Girl Guides of Canada Guides du Canada
BRITISH COLUMBIA COUNCIL

FUN WITH SCIENCE

AN INSTANT MEETING FOR GUIDES
FROM THE BC PROGRAM COMMITTEE

The purpose of this instant meeting is to encourage interest in science and at the same time, earn the Science Badge.

Meeting Plan

10-15 min: Gathering: Science – Technology Poster

10 min: Guide Opening (include discussion about posters)

10 min: Science Careers Game (choose either "I Have a Career" or Career Relay)

10 min: Technology - Blast to the Past

40-60 min: Round Robin Activities (choose 4-6)

Chemistry Activities

- Touching the Tent (5 min) OR
- Make Metal Float (5 min) OR
- Rainbow M&M's (10 min) OR
- Mix 'n Match (10 min)

Physics Activities

- Laser Show (10 min) OR
- Checkered Games (5-10 min) OR
- Checkered Tricks (5 min) OR

Taste Test (5 min) (Human Biology)

Super Structures (10 min) (Engineering)

15-20 min: Women in Science (Skits)

5 min: Guide Closing

120 minute meeting. Approximate activity times shown.

Program Connections

Science Badge – Completed with #'s 1-5, 7 and other

Beyond You: Try New Things 4. Learn about Inertia; 6. Activity of Choice

Discovering You: Discover What's Important to You 4. Hold a career night – learn about careers in science

Beyond You: Try New Things 4. STEM

Related Interest Badge
Chemistry (2), Engineering (5), Physics (8), Career Awareness (2), Basic Camper (5), Camp-out (6)

Preparation Prior to Meeting:

1. Print out 1 copy of the Science Information sheet per girl to fill out during the meeting.
2. Print the Technology Then and Now Cards (1 set for every 3-4 girls), the Science Career Game Cards (1 set for every 4 girls. Copy in colour for "I Have a Career" or in black and white for the Career Relay) and the Women in Science Cards on Cardstock (1 set of cards) and cut out.
   *Note: You may want multiple sets.
3. Print several copies of the protractor page.
4. Print instructions sheets for each of the science experiments.

Preparation at the meeting:

1. Set up the Round Robin as stations. At each activity location, have all ingredients, tools and instructions.
2. Keep an eye on things and be available to help as required.

Meeting Supplies

- ❑ poster board
- ❑ pencils / erasers
- ❑ felt pens or pencil crayons
- ❑ paper
- ❑ Technology Then and Now cards
- ❑ Science Career Game Cards
- ❑ a piece of material (any type with a tight weave) large enough to cover the top of a cup
- ❑ a cup
- ❑ an elastic band
- ❑ water
- ❑ a small plate
- ❑ one paper clip
- ❑ soap
- ❑ compass (optional, for extension)
- ❑ picture of a rainbow
- ❑ coffee filters
- ❑ paper towels
- ❑ M&M's, multiple colours
- ❑ pH kit
- ❑ vinegar and ammonia
- ❑ 1 cup for the waste liquid
- ❑ plastic syringe
- ❑ LED laser pointer
- ❑ rectangular mirror
- ❑ binder clip or clothespin
- ❑ printed pages of a protractor
- ❑ a lot of checkers, the checkers need to have a smooth edge, alternatively, use loonies
- ❑ a ruler
- ❑ jelly beans of different flavours
- ❑ marshmallows
- ❑ spaghetti
- ❑ props – anything that might be able to be used in science skits
- ❑ Science Information Sheet X # of girls

Gathering Activity:

Science-Technology Poster

Purpose: Learn ways that science and technology affect your life.

Directions

1. With a partner or in a group, brainstorm ways that science and technology affect your life.
2. Using the poster board, use your imagination to create a poster that demonstrates at least five ways that technology and science affect your life.
3. Be prepared to talk about your poster with the rest of the girls at opening.

Supplies

- ❑ poster board
- ❑ pencils & erasers
- ❑ felt pens or pencil crayons

Opening

Have your usual meeting opening, e.g. have the girls collect the weekly dues and take attendance in their patrols. Have the Guides sing the Guide Marching Song or the Guide Law Song as they do Horseshoe.

Science Careers Card Game

Purpose: To learn about different science careers.

Directions for "I Have a Career"

1. The goal of the Game is to collect a complete set of 1 career card, 1 education card, and 4 equipment cards.
2. Play in groups of 3-4. If playing in larger groups, you will have to add your own sets of cards to the deck. Other careers could be: Astronomer, Botanist, Environmentalist, etc.
3. Deal 4 cards to each player. the remaining cards face down in the centre of the playing area.
4. The player to the left of the dealer starts the play. She asks any player whether they have a specific type of card (e.g. "Sue, do you have any equipment for a Doctor?"). If the girl has any of the tools, she hands them all to the player asking the question.
5. She can continue asking players for cards until someone indicates that she has none of the requested cards. At that point, she takes a card from the centre pile and adds it to her hand.
6. The winner is the first player to get 6 cards in one set (e.g. 1 career card, 1 education card, and 4 equipment cards) and call "I Have a Career".

