SNC 1D

Introduction: Science Skills

Topic	Learning Goals – By the end of the lesson I will be able to…
Class Expectations	· Understand the rules of the classroom · Know the academic expectations for the teacher and course
Safety	· Identify and explain WHMIS & HHPS · Read and interpret an MSDS properly · Prepare myself properly for safe lab procedures
Lab Equipment	· Identify and explain the use of commonly used lab equipment
Measuring	· Convert between metric units · Use common measurement tools accurately · Alternate between scientific notation and standard notation easily · Identify the number of significant figures in an number
Graphing	· Interpret information presented in graphical form · Create an appropriate graph based on information presented
Scientific Method	· Identify and explain all variables (control, independent, dependant) in a scientific inquiry · Design a valid procedure based on a scientific question · Complete a laboratory investigation based on the steps of the scientific method
Lab	· Write a proper lab report including all necessary elements
STSE	· Identify important Canadian contributions to science

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LESSON 1: Rules & Respect - Expectations in the Science Classroom

Classroom Goals

- To enable each student to learn and achieve to the best of their ability
- To provide a learning environment in which all students can achieve their individual academic potential
- To treat each other with mutual respect and dignity

Classroom Rules - some things are negotiable, these are NOT!

- No open food or drinks in the classroom - Water bottles filled with water are permitted
- No hats, bandanas, or objectionable headwear are to be worn in class
- No personal electronics are allowed to be on during class (i.e. walkmans, **PHONES**, MP3 players etc…)
- Washroom breaks will be kept to a minimum, try to go between classes
- The expectation here is that everyone will be treated, and will treat others, with respect
- **When I am speaking, you must listen!**

Attendance

Two of the most common reasons for failure are:

- **POOR** attendance *and* **POOR** effort
- Avoid absences unless absolutely necessary, absences from a unit test require a doctors certificate
- Avoid being late, be prompt! i.e. get to class before the bell, get seated and *open your notebook*

What to do if you miss a test, quiz, etc…

- × if your absence is invalid, your mark is "0"
- × if your absence is valid, make up the missed test or quiz on your spare period on the day you return (all absences must be validated in the attendance office within 2 days)
- × when possible, notify your teacher prior to your absence

It is your responsibility to complete and catch up any missed work due to an absence

Homework

- On average, you can expect to do about 3 – 5 hours of Science homework weekly
- You will be required to complete a graphic organizer in MSIP each day to summarize the lesson of the day
- To ensure that classroom discussion and lectures will be meaningful learning opportunities; homework must be completed on a daily basis
- Homework is an essential part of this course and lack of completion will negatively effect your grade

Course Website

litschgyscience.weebly.com

- You can get information about daily lessons, homework and due dates for projects
- You may also send me an email using the website if you have any questions related to the course

Lesson 2: Science Safety – WHMIS, HHPS, MSDS

Safety symbols are used to identify dangers associated with products. There are two types of safety symbols:

1. **Hazardous Household Product Symbols (HHPS)** are warning symbols found on household products.
2. **Workplace Hazardous Materials Information System (WHMIS)** symbols were developed to standardize the labelling of dangerous materials used in all workplaces, including schools.

Questions:

1) Why do you think symbols are used (instead of words) to indicate the dangers associated with a product?

2) Complete the table. Use page 513 in your textbook to complete the table below.

Symbol	Name of symbol	Risks	Precautions
	*Compressed gas*	Contents under high pressure Could explode if heated or dropped	Keep away from heat Store it safely (not on a high shelf where it could fall)
		Catches fire easily May ignite without warning	
		May cause combustible material to explode Increases fire hazards	
		May be fatal if swallowed, inhaled, or absorbed through skin	
		May cause death, permanent injury, or cancer	
		Contains living organisms that can cause harm (viruses, bacteria, parasites, etc.)	
		Causes eye and skin irritation on contact Severe burns after long period of contact	
		May react violently with water May explode if exposed to heat or shock	

3) Products with which WHMIS symbols should be stored separately? Why?

4) If acid splashes and lands on your skin, your skin will get irritated, and it may burn. Which WHMIS symbol would you expect to see on bottles of acid?

