

Science 9

unit 1: science skills & safety



book 1: what is science?

name: Key block: _____

1.1 What is Science?

Science is all around us

- If you turn on a light, eat food, or watch TV you are using the products of scientific knowledge

Science is how we work

- Generate new Knowledge → inventions → driving our goals.

Science is very diverse

- There are many branches (fields) of study.

Science is IMPORTANT!

- New technology is constantly developing**
ex. HD-TVs, iPads, WiFi...
- What have you **seen in develop/change/be invented in YOUR lifetime?**
 - electric cars
 - cassette → CDs → MP3s → ipod
 - self-driving cars.
 - flip phones → smart phones
- Developments in science have also **changed how we view the world & our opinions**
"climate change" - recycle, ↓ pollution - electric cars - solar

To be a global citizen, and make good informed decisions in your life...you will need an understanding of SCIENCE!

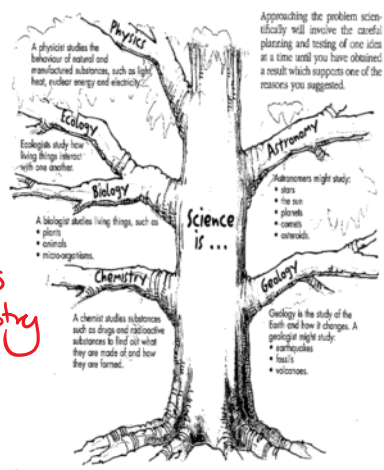
Branches of Science

There are four major branches of science.

Each branch is categorized in different type of subjects that covers different areas of study.

The four major branches of science are, Earth Sciences, Biological /Life Science, Physical Science and Social Science.

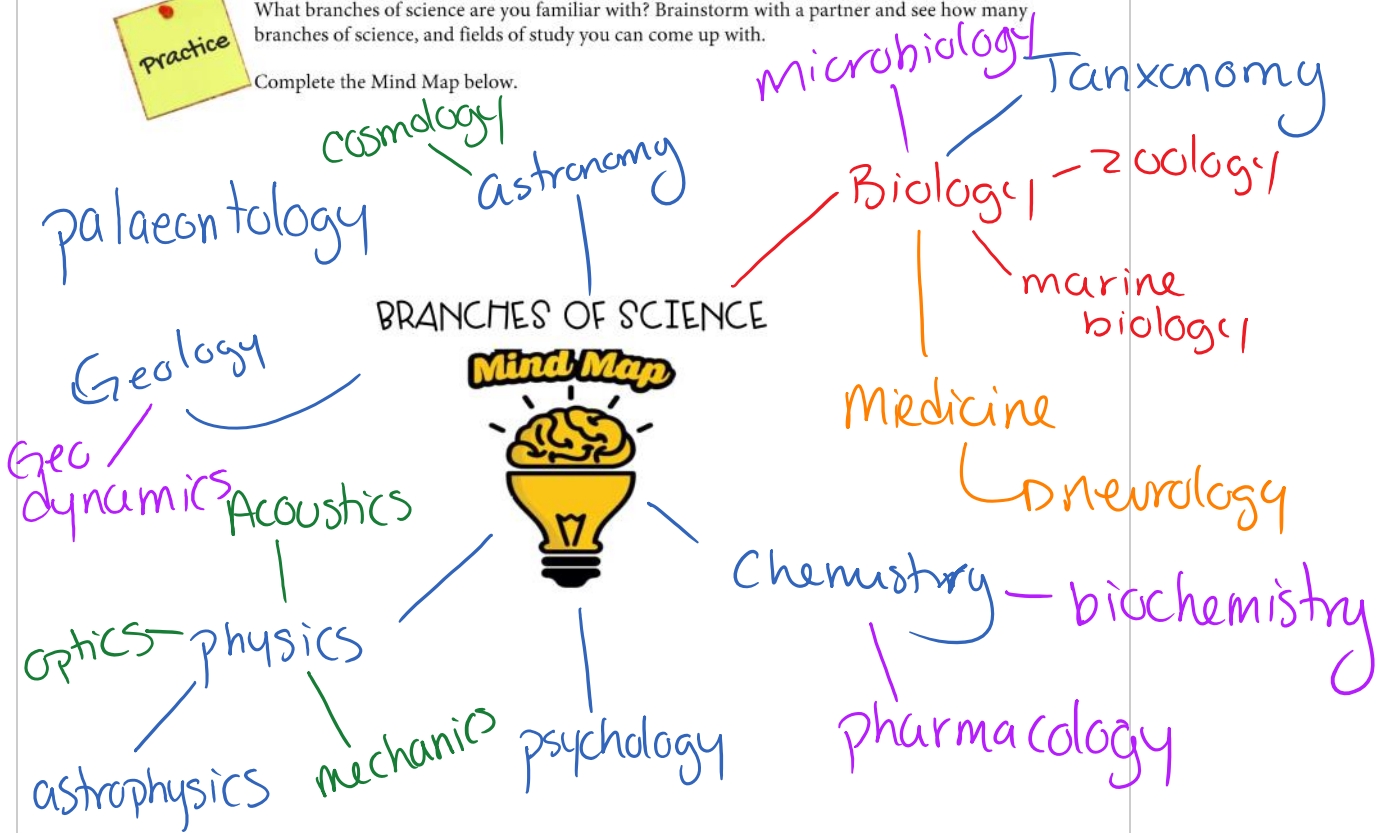
- ↳ sociology
- ↳ psychology
- ↳ Political Science
- ↳ physics
- ↳ chemistry