OR

Supplies

- ❑ Science Careers Game Cards
- ❑ Science Information Sheet

Directions for "Career Relay"

Supplies

- ❑ Science Careers Game Cards
- ❑ Science Information Sheet

1. Girls line up at one end of the room in groups of 4-6.
2. A set of career cards (1 career/girl in the group) is used (e.g. for four girls, use 4 full sets of career cards – Doctor, Engineer, Meteorologist, Pilot).
3. Mix up the cards and place them randomly upside down across the room from the team.
4. The first girl in line runs to the cards opposite her team. She picks up one card and places it down beside the upside down cards, then runs back to tag the second girl.
5. The second girl runs to the cards, picks a new card. If the card belongs to the same career set as the card already turned, then it should be placed below the card. If it doesn't, then it should be placed beside.
6. The next girl and every subsequent girl runs to the cards and either chooses to move a card to the correct row or can pick a new card and place it in the correct row.
7. The winning team is the one to correctly identify the career, education, and tools for all sets of cards.

   On your Science Information Sheet, write down 5 science careers that you think would be interesting.

Technology – Then and Now Memory Game

Purpose: To learn about how technology has improved different science disciplines over the years.

Supplies

- ❑ Technology Then and Now Memory Game Cards
- ❑ paper and pencil for score keeping

Directions

1. This game is played similar to the old style memory game. It is for 2 players.
2. Lay all the cards face down on the table in front of you. Make sure that the cards are mixed up.
3. Player one turns over one of the cards, and then a second card. If the two cards are a matching pair, e.g. the same type of science, then they share one "Then" and one "Now" fact before placing both the cards in her win pile.
4. The first player continues to repeat the process of selecting cards and sharing facts. Until she picks two cards that don't match.
5. At that point, the second player chooses two cards to match.
6. Play continues until all cards have successfully been matched and information from each one has been shared.
7. Players count the number of cards in their win pile and record their score.
8. The game can be played again, but the facts that are shared should be new ones.
9. The game is over after 3 rounds.

   Pick one science and write a fact from each the Then and Now on your Science Information sheet.

Extension

If you have access to the internet, pick a branch of science (e.g. biology, chemistry, physics, geology, etc.) and find out how technology has changed that science over time. You can create new cards using the information that you've found out.

Round Robin Activities (choose 4-6)

Touching the Tent

Directions

1. Pour the water into a cup, place the material on the top, and put an elastic band around it to keep so that it is taut.
2. Predict what will happen if you turn the cup upside-down.
3. Turn the cup over and make sure that it is directly upside down.
4. Touch the material underneath and watch the water leak through.
5. What do you think happens when you touch the side of your tent when it's raining?

Supplies

- ❑ a piece of material (any type with a tight weave) large enough to cover the top of a cup
- ❑ a cup
- ❑ an elastic band
- ❑ water

What's Happening?

Water molecules are attracted to one another and stick tightly together causing a very high surface tension. The surface tension of the water acts like a skin next to the material. When you touch the material, the pressure and the oil on your fingers disrupt the surface tension and the water molecules start to leak through. Surface tension is what allows pond skaters (insects) to "walk" on water. This also demonstrates why you don't want anything touching the sides or the top of your tent when camping.

Make Metal Float!

Directions

1. Pour water into a small plate.
2. Try to slide the paper clip onto the surface of the water until it floats.
3. When the paper clip floats, look carefully at the surface of the water under the clip. Can you see the "skin" of the water that holds up the clip?
4. Put some soap on your finger and gently touch the surface of the water. What happens?

Supplies

- ❑ a small plate
- ❑ water
- ❑ one paper clip
- ❑ soap
- ❑ compass (optional, for extension)

What's Happening?

The water molecules are attracted to each other because of the hydrogen bonding. They stick together tightly causing a surface "film" which makes it harder for an object to move through the surface layer of the liquid than it is to move through the lower layers. Soap molecules, which are only partly attracted to the water, disturb the ability of the water

molecules to "stick" together and this allows the paper clip to break through the surface and fall to the bottom. Once you introduce soap to the water, the paper clip cannot float on the surface of the water. To repeat the activity, wash all the soap off the plate and start again with fresh water. Try floating other light metal objects (eg. a staple or a sewing needle) across the plate.

Rainbow M&M's

Supplies

- ❑ picture of a rainbow
- ❑ coffee filters or paper towels
- ❑ M&M's, multiple colours
- ❑ water

Directions

1. Introduce the girls to ROY G BIV – the acronym for the colours in a rainbow (Red-Orange-Yellow-Green-Blue-Indigo-Violet).
2. Flatten a coffee filter or paper towel on a table.
3. Place different coloured M&M's on the paper about 3 centimetres apart – arrange the colours according to the rainbow (ROY G BIV: red-orange-yellow-green-blue).
4. Place a brown M&M separately on the coffee filter.
5. Drip water onto each M&M until the paper below is wet. Wait for about 2 minutes.
6. Pick up the M&M's and observe that the colours made a ring on the paper.
7. Compare the rings of the coloured M&M's to the ring under the brown M&M. Do you notice anything different about the outside edge of the brown ring?

What's Happening?

This activity demonstrates several principles:

Colour theory shows mixing of primary colours to make secondary colours. For Sparks and Brownies, ask them to notice that the red, yellow and blue rings use primary colours and have only one colour ring. Then point out that the orange and green rings have a yellow ring in addition to the orange and green/blue, respectively. Finally, point out the brown M&M develops three distinct colour rings: red, yellow and blue.

Chromatography is used to separate the dyes used to create the colours of the M&M's. For Guides and Pathfinders, point out that chromatography separates the inks used in the sugar coating (they are water soluble and dissolve with the sugar). The heaviest inks stay close to the centre and the lightest inks move the farthest. By observing the colour(s) of the rings you can tell which ones are primary colours (use only one colour dye) and which are secondary (use two colours). Brown is a composite of red, yellow and blue. Over time, there will be three distinct colours seen around the brown M&M.