5) Read about HHPS symbols on page 512 in your textbook, and answer the following questions:

   i. What are the 4 common HHPS symbols?

   ii. For each hazard symbol, describe two precautions you could take when handling a product with that symbol to keep yourself safe.

   iii. Describe the difference between the triangle (yield) frame and the octagon (stop sign) frame.

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Lesson 3: Lab Equipment

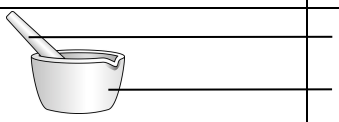
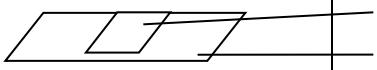
Find each of these items on the lab bench. Use the number on each item to find the name of each piece of equipment from the equipment list below. Write the appropriate **name** in the table (not just the number). Then, write down the letter that corresponds to the equipment's use (make a good guess if you're not sure). Complete both sides of the sheet.

Equipment List

1. Beaker tongs
2. Test-tube holder
3. Test tube
4. Slide and cover slip
5. Graduated cylinder
6. Mortar and pestle
7. Stirring rod
8. Striker
9. Erlenmeyer flask
10. Rubber stopper
11. Scoopula

Equipment Uses

A. Produces a spark when flint is rubbed against rough steel
B. Holds tiny specimens on the stage of a microscope so they can be viewed.
C. Used for stirring
D. "Lobster-claw" end used to hold and move hot beakers
E. Accurately measures the volume of liquids in mL.
F. Small glass container used to hold chemicals.
G. Crushes, grinds, and mixes.
H. Moves and holds hot test tubes.
I. Has a wide stable base; used to hold and mix chemicals
J. Seals the openings of glass containers
K. Scoops and transfers chemicals

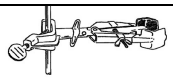
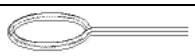
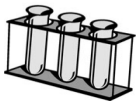
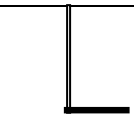
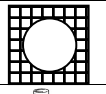
Picture	Name (write it out)	How it is used (letter)
		
		
		
		
		
		
		
		
		
		
		

Equipment List

12. Retort stand
13. Ring clamp
14. Wire gauze
15. Beaker
16. Bunsen burner
17. Thermometer
18. Test tube rack
19. Crucible tongs
20. Hot plate
21. Petri dish
22. Test tube brush
23. Electronic balance
24. Overflow can
25. Test tube clamp

Equipment Uses

J. Holds chemicals
K. Used to heat
L. Stand that supports other equipment when heating
M. Shallow dish with many uses (eg. can be used to grow bacteria cultures)
N. Supports beaker when heating, and spreads flame for even heating
O. Used with a graduated cylinder to measure the volume of irregular shaped objects
P. Measures mass
Q. Holds test tubes
R. Heats with a hot flame
S. Grasps and picks up small diameter glassware.
T. Measures temperature
U. Cleans test tubes
V. Supports wire gauze and beaker when heating

Picture	**Name (write it out)**	**How it is used (letter)**
		
		
		
		
		
		
		
		
		
		
		
		
		
		

Lesson 4: Scientific Notation & The Metric System

In science we often use very large numbers and very small numbers. It is convenient to express these numbers using a mathematical abbreviation known as **_____.**

When written in scientific notation, the answer contains three significant digits – one always being to the left of the decimal point.

Earth is 150 000 000 km from the sun.
Scientific notation: 1.50×10^8 km

Note that the **EXPONENT** is the same numerical value as the number of times the _____.

If the decimal is moved to the _____, the exponent is _____. If moved to the _____, the exponent is _____.

SIGNIFICANT DIGITS

Use the **Certainty Rule for Multiplying and Dividing** - answer has same # of significant digits as _____ of significant digits.

Use Precision Rule for Adding and Subtracting - answer has the same # of decimal places as the _____ decimal places.

The Metric System

The SI (Système International d'Unités) system of measurement is an international system that has been adopted by Canada.

