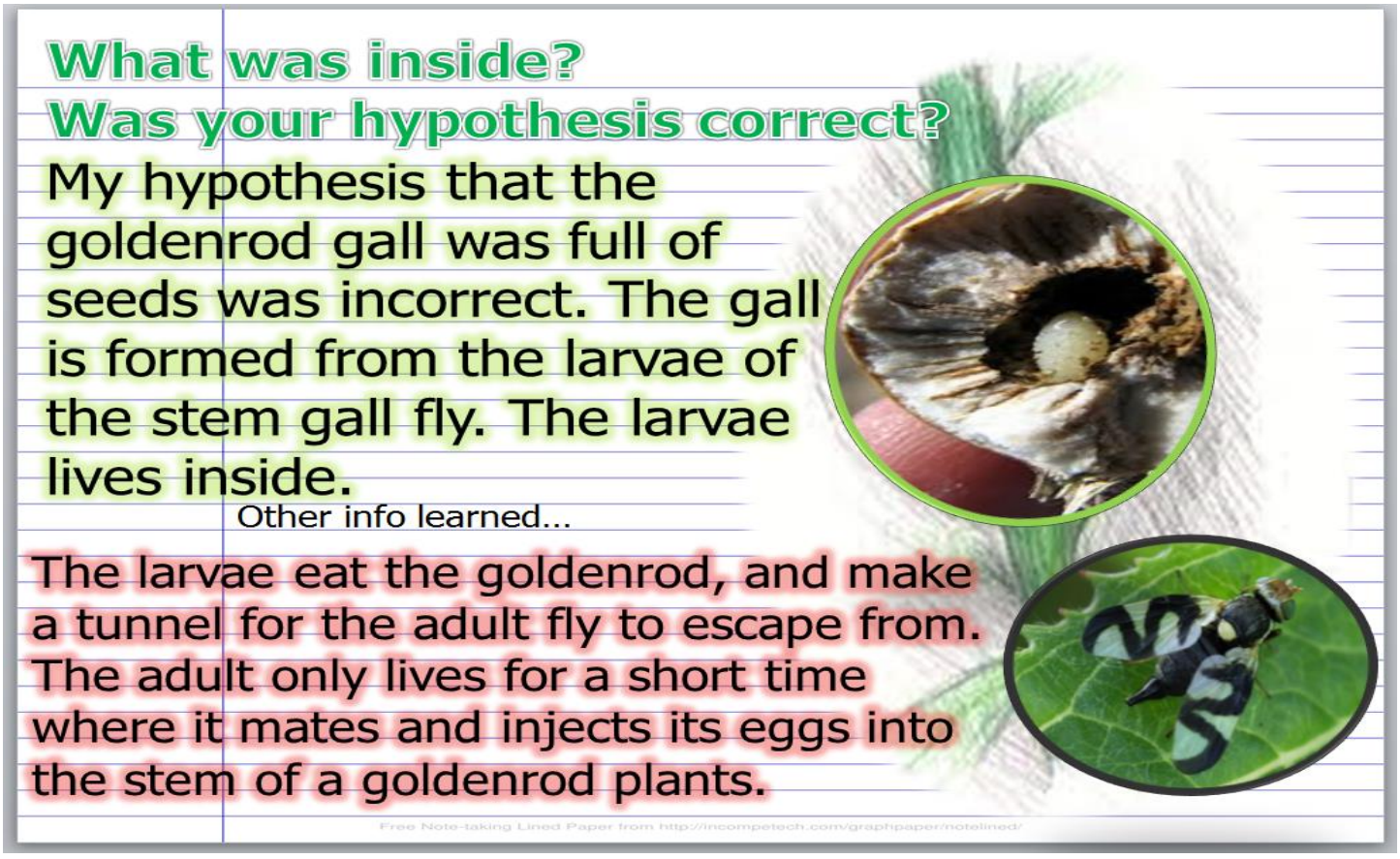
 
</td>
</tr>
<tr>
<td>Messy Bedroom Scene…
It was a girls room, however, it could be a shared bedroom, transgender, or other.</td>
<td>Roadway Scene
The sky was grey</td>
</tr>
<tr>
<td>Kids in the line…
What type of location are the people at?
Airport, Train Station, Bus Station?
Describe the person who walked away with someone else's green suitcase.
Male, 5'8" Black Hair, Red short sleeved shirt and blue jeans and wearing a backpack</td>
<td>Ocean view scene…
What is this a picture of?
Reflection in the window. A women (adult) with blonde hair, maroon shirt and wearing eyeglasses.</td>
</tr>
</table>

Big Scissors Scene… What is the grand opening for? This is most likely a McDonalds (Red and Yellow color scheme) or another fast food chain. You can see the illuminated value menus in the upper right hand corner, and the Coca-Cola drink dispenser on the left. Coca-Cola is affiliated with the McDonalds Corporation.	Man with rubble… A place of worship
Waterpark Scene… The Owl hiding	Skittles… The Skittles Berry Explosion. The red skittle with the letter **S** in front of **Ex**plosion creates the word (SEX) / subliminal

Part 6 Lesson 7 Hypothesis and Rafting / Soda

Hypothesis: An educated guess to your problem / question that is testable.