Capillary action is the movement of water through small openings caused by the high surface tension of water. This explains why the water moved outward from the M&M's. The water texture of the paper towel or coffee filter has many small channels (capillaries). The surface tension of water makes it climb up the sides of these capillaries and travel out from the centre of the M&M.

Extension: Make this an experiment

Once you have learned about chromatography, turn this demonstration into an experiment by testing different types of coloured food products (jelly beans, Skittles, Kool-Aid, fruit juice crystals, etc.) or felt/ink markers to see if you can create different types of rainbows!

Mix and Match

This activity is similar to the STEM Challenge: Science activity “Cabbage Juice pH Indicator”. The pH indicator can be used to replace the pH kit listed in the supply list for this experiment.

Supplies

- ❑ pH kit
- ❑ vinegar, water, and ammonia
- ❑ 1 cup for clean water
- ❑ 1 cup for the waste liquid
- ❑ plastic syringe
- ❑ paper towel
- ❑ phenol red dye

Directions

1. Put your gloves and safety glasses on. Spread the paper towel on the tabletop.
2. Take the red lid off the pH tester.
3. Use the syringe to take some of the liquid out of one of the containers labeled ammonia, water, or vinegar and place it in the pH tester. Fill up to the MAX line.
4. Add 5 drops of the pH indicator, phenol red dye. Put the lid on tightly and shake it a bit.
5. The liquid will have changed colour. Look to the left and match the colour and the number.
6. Now look on the pH scale above to find out if the liquid is an acid or a base (alkaline).
7. Pour the used liquid into the waste cup.
8. Use clean water to rinse out the kit with the syringe.
9. Now repeat with the other two liquids.

What’s Happening?

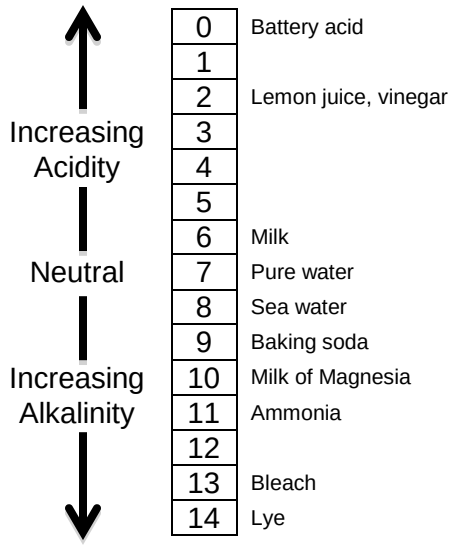
A pH indicator is a special type of compound that changes colour according to the pH of the substance it reacts with. The phenol red dye that you have in your pH kit is a pH indicator.

Acids, Bases and pH

Acids and bases (also called alkaline) are on the opposite ends of a pH scale.

The pH scale shows how acidic or basic a substance is. The pH scale ranges from 0 to 14. A substance with a pH of 7 is neutral. A substance with a pH less than 7 is acidic (eg. it has high concentrations of hydrogen ions, H+), and a substance with a pH greater than 7 is basic (eg. it has high concentration of hydroxide ions, OH-).

Water is neutral (eg. it has equal concentrations of hydrogen and hydroxide ions). Vinegar and lemon juice are acidic substances, while laundry detergents and ammonia (found in glass cleaner) are basic. Chemicals that are very basic (e.g. lye, found in household drain cleaners) are



very acidic (e.g. car battery acid) are called “reactive.” Acids and bases are very corrosive and can cause severe burns. Combining strong acids with strong bases is very dangerous.

Extension

Test all kinds of different liquids. Start with the liquids you drink, such as pop, milk, and juice. Then take the pH kit on a hike and sample a creek, river, pond or puddles of water.

Laser Show

Directions

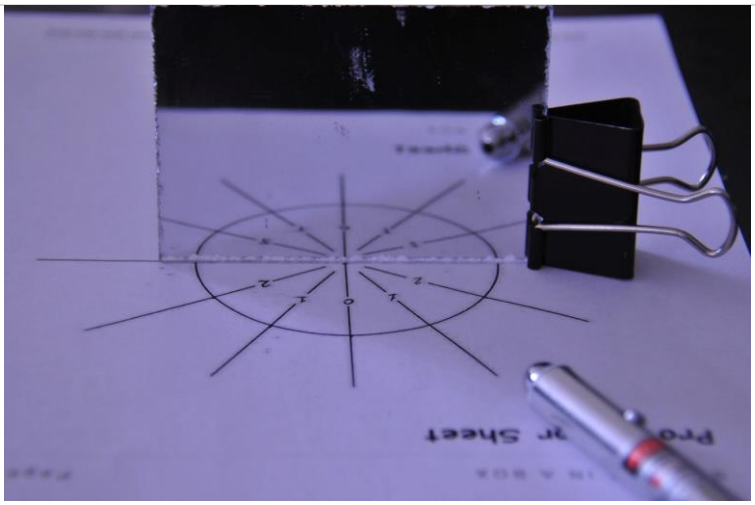
Supplies

- ❑ red laser pointer
- ❑ rectangular mirror
- ❑ binder clip or clothespin
- ❑ printed pages of a protractor

1. Girls can work in pairs or small groups.
2. Attach the binder clip or clothespin to the bottom of one side of the mirror. The clip or clothespin will act as a stand.
3. Place the protractor page on a flat surface. Make sure the mirror lies flat on the paper.
4. Balance the mirror on top of the flat line of the bottom of the protractor.
5. Pick a number on the protractor and shine the laser horizontally along the line aimed at the centre point on the protractor at the mirror. Ask your partner to hold her hand touching the table in front of the number on the other side of the protractor.
6. What happens to the laser light? What number does the reflected laser beam shine on?
7. Try a different number on the half circle. Does the light reflect to the same number on the other side?