SI Prefixes for Metric Conversion

Multiplying Factor	Exponent Value	Prefix	Symbol
1 000 000 000 000	10^{12}	tera	T
1 000 000 000	10^{9}	giga	G
1 000 000	10^{6}	mega	M
1000	10^{3}	kilo	k
100	10^{2}	hecto	h
10	10^{1}	deca	da
1	10^{0}		
0.1	10^{-1}	deci	d
0.01	10^{-2}	centi	c
0.001	10^{-3}	milli	m
0.000 001	10^{-6}	micro	µ
0.000 000 001	10^{-9}	nano	n
0.000 000 000 001	10^{-12}	pico	p

Worksheet: Practice with Conversions & the Metric System

1. Convert each of the following as directed

a) 1.23 km = _____ m

b) 456 000 cg = _____ kg

c) 0.002 L = _____ mL

d) 3.00 x 10^{-3} km = _____ m

e) 750 kW = _____ W

f) 7 days = _____ min

g) 1 000 000 s = _____ days

h) 1 000 000 h = _____ years

i) 53 Mg = _____ kg

j) 500 nm = _____ cm

k) 5 x 10^{-6} L = _____ µL

i) 34 cm^3 = _____ mL

j) 34 mL = _____ L

k) 34 cm^3 = _____ L

l) 250 cm^2 = _____ m^2

m) 78 900 cm^3 = _____ m^3

2. Convert each of the following to scientific notation or standard form:

a) 978 000 000 000 = _____

b) 0.000 000 3001 = _____

c) 457.1 = _____

d) 8 920 000 = _____

e) 1000 = _____

f) 0.035 000 = _____

1.2355 x 10^{6} = _____

2.04 x 10^{-5} = _____

6.998 x 10^{-3} = _____

5.421 x 10^{4} = _____

8.022 x 10^{-1} = _____

1. Convert each of the following.

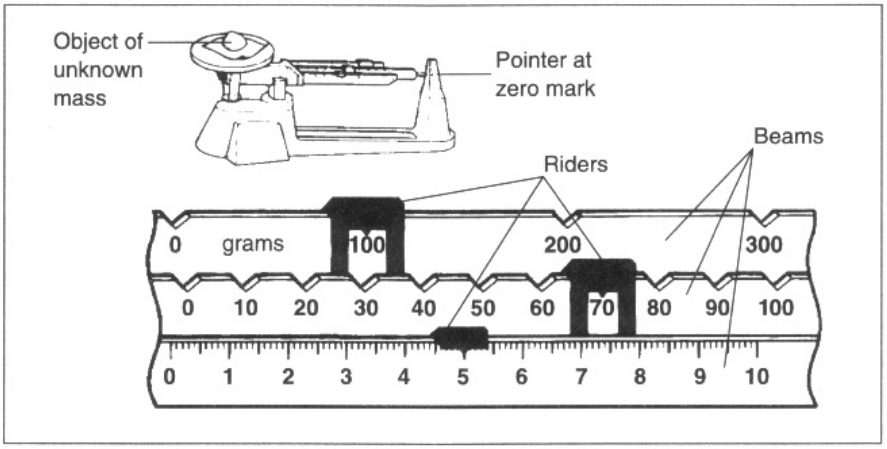
1. 16 km = _____ m
2. 9 cm = _____ mm
3. 5 km = _____ cm
4. 20 km = _____ m
5. 46 m = _____ mm
6. 2.2 km = _____ mm
7. 19 cm = _____ mm
8. 0.4 km = _____ cm
9. 39 mm = _____ cm
10. 49 m = _____ km
11. 33 m = _____ mm
12. 44 m = _____ cm
13. 30 mm = _____ km
14. 18 km = _____ m
15. 4.9 m = _____ cm

1. 4 days = _____ h
2. 22 s = _____ min
3. 45 m = _____ s
4. 11 days = _____ y
5. 36 months = _____ days
6. 48 min = _____ s
7. 31 h = _____ s
8. 40 days = _____ h
9. 8 min = _____ h
10. 13 s = _____ h
11. 10 days = _____ min
12. 0.40 y = _____ s
13. 0.220 h = _____ days
14. 34 s = _____ days
15. 27 s = _____ y