	What is your hypothesis for what is inside? Any educated guess will work. Students may say seeds, fluid, its empty, etc. Students will open, if available, or slideshow provides information.



Soda and the Scientific Method.

Problem: What type of soda should we bring on a rafting trip?

We are going rafting down a Class V section of whitewater.

The first rapid called "*The Turbine*" will flip the raft and everything on it.

Brand of Soda	Sodium	Calories	Sugar	Mass	Volume. H_2O	Density
Coke	45mg	140	39g	388g	375 ml	1.03 g/cm3
Sunkist	70mg	190	50g	387g	375 ml	1.03 g/cm3
Mt. Dew	65mg	170	46g	387g	375 ml	1.03 g/cm3
Diet Coke	40mg	0	0	370g	375 ml	.98 g/cm3
Sprite	60mg	140	38g	380g	375 ml	1.01 g/cm3
					375 ml	

Which soda should we bring on the rafting trip? Explain below using data collected on the spreadsheet on the above page. Think Density

Which soda should we bring on the rafting trip? Explain below using data collected on the spreadsheet on the above page. Think Density

The brand of soda that should be brought on the rafting trip was diet Coke. Diet Coke is the only brand that will float in water when the raft flips over. Diet Coke had a density of less than 1g/cm³ so it floated. The sugar content was higher in many of the other brands of soda which gave them a higher density. Mtn. Dew for example had 46 grams of sugar and a density of 1.03 g/cm³. Perhaps we should bring a water bottle and make sure that its securely fitted to the raft.

Part 5 Lesson 8 Times have Changed

-Choose a partner for this project that was not next to you during random order collection.
-Keep your random test order hidden from your new partner / listener.
-Listener should keep eyes closed during each drop and until pennies have been collected.
-Old and new pennies look differently.
-Tester and listener must communicate for each drop. Tester says "dropping" and listener says "drop away." -Listener can open eyes when tester says pennies have been collected and mark their guess on the listener spreadsheet.

Listener

Trials	1	2	3	4	5	6	7	8	9	10
Old										
New										
Correct √ Wrong X										

The number correct out of 10. ____ / 10

Collect the class data. Total score of class divided by the number of students.
Total Score _____ / number of students_____ = _____ Average

Did we answer the problem? Can you determine the age of a penny by the sound that it makes when dropped? **Use data in your response.**

_____

_____

_____

_____

_____

Finding Standard Deviation and Variance.

- Standard variation is the square root on the variance.
- Variance: The average of the squared differences from the mean.
- The mean / average was… _____
- Everyone calculate how far away <u>their</u> data was from the mean / average.
  - Ex.) The mean was 80 and I got 60 so I was 20 from the mean.
- To calculate the variance, take each difference, square it, and then average the result as a class.
  - Ex) 22 + 4.52 + 1.52 + 3.52 + (rest of class)

Divide by total # of students = variance

- The Standard Deviation is just the square root of the Variance.
  - So square the variance that we found.

Example… $\sqrt{6523}$ = 80.76%

Class data Variance

Total from above _____ / number of students_____ =_____Variance

√_____ Variance = _____ % Standard Deviation

We now have a standard to show which scores are high and low and to help answer our problem.

What was your score compared to the Standard Deviation? Were you above or below?____

_____

_____

_____

_____

What problems did you encounter? Are your results accurate or should you throw them out?

_____

_____

_____

_____

Across

3. A good scientist can Observe and Question

6. A series of actions conducted in a certain order or manner

7. Science is a study of Natural phenomenon.

8. The variable you have control over, what you can choose and manipulate.

10. A good scientist is Is accurate, _____ and methodical.

11. Science is a systematic study and _____.

12. A good scientist is _____, a seeker of the truth.

14. Quantities that a scientist wants to remain constant so it a fair test.

15. An educated guess. Is a testable statement about the relationship between two or more variables or a proposed explanation for some observed phenomenon

Down

1. Talking with others Collaboration

2. Anything you can see, hear, touch, taste. -Your Senses, (Using your senses).

4. Changing quantity of something.

5. _____ method: A process that is the basis for scientific inquiry (questioning and experimenting).

9. The variable that you measure in the experiment and what is affected

13. Science is learning through _____.

Class Data to graph. Please rip off once completed to be cut and sort by teacher.

What month is your birthday?

How many hours do you play video games on a school night/day?

How many pets do you have? What are they? Record below…	

How many brothers or sisters do you have? Step or biological. What are their ages?

How many screens do you have in your house? (TV, tablets, phones, etc.)

What color are your eyes? Brown, blue, hazel, green, other?