What’s Happening?

Light is reflected from a mirror at the same angle that the light approached it. When you hold the laser pointer along line “0”, it is reflected straight back at the laser pointer. But if you place the laser pointer to shine along line “1”, it is reflected at an angle and back on the opposite line “1”. If you measure the angle from the mirror to the line, it is the same angle from the mirror to the reflected line. This is called the angle of reflection and the number will always be the same.



Checkered Tricks

Directions

Supplies

- ❑ a lot of checkers

1. Bend your arm with your elbow up (forearm level to the floor) and your hand next to your shoulder, palm up.
2. Place a checker on the flat area next to your elbow.
3. Try to catch the checker in the hand on the same arm by quickly swinging your elbow down and rotating your hand to the location where your elbow started.
4. When you master this action, try it with 2 stacked checkers, then three. See how many you can catch.
5. Play a relay game by dividing the girls into two groups. Place a table at one end of the room and a second table at the opposite end.
6. To play the relay game, have half of each team at each table. The girls will take turns placing a checker on their elbow and catching it. If the girls drop the checker, they must pick it up and try again. Once they successfully catches the checker, they run to the other side and give the checker to the next girl. The team that finishes first wins.

What's Happening?

As your elbow moves down from under the checker, your hand comes down toward the checker. If your timing is right, you can catch the token. There is a slight delay before the checker starts to fall. This is called inertia, which gives you time to rotate your hand around to catch it.

Checkered Games

Directions

1. Build a stack of eight or ten checkers.
2. Place another checker on the table next to the stack, about 3 cm away.
3. Using your forefinger, flick the single checker toward the stack of checkers, trying to knock out the bottom one. You need to flick it really hard and make sure it goes flat across the surface.

Supplies

- ❑ a lot of checkers, the checkers need to have a smooth edge, alternatively, use loonies
- ❑ a ruler
- ❑ a flat surface

What's Happening?

This is inertia at work again. The stack of checkers wants to remain in place when the rogue checker strikes the stack. The bottom checker will fly away while the rest of the checkers stay in their stack and drop to the table.

Extension

Try using a ruler to dislodge a middle checker instead of the bottom one. To do this, you must be sure to hit only one checker and hit it hard enough to cause it to fly out without knocking over any other checkers.

Taste Test

Directions

1. Working in pairs, close your eyes and hold your nose while your partner feeds you a jellybean.
2. Keeping your nose pinched, try to guess the flavour of the jellybean.
3. Observations should proceed as you slowly chew the candy.
4. Is there any change in the taste of the candy from the beginning to the end of the activity?
5. Describe the tastes.
6. Switch and let your partner try.

Supplies

- ❑ jellybeans of different flavours

What's Happening?

There are four different types of taste that are sensed on the tongue: sour, sweet, salty and bitter. About 80-90% of what we think of as "taste" actually is due to our sense of smell. Think how different food tastes when you have a stuffy nose. It is actually smell that lets us experience the complex, mouthwatering flavours we associate with our favourite foods.

Super Structures

Supplies

- ❑ marshmallows
- ❑ spaghetti

Directions

1. Divide girls into groups of two. Give each pair of girls the same number of marshmallows, spaghetti and linguini noodles.
2. Using only the materials provided, challenge the pairs to build the highest structure that they can.
3. Set a time limit before starting. When time is up, compare the structures.
4. Ask the girls to discuss their experience. Did they use spaghetti or linguini for their structure? Did they notice a difference?

What's Happening?

Circles are among the strongest shapes in nature. External and internal stress distributes itself evenly through a round structure. Spaghetti is shaped like a cylinder, while linguini is shaped like a flattened rectangle. A piece of spaghetti has the same strength in any direction that it is bent. Linguini will bend more easily in one direction than in another.

Women in Science

Purpose: To learn about women who were or are instrumental in making great strides for women in their chosen science career.

Supplies

- ❑ props – anything that might be able to be used in skits
- ❑ paper, poster board
- ❑ pencils, felt markers
- ❑ Science Information Sheet

Directions

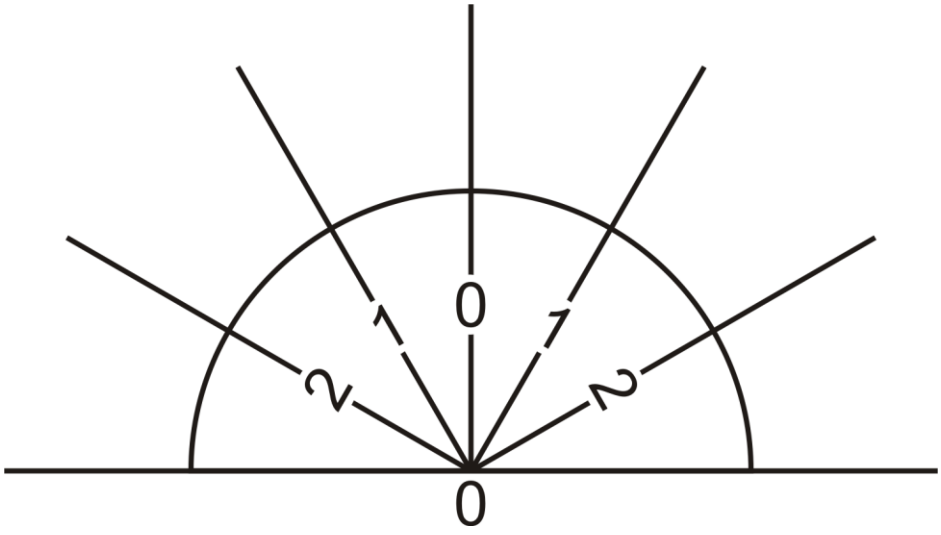
1. Divide into small groups of 2 or 3.
2. Pick a card about a woman in science and using the information provided, figure out a creative way to tell the rest of the unit about her.
3. You can do this by making up a skit, drawing a poster, writing a poem, etc. Be as creative as you like.
4. Make your presentations to the rest of the girls in the unit.