1. 400 g = _____ kg
2. 2.22 kg = _____ g
3. 0.45 kg = _____ mg
4. 47 g = _____ kg
5. 7.2 kg = _____ g
6. 335 g = _____ kg
7. 0.31 mg = _____ kg
8. 44 g = _____ mg
9. 8.05 g = _____ kg
10. 1025 g = _____ kg
11. 10 g = _____ mg
12. 0.40 mg = _____ g
13. 0.220 kg = _____ mg
14. 0.0023 kg = _____ g
15. 2723 g = _____kg

Mass & Weight

Mass and weight are related, but they are not the same. Mass is a measure of the amount of matter in an object. Weight is a measure of the pull of gravity on an object. Mass is measured in grams (or kilograms) and uses a balance.



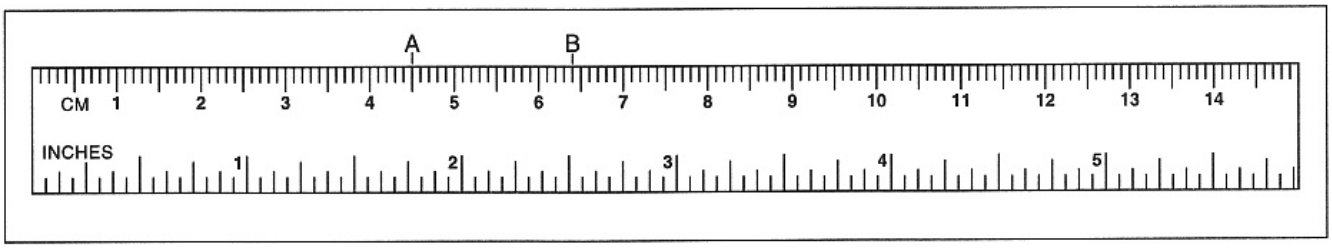
Try This!

1. The mass of the object shown above is: _____ g
2. In the list below indicate whether each is True or False.

___ a) Weight is a measure of the amount of matter there is in an object.
___ b) One kilogram is less than 1 gram
___ c) A graduated cylinder is used to measure the amount of matter in an object.
___ d) A measurement has 2 parts – a number and a unit

Length

Length is measured with a ruler. It can be used to find the dimensions of an object. Most rulers show major units such as centimetres, millimetres or metres. A metric ruler is shown below.



Try This!

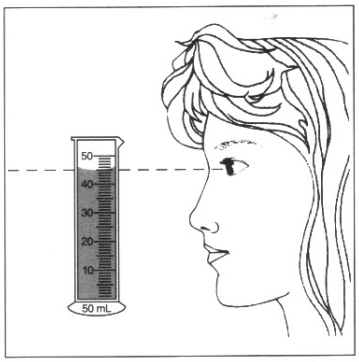
1. The length at A may be written as 4.5 cm. It may also be written as _____ mm.
2. The length at B is _____ cm or _____ mm.
3. Measure the length of each of the lines below. Write their lengths in centimetres and millimetres.

a) _____ a) _____ cm _____ mm
b) _____ b) _____ cm _____ mm
c) _____ c) _____ cm _____ mm
d) _____ d) _____ cm _____ mm

4. To the right of each measurement, **DRAW** a line of that exact length. Use the dotted line as a guide.

a) 39 mm ----------
b) 4.5 cm ----------
c) 94 mm ----------
d) 7.3 cm ----------

Volume



Volume is a measure of the amount of space an object takes up. The litre (L) is the basic unit for measure liquid volumes, whereas cm^3 is used for solids. The volume of a solid can be calculated using the volume equation for the shape that the solid takes – most are rectangular and therefore
V = L x W x H is the most useful equation. For liquids, a graduated cylinder is used to observe the volume of the substance. The cylinder should be placed on a flat surface and the meniscus read at eye level.

Try This!