What branches of science are you familiar with? Brainstorm with a partner and see how many branches of science, and fields of study you can come up with.

Complete the Mind Map below.





Assignment #1: Types of Scientists

Complete the following worksheet.

Types of Scientists

Scientists are involved in important and interesting work. Below is a short list of some of the different type of scientists. Try to match up the type of scientists and the area of science that they study.

Type of Scientist		What They Study
Ex. entomologist	C	A. This scientist studies microorganisms such as bacteria, viruses, algae, fungi, and some types of parasites.
botanist	F	B. This scientist studies the causes and effects of disease.
neuroscientist	I	C. This scientist studies insects.
meteorologist	G	D. This scientist studies the <u>universe</u> and the components of the universe.
astronomer	D	E. This scientist studies hearing.
ecologist	P	F . This scientist studies plants.
oceanographer	L	G. This scientist studies the <u>atmosphere</u> .
pathologist	B	H. This scientist studies Earth's natural environment and human society
audiologist	E	I. This scientist studies the anatomy, functions, and disorders of nerves and the nervous system.
physicist	R	J. This scientist studies living organisms and living systems.
geographer	H	K. This scientists studies chemical processes and chemical transformations in living organisms. They study DNA, proteins and cell parts.
petroleum geologist	M	L. This scientist studies marine life and ecosystems, ocean circulation, plate tectonics and the geology of the seafloor, and the chemical and physical properties of the ocean
biologist	J	M. This scientist discovers new oil and gas deposits.
microbiologist	A	N. This scientist studies water and water systems.
herpetologist	Q	O. Scientists who invent, design, analyze, build, and test machines, systems, structures and materials.
engineer	Q	P. This scientist studies the relationship of living things with their living and nonliving environment.
biochemist	K	Q. This scientist studies amphibians and reptiles.
<u>hydrologist</u>	N	R. This scientist studies matter, energy, and how they interact.

Science Art

Big Idea Think about what a scientist looks like?

Miss Zee	Class
11	5
5	10
11	4
10	4
8	8
8	5

★

Name _____
Grade _____ Year _____
Teacher _____

Who are scientists?

Scientists are people who study things around them by making observations, asking questions, making predictions, testing hypothesis and carrying out investigations (or experiments)

Analyze each science skill and think about how you have used that skill in your everyday life.

What are some other skills that are important for a scientist to have?

- ① make models - hanging Xmas lights.
- ② Predictions -
- ③ work with others -
- ④ Classify -
- ⑤ Infer -
- ⑥ measure - ✓
- ⑦ Analyze -
- ⑧ Observe -
- ⑨ Hypothesize -

What do we consider "a science"?



TASK: to determine whether or not "Umbrellaology" represents science.

1. On your own, read the letter on the next page that describes detailed data collected on umbrellas.

2. Form a small group to discuss. Complete the table to outline "why umbrellaology IS science" and "why umbrellaology is NOT science". It is important that when forming your opinions, you support your claims with evidence.

When you are finished be prepared to support your claims in a class discussion.

Handwritten notes:

- Make models
- work with others
- Infer
- measure
- Hypothesize
- Analyze
- Intelligence (smarts)
- Patience
- +3 more skills
- observe
- open minded
- classify

What is science?

The question of "Umbrellaology"

Imagine that you receive the following letter.¹ Do you agree with its author? Is umbrellaology a science? If so, why? If not, how does it fall short of being a science? How does it compare to astronomy/zoology/geology/etc.?

"Dear Sir:

I am taking the liberty of calling upon you to be the judge in a dispute between me and an acquaintance who is no longer a friend. The question at issue is this: Is my creation, umbrellaology, a science? Allow me to explain this situation. For the past eighteen years, assisted by a few faithful disciples, I have been collecting materials on a subject hitherto almost wholly neglected by scientists, the umbrella. The results of my investigations to date are embodied in the nine volumes which I am sending to you under separate cover. Pending their receipt, let me describe to you briefly the nature of their contents and the method I pursued in compiling them. I began on the Island of Manhattan. Proceeding block by block, house by house, family by family and individual by individual I ascertained 1) the number of umbrellas possessed, 2) their size, 3) their weight, 4) their color. Having covered Manhattan after many years, I eventually extended the survey to the other boroughs of the City of New York, and at length completed the entire city. Thus I was ready to carry forward the work to the rest of the state and indeed the rest of the United States and the whole known world.