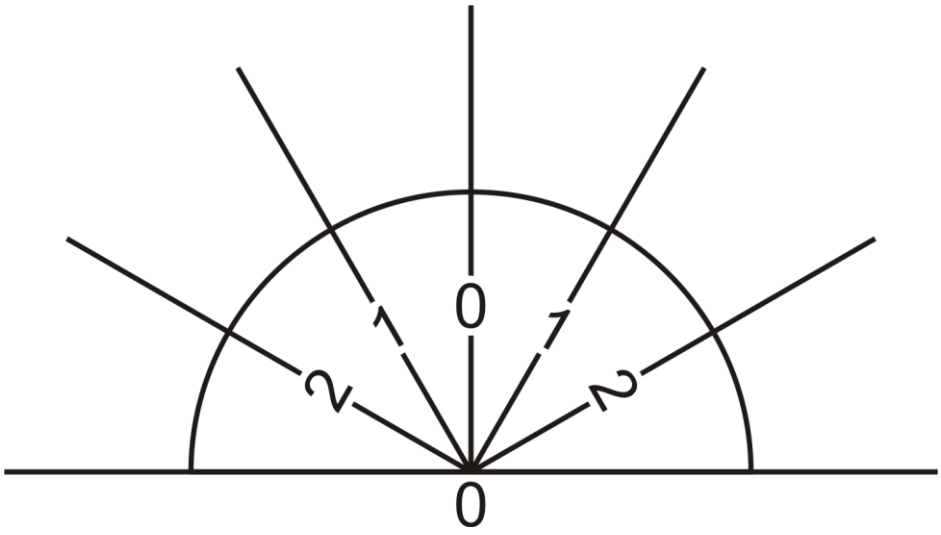
Write the names of the two most interesting women in the Science Information Sheet.

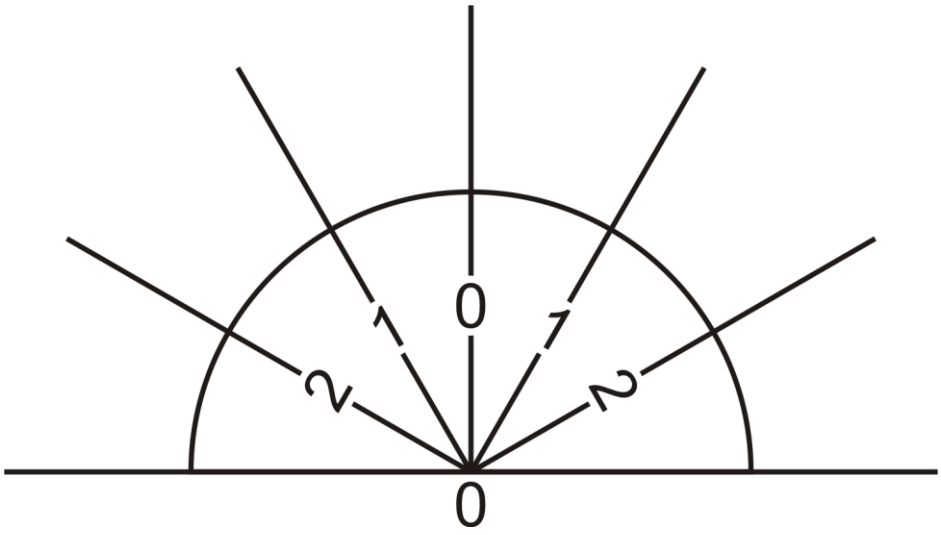
Closing

Close the meeting in your usual way.

PROTRACTOR SHEET







SCIENCE INFORMATION SHEET

1: Improvements in Technology that changed Science

Choose the Science: _____

List some changes in technology that have changed this science:

1. _____ 2. _____

2: List 5 careers in science:

1. _____ 2. _____

3. _____ 4. _____

5. _____

3: List two women in science and what they do or did:

1. _____ 2. _____

_____ _____

4: What Sciences did you do experiments from?

1. _____ 2. _____

3. _____ 4. _____

Technology Then and Now

Forensics – Then

Forensics is a science that is used to solve crime.

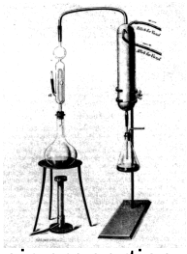
- In the early days of solving crimes, detectives relied on eye-witnesses to identify the criminals.
- Fingerprints were compared by a person, one print at a time with only a few prints available.
- Blood at a crime scene couldn't be used for identification.
- Hair, skin cells, or body fluids at the crime scene could help detectives to figure out what might have happened (a struggle, etc.), but wasn't otherwise useful.
- Physical evidence gathered at the crime could only be compared visually to items found with the suspect.

Forensics – Now

Today detectives have a large number of tools available to them.