1. Find the volume of the following rectangles

a) 2 cm x 5 cm x 1 cm _____

b) 8 m x 4 m 3 m _____

c) 4 mm x 6 mm x 2 mm _____

d) 3 cm x 2 mm x 2 cm _____

Density

Density is a physical property of matter. It is a representation of the amount of matter an object has compared to its volume. Each substance has its own characteristic density. This explains why some substances "float" or "sink" in a liquid. An object with lower density floats in one with a higher density. For example, ice has a density of 0.92 g/cm^3, this makes it float in water (density 1.0 g/cm^3).

$$density = \frac{mass}{volume}$$

or, in short form:

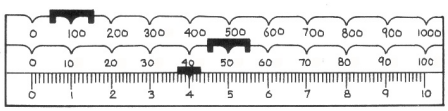
$$d = \frac{m}{v}$$

Try This!

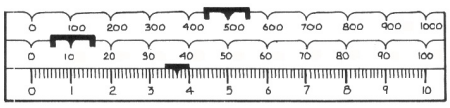
1. Calculate the density of a rectangular box that has a mass of 15 g, and a volume of 12.5 cm^3. Will it float or sink in water?

Measurement Practice

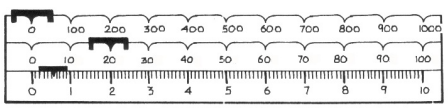
1. What mass is indicated by each of these balances?



_____ g

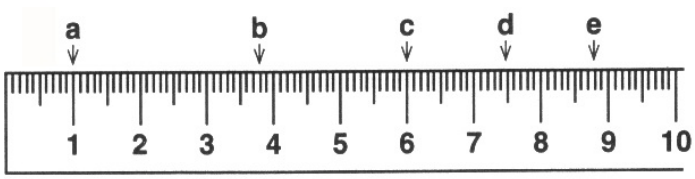


_____ g



_____ g

2. What lengths are marked on the centimetre ruler?

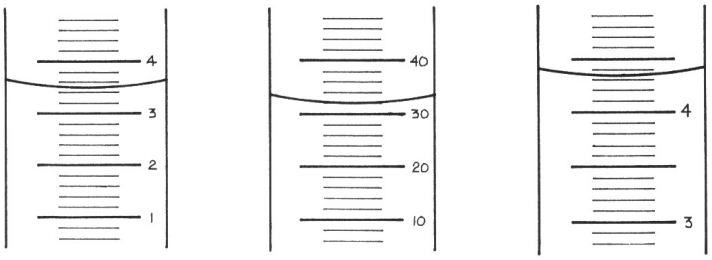


a) _____ b) _____

c) _____ d) _____

e) _____

3. What volume is indicated on each of the graduated cylinders?

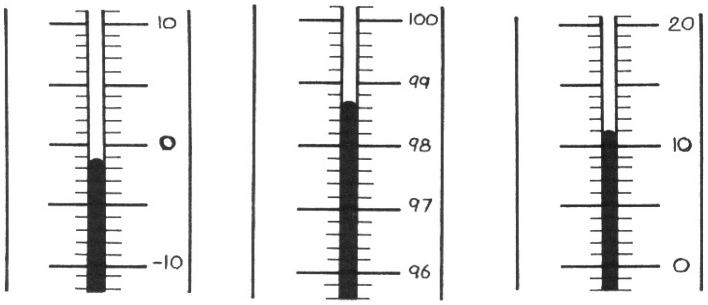


a) _____ mL

b) _____ mL

c) _____ mL

4. What temperature is indicated on each of the thermometers below?



a) _____ °C

b) _____ °C

c) _____ °C

5. Calculate the missing quantity in each of the following density problems, given the information in each question.

a) mass = 25 g; volume = 2 cm x 3 cm x 5 cm

b) density = 1.25 g/mL; volume = 0.45 mL

c) volume = 0.035 L; density = 0.92 g/mL

Activity: Density of the Human Body

Ever wonder why some people are natural floaters in the water, while others sink to the bottom? The answer is density - each person has a different amount of mass per unit of volume – therefore a different density. So, what do you do. . . . float or sink in the water?

Part A: Body Volume

You can calculate a rough estimate of the volume of your body by treating each major body part as if it were a regular solid. For example, your arms/legs are roughly cylindrical, your head a sphere, etc.

Using the measuring tools, take measurements (in cm) of all of your major body parts. Remember that you have **2** arms, legs, hands and feet. Add the volumes together to get your total body volume in **cm^3**.