"It was at this point that I approached my erstwhile friend. I am a modest man, but I felt I had the right to be recognized as the creator of a new science. He, on the other hand, claimed that umbrellaology was not a science at all. First, he said, it was silly to investigate umbrellas. Now this argument is false because science scorns not to deal with any object, however humble and lowly, even to the 'hind leg of a flea'. Then why not umbrellas? Next he said that umbrellaology could not be recognized as a science because it was of no use or benefit to mankind. But is not the truth the most precious thing in life? And are not my nine volumes filled with the truth about my subject? Every word is true. Every sentence contains a hard, cold fact. When he asked me what was the object of umbrellaology I was proud to say, 'To seek and discover the truth is object enough for me'. I am a pure scientist; I have no ulterior motives. Hence it follows that I am satisfied with truth alone. Next, he said my truths were dated and that any one of my findings might cease to be true to-

¹Excerpted from: Somerville, J. (1941). Umbrellaology, or, Methodology in Social Science. *Philosophy of Science*, 8, 557-566.

morrow. But this I pointed out, is not an argument against umbrellaology, but rather an argument for keeping it up to date, which is exactly what I propose. Let us have surveys monthly, weekly or even daily to keep our knowledge abreast of the changing facts. His next contention was that umbrellaology had entertained no hypotheses and had developed no theories or laws. This is a great error. In the course of my investigations, I employed innumerable hypotheses. Before entering each new block and each new section of the city, I entertained an hypothesis as regards the number and characteristics of the umbrellas that would be found there, which hypotheses were either verified or nullified by my subsequent observations, in accordance with proper scientific procedure, as explained in authoritative texts. (In fact, it is interesting to note that I can substantiate and document every one of my replies to these objections by numerous quotations from standard works, leading journals, public speeches of eminent scientists and the like.) As for theories and laws, my work presents an abundance of them. I will here mention only a few, by way of illustration. There is the Law of Color Variation Relative to Ownership by Sex. (Umbrellas owned by women tend to great variety of color, whereas those owned by men are almost all black.) To this law I have given exact statistical formulation. (See vol. 6, Appendix I, Table 3, p. 582.) There are the curiously interrelated Laws of Individual Ownership of Plurality of Umbrellas, and Plurality of Owners of Individual Umbrellas. The interrelationship assumes the form, in the first law, of almost direct ratio to annual income, and in the end, of almost inverse ratio to annual income. (For an exact statement of the modifying circumstances, see vol. 8, p. 350.) There is also the Law of the Tendency towards Acquisition of Umbrellas in Rainy Weather. To this law I have given experimental verification in chapter 3 of volume 3. In the same way I have performed numerous other experiments in connection with my generalizations.

“Thus I feel that my creation is in all respects a genuine science, and I appeal to you for substantiation of my opinion.”

* Why Umbrellaology IS a Science	Why Umbrellaology is NOT a Science
<ul style="list-style-type: none"> • Using science skills such as: <ul style="list-style-type: none"> - observing - predictions - measured - analyse • Scientific <u>Laws</u> <ul style="list-style-type: none"> ↑ proven pattern 	<ul style="list-style-type: none"> • silly topic • doesn't change people's views / thinking. • doesn't change / affect our lives. • don't <u>need</u> to know about it.

TEAM CHALLENGE ACTIVITY: Marshmallow Towers

Objective: To build the tallest “freestanding” tower that can support a Marshmallow on top, in your assigned group of 3-4.

Instructions: For this challenge, your team must build a tower using only the materials provided. It must be freestanding (cannot lean on anything or be supported by anything) and must be completed in the allotted time. The tallest tower wins!

Materials:

- 20 pieces of pasta
- 1 Yard Masking Tape
- 1 Yard String
- 1 Marshmallow



Directions:

1. Using the name card, write your team's name on one side and write each of your team members on the other side, and place it at the front of your desk.



2. You will have exactly 8 minutes ^{+ 2 mins planning time} to design the tallest “freestanding” tower out of pasta, tape, and string that you can. This means the tower must stand on its own. You may not hold it up.
3. You must place your marshmallow on top of the tower. The height of the pasta does not matter. I measure from the marshmallow's position to the table/ground.

	Trial 1	Trial 2	Trial 3
Plan		+ 8 mini marsh.	
Height (cm)			
Reflection			

HW: ① complete reflection
 ② Assignment #2 worksheet.



How scientific is it?