- Now detectives know that eye-witness accounts are very often unreliable.
- Fingerprints are compared on computers where many millions of prints are stored. The computers are very fast and accurate.
- Blood at a crime scene can be analyzed to determine blood type.
- Hair, skin cells or body fluids can be used to identify DNA. Computer systems can quickly identify if the DNA is already in data storage. If a suspect DNA sample is obtained, it can be quickly compared.
- Physical evidence gathered at the crime can be analyzed – many items can be identified as to what brand, where it was made, even where it was purchased.

Chemistry – Then



The earliest chemists were called alchemists and they were convinced that they could transform regular chemicals into gold. Chemists began identifying different chemicals based on their properties and how they look.

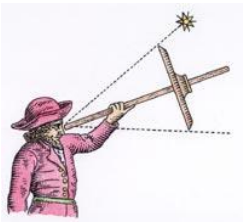
- Chemists didn't know enough about safety to protect themselves from the chemicals. Sometimes they became ill due to exposure to the chemicals with which they worked.
- Chemists didn't easily find out what other chemists were working on. Sometimes it would take years to find out about another scientists work or discoveries.
- Chemists had to try out their ideas in the lab and used up their starting materials.

Chemistry – Now

We now know that you cannot transform one atom into another one with simple chemistry.

- Chemists use sophisticated technology to identify chemicals. They used chromatography to separate the dyes.
- Chemists can separate and identify different molecules and with an electron microscope. They can even see individual atoms.
- Chemists work in laboratories with elaborate venting systems, using gloves and lab coats to protect themselves from exposure to the chemicals.
- Chemists use global communication systems to collaborate with their peers around the world, sharing information and learning from each other.
- Chemists use computer models to simulate reactions and products before trying to make them in the lab.

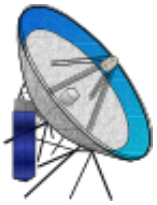
Astronomy – Then



The earliest astronomers simply looked at the night sky and noticed that the patterns of stars changed with the seasons. Galileo began using the first telescope to look at the night sky in 1610.

- Galileo's first telescope had 3X power.
- Early astronomers used only visible light to get information about the night sky, by simply looking up at the night sky and recording what they saw.
- Early astronomers created names for groups of stars, now known as constellations. They transferred this information by oral history.

Astronomy – Now



Amateur astronomers have technology that far exceeds what the early astronomers had available to them. Professional astronomers have incredible technology to use now.

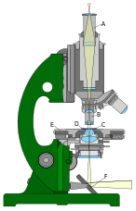
- Today's most well-known telescope is the Hubble Space Telescope. It can magnify things by 4700X.
- Astronomers gather information from the night sky using radio, infrared, ultraviolet, and other types of electromagnetic waves.
- Today's astronomers use start charts, either printed ones or charts available through apps on their phones or tablets.
- Astronomers gather information about the night sky using radio waves, like the Very Large Array in Socorro, NM.

Medicine – Then

Early doctors thought that diseases were caused by "bad" spirits.

- Doctors used herbs and plants to treat illnesses.
- Doctors often had to remove infected limbs to keep the patient from dying of an infection.
- Doctors used leeches to remove "bad" blood from patients.
- Doctors didn't know that caused many diseases.
- Doctors had to wait until the patient died before they could see what was happening inside the body.

Medicine – Now



Doctors know that many illnesses are caused by microorganisms, such as bacteria and viruses.

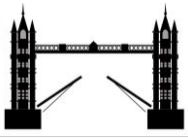
- Doctors use tested drugs to treat and cure illnesses.
- Doctors use antibiotics to treat bacterial infections. They try to work in a sterile environment to avoid introducing microorganisms while treating the patient.
- Doctors make sure to sanitize their hands to keep from spreading germs from patient to patient.
- Doctors use microscopes to look at pathogenic microorganisms that cause diseases.
- Doctors have many machines to look at the body to help identify health problems – for example X-rays and ultrasound machines, MRI's, CAT scanners, etc.
- Doctors have ready access to information via books, professional magazines, the Internet, etc.

Engineering – Then

Engineering in the early days was the concept of applying science to solve problems. Most of the Renaissance scientists were also inventors and engineers: Galileo designed a water clock to be able to do experiments in motion.

- Most engineers used trial and error to make things work.
- Most used very simple methods for creating impressive structures, like the pyramids.
- When the engineers built large structures, there were often accidents that would hurt the workers

Engineering – Now



Engineering is now a separate field of study, beginning with the fundamental science topics (physics, mathematics, chemistry, etc.) and building upon those topics with a focus on using technology to solve problems.

- Formal application of the scientific method to analyze how to improve how things work.
- Engineers use sophisticated measuring devices to build structures. Skyscrapers weren't possible until engineers learned to combine metals to create alloys that are stronger than the original metals.
- Technology allows engineers to design better systems, before building to make things stronger, more efficient, and safer.
- Design standards provide a starting point for engineers to do their work providing a minimum assurance of public safety.

Aeronautics – Then

Leonardo Da Vinci created drawings of flying machines in the late 15th century, but the first successful plane flight wasn't until 1903 by the Wright brothers.

- First flight took one man 120 ft. The first non-stop flight to cross the Atlantic Ocean was in 1919.
- The first flights were arranged directly with the pilot.
- When landing and taking off, pilots had to rely on vision to ensure safety.
- The first commercial planes could carry two – the pilot and one passenger.

Aeronautics – Now

Plane flight has made amazing technological advances in the past 100 years.

- Flights routinely cross the ocean, since the late 1950's.
- Flights are booked on line and scheduled using a computer.
- Air traffic controllers use radar and voice communication systems to assist with take off and landing.
- Today's planes are capable of carrying more than a hundred passengers, as well as a lot of cargo.