Body Part	Circumference	Radius	Length	Width	Height	Volume
Head (sphere)			X	X	X	
Neck (cylinder)			X	X		
Torso (cylinder)			X	X		
Arm (cylinder) x 2			X	X		
Hand (cylinder - use a clenched fist) x 2			X	X		
Leg (cylinder) x 2			X	X		
Foot (rectangle) x 2	X	X				
					Total Volume (in cm^3)	

Part B: Body Mass

Convert your body mass in pounds (lbs) to mass in grams (g). (454g x mass in pounds = _____ g)

Part C: Body Density

Calculate your body density in g/cm^3. Show a full solution.

Part D: Will you float or sink?

Using the density you calculated in Part C, explain why whether you will float or sink in the following types of pools.

Pool A: Fresh Water 1 g/cm^3 Pool B: Saltwater 1.29 g/cm^3 Pool C: Chlorinated Water 1.12 g/cm^3

Have you ever wondered why we use graphs? Or what it is that a graph is telling you? Graphing is a pictorial way of representing relationships between various quantities, parameters, or measurable variables in nature.

A graph basically summarizes ***how one quantity changes if another quantity that is related to it also changes***.

Steps to Drawing a Line Graph

1. Draw the axes. One will go up the left side of the page and one will go across the bottom of the page. Leave about 4 lines from the edge in each case to write in. Use most of the page.

2. The **independent variable** will go on the bottom (or x) axis. Write the name of the variable and put the units in brackets about 3 lines below the axis.

3. Count the number of squares on the bottom axis. Determine the **range** of the **independent variable** (the amount between the highest and lowest numbers). Divide the range by the number of squares. Round this number **up** to either 1, 2, 5 or 10 or a multiple of that (like 100, 0.1, 0.01, 200, 20, 0.2, etc…). Now, each square on the bottom axis will have that number.

4. The **dependent variable** will go on the side (or y) axis. Write the name of the variable and put the units in brackets about 3 lines to the left of the axis. Write this sideways from the bottom to the top.

5. Plot the data. Make sure all the data is plotted.

7. After all the points have been plotted, if appropriate, draw in a **smooth curve or line** passing near most of the point. *The line or curve is NOT like connecting the dots! It only needs to pass near most of the points.* If it is a line that is drawn, we call it the **line of best fit.**

8. Give a descriptive title to the graph.

Assignment: Graphing Practice

Complete the following questions and graphing for each of the situations below.

1. Hookworms live in the human intestine drinking the blood it sucks from the intestine wall. It is estimated that a single hookworm can drink 0.85 cm^3 of blood per day.

Number of hookworms in the intestine	Amount of blood lost per day in cm^3
15	12
30	26
45	38
60	53
75	63
90	78

   a. What is the dependent variable? What is the independent variable?
   b. How many cm^3 of blood will be lost in a person infested with 90 hookworms in a week?

2. Ethylene is a plant hormone that causes fruit to mature. The data above concerns the amount of time it takes for fruit to mature from the time of the first application of ethylene by spraying a field of trees.

Amount of ethylene in mL/m^2	Wine sap Apples: Days to Maturity	Golden Apples: Days to Maturity	Gala Apples: Days to Maturity
5	18	16	15
10	15	13	11
15	11	10	10
20	9	8	9
25	6	7	8

   a. What is the dependent variable? What is the independent variable?
   b. How much ethylene (mL/m^2) is needed to have each of the apples reach maturity in 12 days?

