

Transformation 2013

5E Lesson

PBL 5E Lesson Title: What's the matter?

Teacher(s): Julie Webb

School: Transformation 2013 T-STEM Center

Subject: Chemistry or Integrated Physics and Chemistry (IPC)

Abstract:

Students learn what matter is and what matter is not and classify samples of matter as elements, compounds, or mixtures. Students investigate a variety of physical means of separating mixtures. Then the students, acting as environmental chemists, are challenged to devise and execute a plan for separating an unknown mixture for further chemical analysis.

MEETING THE NEEDS
OF STEM EDUCATION
THROUGH DESIGN CHALLENGES

Design Challenge Title: *What's the Matter?*

TEKS/TAKS objectives: Chemistry 4ACD/IPC 7E

Engage Activity

1. Matter – What it is and what it isn't

In order to study matter, it is important that students understand what matter is and what properties all matter possesses. In this activity, students work to develop a conceptual understanding of what is matter and what is not matter.

To begin, each student constructs a 3 door foldable (with the doors labeled “Matter”, “Unsure”, “Not Matter” (see [WhatsTheMatter_Engage.pdf](#)). Working in groups of 3-4, students view pictures provided (see [Matter_Engage.ppt](#); print slides 9 per page, cut to make class sets) and record under the appropriate flap of foldable where they think the object or concept belongs.

As a team, students discuss and record what properties the things in the matter category have in common. Stress to students that these properties must apply to *all* things that are matter. Using the properties identified, students construct a definition for matter in their own words.

Facilitate a class discussion focusing on what constitutes matter and what does not. Ask students to explain their responses and their rationale.

Discussion questions:

- Which items are clearly matter?
- Which items are clearly not matter?
- Which items are up for discussion?
- Do you think air is matter?
- If an item is not matter, what is it? (This is a good question and not easy to answer. It could be energy (heat), a concept (wisdom) or movement of something like sound or wind or a sensation such as fear.)

List on the board the properties of matter students came up with and use this information to create a class definition of matter.

Discussion questions:

- Based on what we've discussed, what is matter?
- What are some possible definitions of matter?
- Does everyone agree 100% with this definition?
- What refinements are needed?
- Which senses are used to detect matter? Do some of these senses also detect things that are not matter?
- Does are definition help us sort out items in the “not sure” column?

At this point, have students look up the definition of matter in their textbook and compare to the class derived definition. Some good discussion questions include:

- How close is our definition to the textbook definition?
- What are the major similarities and/or differences?
- What made it difficult to define a term like matter?
- Do you have any criticisms of the textbook definition?

Time permitting; ask the question, “Can we experience heat without matter?”

Students record class definition of matter on flap of foldable and glue foldable into their journal.

- 2. Introduce the problem that students will have to solve as they progress through the lesson; read the following to the students and post on classroom bulletin board:**

To: Class
From: ABC Environmental Testing Services
Re: Samples from superfund site

Within the week, you will receive soil samples from a high priority superfund site. The multiple components of the sample soil mixture must be physically separated into their individual components before chemical analysis on each component can be completed. It is not known how many different components are present. It is imperative that the samples are purified to the greatest extent possible and that all samples are conserved, as we only have a limited amount of sample available.

Engage Activity Products and Artifacts:

Foldable

Engage Activity Materials/Equipment

Class sets of matter pictures, foldable handout

Engage Activity Resources

http://www.chem4kids.com/files/matter_intro.html
<http://ippex.pppl.gov/interactive/matter/>
<http://en.wikipedia.org/wiki/Matter>

Explore Activity

Classification Stations

Setup stations that include simple, common examples of elements, compounds, and mixtures (both homogenous and heterogeneous). Students will view the actual substances and models (you can use ball and stick or other materials such as craft pom poms and glue to construct models) of the substances and create a 2D diagram from the 3D model. Using the key provided with the sample summary information, students record the number and type of each atom present (write a chemical formula); the recording sheet provided can be used directly or as a template for students to copy into their journals. At this point, it is not important if the atoms are written in the proper order. For example, O₂H would be acceptable for water. Students will learn formula writing conventions in a future lesson.

Example stations

Elements: Copper, Carbon (graphite)

Compounds: Table salt, table sugar

Mixtures: Homogenous – salt water, air; heterogeneous – water/sand, table salt/sand

Explore Activity Products and Artifacts:

Journal entry: 2D diagram and chemical formula for each substance in journal.

Explore Activity Materials/Equipment

Samples of: copper shot or wire, graphite, table sugar, table salt, salt water, water/sand mixture, salt/sand mixture, molecular models for each substance/mixture, colored pencils, glue, recording sheet

Explore Activity Resources

Classification Stations instructions (attachment 1)

[Student recording sheet](#)

Explain Activity:

Students create Frayer Models of the vocabulary terms element, compound, homogenous mixture, and heterogenous mixture. Follow the sequence I Do/We Do/You Do to guide students through the process of creating a Frayer model.