Meteorology – Then

The earliest weathermen simply looked at signs from nature to predict the weather. They began tracking weather information and publishing the data in books called almanacs. Farmers would use this information to determine the best dates for planting and harvesting.

- The earliest weathermen made up stories about the “gods” to explain weather events.
- Wives tales were used to remember the signs leading to specific natural events – the first appearance of a robin, beavers add to the north side of their den before a hard winter, a squirrels’ tail grows bushier before a hard winter, etc.
- The first weather almanacs were created by the ancient Greeks.

Meteorology – Now

Weathermen today are known as meteorologists. They use a wide variety of sophisticated tools to predict the weather. Almanacs still exist to document historical information, but are not used as a significant source for prediction.

- Technology provides a variety of information about developing weather trends: wind speed, air temperature, humidity levels, etc.
- Computer models use information from multiple technology tools to predict weather patterns.
- Weather data is available on the internet going back a hundred years.
- Doppler radar is used to collect current information about the weather.

Career equipment card (print on cardstock)

Career Card **DOCTOR**	Career Card **ENGINEER**
Equipment Card **Stethoscope**	Equipment Card **Calculator**
Equipment Card **Thermometer**	Equipment Card **Graph Paper**

Equipment Card

R_x

Equipment Card

Ruler

Equipment Card

Reflex Hammer

Equipment Card

Bridge Design

Education Card

- 7-9 years to complete education
- Includes 2-3 years of pre-med or a 4 year bachelor's program
- 3-4 year MD degree by an accredited university
- Completion of qualifying examinations and licensing by provincial licencing authority
- 2 years of Family practice or 4 years of specialty post-graduate training where you spend time as a resident training for certification.

Education Card

- Graduate from a Canadian Engineering Accreditation Board-certified university
- Licenced in the Province in which you are employed
- Engineering graduates must have 3 to 4 years of on-the-job engineering work experience depending on the province, under the supervision of a licensed engineer, as well as pass the professional Ethics exam to obtain a P.Eng.

Career Card **PILOT**	Career Card **DETECTIVE**
Equipment Card **Navigation Display**	Equipment Card **Crime Scene Tape**
Equipment Card **Altimeter**	Equipment Card **Magnifying Glass**

Equipment Card

Fuel Gauge

Equipment Card

Fingerprint

Equipment Card

Airplane

Equipment Card

Wire Taping Skills

Education Card

- Start with either a Recreational Pilot Permit or a Private Pilot's License.
- Upgrade to a Commercial License and finally to an Airline Transport Pilot's License.
- Must pass a medical exam.
- Must take ground school classes and flight lessons.
- Must log a specific number of hours in the air – approximately 1500 hours over two years for a commercial pilot.

Equipment Card

One way to complete education:

- Earn a Bachelor of Technology in Forensic Investigation
- Pre-requisites for entry: equivalent of English 12 or 3 credits of post-secondary English, Humanities or Social Sciences plus a 2 year post-secondary program
- 200 hours of relevant work experience before completion
- A criminal record check.

Career Card **PHARMACIST**	Career Card **COMPUTER PROGRAMMER**
Equipment Card **Beakers and Test Tubes**	Equipment Card **Laptop**
Equipment Card **Chemicals**	Equipment Card **Computer Book**

Equipment Card

Bunsen Burner

Equipment Card

Mouse

Equipment Card

Safety Glasses

Equipment Card

Hard Drive

Education Card

- Students are not admissible to the program directly from high school.
- Admission is after a minimum of one year of post-secondary training where a minimum of 30 credits of specified coursework in the sciences must be completed.
- The Bachelor of Science in Pharmacy (B.Sc. (Pharm)) takes an additional 4 years beyond this.

Education Card

- Can go to college for an Associate of Science Degree in Computer Science. This transfers to a third year computer science program.
- If doing all 4 years at university, students can apply to major in Computer Science once their 2nd year in the Bachelor of Arts program has been completed.
- The degree program is four years long.

Career Card **METEOROLOGIST**	Career Card **OPTOMETRIST**
Equipment Card **Satellites**	Equipment Card **Glasses Frames**
Equipment Card **Weather Station**	Equipment Card **Contact Lens Solution**

Equipment Card

Weather Balloons

Equipment Card

Eye Chart

Equipment Card

Radar

Equipment Card

Snipe Nose Pliers

Education Card

- Bachelors or higher degree in meteorology or atmospheric science. OR
- If a person already has a Bachelor's degree in another field (physics, applied mathematics, engineering or similar discipline), they can earn a Diploma of Meteorology in a two year part time program.

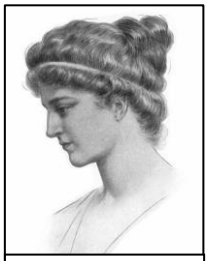
Education Card

- Minimum 3 years undergraduate education, preferably in sciences.
- 4 to 5 year program at an accredited (by Optometric Education) university.
- Can choose to do a year of residency to complete Doctor of Optometry degree.
- Must satisfy the provincial board requirements in the province they want to practice. This includes an examination by the Canadian Examiners in Optometry.

Station 4: Women in Science

Hypatia of Alexandria
(350 – 415AD)
Greek

Mathematician, inventor and teacher


Public Domain

- Wrote texts on geometry, algebra and astronomy.
- Credited with developing 3 scientific devices:
  - a hydrometer: used to determine the relative density of liquids,
  - an astrolabe used to locate and predict positions of sun, moon, stars and planets,
  - an instrument for distilling water.