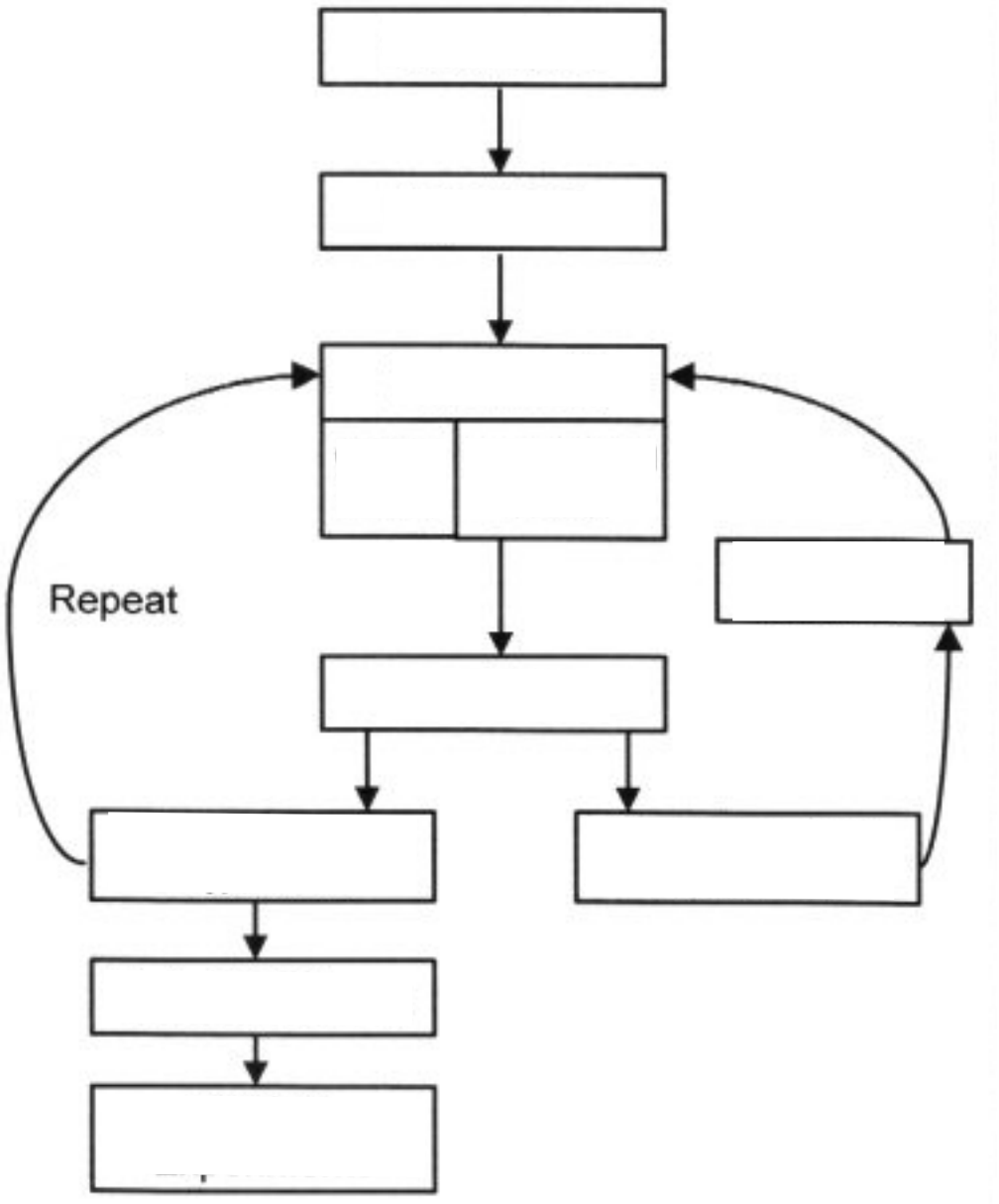
3. When would you use a bar graph instead of a line graph?

4. Graph the following data tables showing the comparison of the temperature and population of pickerel in Harris Lake, Ontario.

Month	Lake Temperature (^oC)	Fish Population (in 000)
Jan	**- 10.5**	**4.5**
Feb	**- 18.3**	**3.2**
Mar	**-13.5**	**2.8**
Apr	**4.8**	**1.5**
May	**9.0**	**4.0**
Jun	**16.2**	**4.8**
Jul	**22.4**	**5.4**
Aug	**29.5**	**5.0**
Sep	**24.5**	**4.9**
Oct	**19.0**	**4.9**
Nov	**9.7**	**4.8**
Dec	**-8.6**	**4.6**

The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. It determines a _____.

The steps of the scientific method are to:



When we do experiments and write up our labs, we will always follow this process!