How do we decide that something is scientific versus something that is unscientific? Below, you will find six knowledge claim statements.

1) Read each of the knowledge claim statements below.

Knowledge claim statements

- A. All living things are composed of one or more cells. We know this because every living thing examined to date has been found to be composed of one or more cells. *(evidence)*
- B. If you break a mirror, you will have seven years of bad luck. *- superstition*
- C. The Earth is flat. Anybody can see that! *→ old evidence; new info changed our views.*
- D. Taking Vitamin C prevents the common cold. Linus Pauling, the Nobel laureate who discovered the structure of Vitamin C, says it does. *→ claims of a scientist*
- E. Humans have a soul. I believe this because it says so in the Bible. The soul is what separates us from animals. *→ depends on belief*
- F. The rate of acceleration of all falling objects on Earth is constant. Two spheres of identical diameter and volume are dropped from the top of a building; one is made of steel, the other made of a plastic polymer. They both will accelerate at the same rate (32 ft/s^2) and hit the ground at the same time. *→ measurable*
- 2) Think about and agree on an order to the claims, by letter, from that which you think is least scientific to that which you feel is most scientific.

3) Place the letters along the arrow below from least scientific to more scientific.

Less scientific \leftarrow ----- \rightarrow More scientific

B E C D A F

4) Justification: **EXPLAIN** the reason you used for this order.

(see above)

10



Assignment #2: What is science?

Complete the following worksheet. Answer the questions neatly in the space provided

Science is an exciting subject, where you can do experiments and work in a laboratory. But what is science?

- 1 Science is doing experiments. Experiments are a way of finding answers to problems.
- 2 Science is knowledge.

People whose career is studying science are called scientists. Areas of special study in science have special names.

- **Biology** is the study of living things. A person who specialises in this study is called a **biologist**.

- **Chemistry** is the study of chemicals and how to change them, and is studied by a **chemist**.
- **Physics** is the study of energy, matter and movement and is studied by a **physicist**.
- **Geology** is the study of rocks and the earth, and is studied by a **geologist**.
- **Ecology** is the study of how plants and animals interact together in the environment, and is studied by an **ecologist**.
- **Astronomy** is the study of the planets, stars and the universe, and is investigated by an **astronomer**.

Activity

A

HW: Jan 30th
• Assignment #2
• How Scientific is IT? worksheet.

biologist.

astronomer.

Activity

With the help of your teacher, state which pictures include the following:

	A	B	C
stereo microscope	✓	✓	
Petri dish			✓
telescope	✓		
forceps			✓
an astronomer	✓		
science laboratory	✓	✓	? maybe.
biologist	✓	✓	

could be.



Figure 1.1.1



Figure 1.1.2



Figure 1.1.3

Science fact

Science and technology

Often people confuse science and technology. Science deals with 'understanding' while technology deals with 'doing'.

List 5 examples of science and technology used at home and at school

- 1 computer
- 2 electricity
- 3 internet
- 4 cars
- 5 _____

Australia has a long tradition of producing talented scientists such as Adrienne Clarke and Andy Thomas. Many of our scientists have been awarded the Nobel Prize, the highest science honour in the world.

ADRIENNE CLARKE is a botanist who specialises in the development of new plants. By transferring genes, she can make plants that grow more food, do not get eaten by insects and grow on land currently unsuited to farming.

Which branch of biology includes the study of genes?

Genetics.



ANDY THOMAS has orbited the earth 2250 times, and has travelled almost 100 million kilometres. As an astronaut he has spent 141 days in space. Andy went to school in Adelaide and trained to be an astronaut in the USA and Russia.

Which branches of science might an astronaut need to know?

physics, astronomy.

Complete the following: (read paragraph on prev. page)

Science is doing investigation. Experiments are a way of finding answers to problems.

Science is knowledge.

People whose career is studying science are called scientists. Areas of special study in science have special names.

Questions

1 Complete the table below.

Part of science	Name of scientist	What is studied or learnt
<u>Botany</u>	biologist	<u>studied living things</u>
<u>Chemistry</u>	<u>chemist</u>	study of chemicals and how to change them
physics	<u>physicist</u>	<u>study of energy matter + movement.</u>
<u>Geology</u>	geologist	<u>study of rocks + the Earth</u>
ecology	<u>ecologist</u>	<u>study of how plants + animals interact w/ environment.</u>
<u>Astronomy</u>	<u>Astronomer</u>	study of planets, stars and the universe

2 Some parts of science are combinations of different branches of scientific study.

Can you guess what is studied in: geophysics geology + physics

biochemistry biology + chemistry astrophysics astronomy + physics

3 What is a meteorologist? study the atmosphere.

What is the name of the meteorologist on a TV channel that you watch? weather man/woman.

Library/Internet Research: Research the life and times of Albert Einstein. Describe when and where he lived, and why he is remembered today.