Maria Sybillia Merian
(1647 – 1717)
German

Botantist and illustrator


Public Domain

- Published books of natural illustrations. First published book entitled *Neues Blumenbuch*, in 1675 when she was 28.
- Considered to be the founder of modern botany and zoology.
- One of the first naturalists to observe insects directly.
- Just before her death, she met Peter the Great. After her death he purchased a number of her prints that are still in the academic collections in St. Petersburg.

Ada Lovelace
(1815 **–** 1852)
British

English mathematician


Public Domain

- Was a Countess.
- Commissioned to translate the French paper on Babbage's Analytical Engine into English. She augmented it with explanatory notes, thicker than the original memoir.
- Regarded to be the first computer programmer because of the algorithm that she describes for the Analytical Engine to compute Bernoulli numbers. This is considered to be the first ever algorithm written for computer implementation.

Marie Curie
(1867 **–** 1934)
Polish/naturalized French

Physicist and Chemist


Public Domain

- First woman to win a Nobel Prize.
- Earned two Nobel Prizes in her life – the first in 1903 for Physics and the second in 1911 for Chemistry.
- She did research in radioactivity, sucessfully isolating radium.
- First woman to become a professor at the University of Paris.
- Defined an international standard for radioactive emissions.

Harriet Brooks
(1876 – 1933)
Canadian

Nuclear Physics


Public Domain

- Worked in Research at McGill University as Canada's first woman nuclear physicist.
- 1901 was the first woman to study at the Cavendish Laboratory at Cambridge University in England.
- Worked for a period of time in Dr. Marie Curie's laboratory.
- Since the rule of the day was that once women were married, they were not allowed to work, she was forced to give up her work as a physicist.
- She raised her 3 children, but remained active in the Federation of University Women.

Margaret Newton
(1887 – 1971)
Canadian

Agricultural Science


Fair use

- In her second year of university, enrolled in the agriculture program. She was the only woman in a class of 50. She was one of the first Canadian women to earn a degree in agriculture, and the first to earn a PhD in Agricultural Science.
- 1933 - Invited to Russia to train students in the problems of rust research.
- Second woman to become a Fellow of the Royal Society of Canada.
- First person and only woman to have received the Flavelle Medal for Meritorious Achievement in Biological Science.
- Margaret Newton Hall at the University of Victoria has been named for her.

Elsie Gregory McGill
(1905 – 1980)
Canadian

Electrical Engineer


Public Domain

- 1927, became the first Canadian woman to earn a degree in electrical engineering.
- 1929, first woman in North American and likely the world to receive a master's in aeronautical engineering.
- First woman elected to corporate membership in the Engineering Institute of Canada.
- Chief Aeronautical Engineer at Canadian Car and Foundry (CC&F), first woman in the world to hold such a position.
- In WWII, her primary responsibility was the production of the Hawker Hurricane fighter aircraft. Her staff of 4,500 people produced more than 2,000 aircraft.
- Considered the first woman to be a designer of airplanes.

Dorothy Hodgkin
(1910 – 1994)
British

Chemist


Wikipedia:Unattributed photograph from Les Prix Nobel 1964 p84

- Became the third woman to win the Nobel Prize in Chemistry.
- Advanced the technique of x-ray crystallography .
- Deciphered the structure of insulin.
- Confirmed the structure of penicillin and then the structure of vitamin B_{12}.
- Regarded as one of the pioneer scientists in the field of X-ray crystallography studies.
- One of five 'Women of Achievement' selected for a set of British stamps issued in August 1996.

Sylvia Olga Fedoruk
(1927 – present)
Canadian

Fair Use

Medical Imaging

- Established her reputation in nuclear medicine research early in her career.
- Instrumental in the development of the cobalt radiation unit used in cancer treatments.
- First women to become Chancellor at the University of Saskatchewan.
- First women trustee of the Society of Nuclear Medicine.
- First woman to be appointed to the Atomic Energy Control Board of Canada.
- Lieutenant Governor of Saskatchewan from 1988 to 1994.

Jane Goodall
(1934 **–** present)
British

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Primatologist

- Considered to be the world's foremost expert on chimpanzees having extensively studied them in Gombe Stream National Park, Tanzania.
- 1977 established the Jane Goodall Institute which supports Gombe research.
- She has 8 honourary doctorates from Universities and Institutions around the world.
- She was honoured with a plaque on the Tree of Life at Walt Disney World's Animal Kingdom theme park, beside a carving of her beloved chimpanzee David Greybeard.

Roberta Bondar
(1945 – present)
Canadian

Public Domain

Neurologist, Astronaut

- First female Canadian astronaut. Flew on the space shuttle in 1992.
- Payload Specialist for the first International Microgravity Laboratory Mission (IML-1).
- Certified in sky diving and parachuting
- Celebrated landscape photographer. She studied professional nature photography at Brooks Institute of Photography in California.
- 2009, the Roberta Bondar Foundation as a not-for-profit charity centred on environmental awareness.

Nancy Margaret Reid
(1952 – present)
Canadian

Photo unavailable

Statistician

- Earned her B.A. from the University of Waterloo, her Masters from the University of British Columbia and her PhD from Stanford University.
- 1992 – First woman to receive the President's Award of the Committee of Statistical Societies for outstanding contributions to the field of statistics.
- 1995 – First recipient of Krieger-Nelson Prize lectureship for distinguished research by a woman in mathematics.
- 1997 – Professor of Statistics at the University of Toronto.
- 2001 – elected as a Fellow of the Royal Society of Canada.
- 2004-5 – President of the Statistical Society of Canada.