1. Ask a testable question
Questions are very important in science because they form the basis for learning more about the world around us. Testable questions are written to show an obvious cause and effect relationship.

For example:

Observation	Some gum loses flavor faster than others.
Brainstorm Question	Why does gum lose its flavor? Why doesn't all gum lose its flavor at the same rate?
Testable Question	Will the brand of gum determine how long it has flavor? Will the type of gum (regular or sugar-free) affect the length it has flavor?

To check if the question is truly "testable", underline the cause and circle the effect in each of the above Testable Questions.

In all Testable Questions, there is a cause and effect relationship. These are called VARIABLES.

Independent Variable (IV) –

Dependent Variable (DV) –

Control Variable (CV) –

Practice: Does the size of the pumpkin grown in a garden depend on the presence of manure in the soil?
List the IV, DV and five CV's for this testable question.

2. Making a Hypothesis
To make a hypothesis, we suggest an answer or reason why the independent variable affects the dependent variable. Your predictions are generally based on past observations, logic and on bits of scientific theory you remember. It does not matter if your prediction is right or wrong. Hypothesis statements are set up in a specific way – _____
_____

E.g. If there is sugar in the gum, then it's flavor will last longer.

Practice:

Question: Will manure improve pumpkin size?
Hypothesis: If the manure is lots you get bigger pumpkins.
Explain what the above hypothesis is not correct. Rewrite it to make it correct.

3. Designing the Experiment

To design an experiment to test your hypothesis, you must identify your variables and design a control. You must decide how you will change your variable and what you will observe and/or measure with each change. This may require you to create some tables for recording your data. You must also decide on the equipment and materials that you will use. It is sometimes useful to create a diagram to illustrate your experimental set-up.

It is extremely important that your design includes all of the exact steps you took in your experiment, so that it can be duplicated exactly. Scientists cannot use their data to prove something unless it can be shown over and over again.

Materials - _____

Procedure - _____

- _____

- _____

Practice: Create a procedure for making a peanut butter and honey sandwich. Then, create a material list for your procedure. This will be marked, so be thorough and complete.

4.Making Observations - There are many ways to gather information about an observation:

Qualitative analysis: _____

Quantitative analysis: _____

Your observations should be clear, concise and organized. Usually this involves putting your gathered information into charts, graphs, diagrams and written descriptions.

Chart Format

Table 1: Type of Gum and Flavour Chewing Time

Gum Type	Time that Flavour Lasts while Chewing (minutes)
Dentyne Sugar-free	43.25
Bubbalicious (Sugar)	18.75

Graph Format – If the IV & DV are both measured using numbers, you can use a line graph to represent your observations.

5. Discuss your results, problems - It is important to reflect on the experiment to improve it and accurately interpret the data. What went well? What were the challenges? What could be improved? What would you do differently if you were to complete the investigation again? Be sure to also include any experimental error that may have occurred during the experiment.

6. Drawing Conclusion - Once the experiment has concluded, the experimenter must go back to the hypothesis to see whether the results supported, partially supported or rejected the hypothesis. The conclusion should state if the hypothesis was right or wrong and the results that proved this. Complete the concluding sentence by providing an explanation of the results.

Lab: Drops On A Quarter

Background Information

Cohesion Tension

Water molecules are attracted to other water molecules. The oxygen end of water has a negative charge and the hydrogen end has a positive charge. The hydrogen atoms of one water molecule are attracted to the oxygen from other water molecules. This attractive force is what gives water its cohesive properties.

Surface Tension

Surface tension is the term used for the cohesion of water molecules at the surface of a water body. The cohesion of water molecules forms a surface "film" or “skin.” Some substances may reduce the cohesive force of water, which will reduce the strength of the surface “skin” of the water.

Using your knowledge of the scientific method, design and carry out an experiment that would answer your testable question related to drops of water on a quarter.

Considerations in Experimental Design:

1. In this experiment, what were your control variables?
2. Identify the independent variable in the experiment.
3. Identify the dependent variable in the experiment.
4. Why were many trials taken and averaged?
5. What errors could have occurred? (Human error is not acceptable)