What is the Frayer Model?

The Frayer Model is a vocabulary development activity. It was designed by Frederick Frayer, who believes that learners develop their understanding of concepts by studying them in a relational manner—in other words, how they relate to other things. Using the Frayer Model, students analyze a word's essential and nonessential attributes (*what it is, and what it is not*). This method of evaluating a word will refine their understanding of a word or concept. By using examples and non-examples, the student has a deeper understanding of a word's meaning. By understanding what a word is not, they are better able to understand what it is.

How do I use it?

The Frayer Model is very simple, and user-friendly. Here's how it works:

1. Tell the students the word or concept to be studied
2. Explain the Frayer model to students—all four squares, and how to complete it.
3. Using the concept, element, complete the model with the class. (I DO)
4. Using the concept compound, complete the model with the class providing their own input. (WE DO). Complete the term homogenous mixture in the same manner.
5. Have students work in pairs to complete their model diagram using heterogeneous mixture, roam the room giving assistance where it is needed. (YOU DO)

Once the students have completed the model, have them share their work through a guided class discussion. Students may vote on the best example and create the models on chart paper with colored markers; you can display the posters during the entire unit of study so that they can refer to the words being studied. Students should be allowed to continue to add ideas to the displayed models as their studies continue.

Explain Activity Products and Artifacts:

Journal entries of Frayer Models.

Explain Activity Materials/Equipment

Student journals, colored pencils

Explain Activity Resources

Frayer model, attachment 2.

Explore Activity

Separation Techniques Station

Students, working in groups of 2-3, rotate through the stations over the course of 2-3 days, based on length of class period and efficiency of students. For a class of 24 students, 4 setups of each station are recommended.

Station 1

Distillation of Cherry Coke: Students separate three components of Cherry Coke: CO₂, water, and flavoring. See documents [CherryCokeDistillation](http://www.learner.org/channel/workshops/chemistry/support/act5_b1.pdf) (retrieved online 8/29/2008 from http://www.learner.org/channel/workshops/chemistry/support/act5_b1.pdf) and [CherryCokeDistillation_student](http://www.learner.org/channel/workshops/chemistry/support/act5_b2.pdf) (retrieved online 8/29/2008 from http://www.learner.org/channel/workshops/chemistry/support/act5_b2.pdf) for instructions.

Station 2

Students explore three procedures for conducting paper chromatography:

Calculating the Retention Factor (R_f) of a substance: Students use paper chromatography to determine the R_f value for each of four color ink samples.

Separating Ink Dyes (option: assign this activity as homework)

High Speed Radial Chromatography: Students create a chromatogram in seconds. Prepare a chromatography “centrifuge”:

1. Make a tiny hole in the center of a plastic lid from a butter container or coffee can.
2. Securely fasten the lid to the shaft of a small battery-operated motor (available at most Radio shack Stores).
3. Have students make ink spots around the center of a filter paper disk (8 cm filter paper works well).
4. Impale the filter paper on the shaft of the motor so that it rests in the lid.
5. Turn on the motor and drip water on the center of the filter paper disk as it spins. The chromatogram will be complete in seconds.

Station 3

For each station, have students draw/label the experimental setup in their journals and record observations/results.

Separation by magnetic properties: Students separate iron fillings from sulfur using a bar magnet.

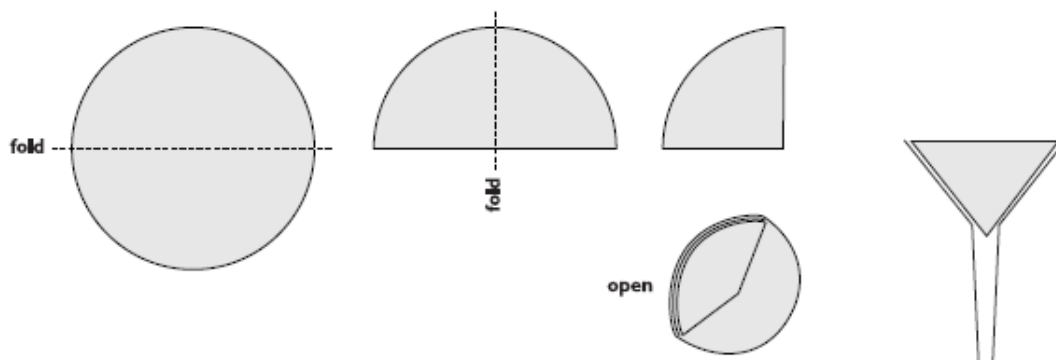
Evaporating a Solution: Students separate salt from water by evaporation using a hot plate and evaporating dish.

Using Sieves: A sieve is an instrument with a meshed or perforated bottom, used for separating coarse substance from fine substances of loose matter. Students separate a mixture of beads of multiple sizes using a sieve system.

Filtering a liquid: Students filter sand from water, using the proper technique to fold a filter paper.

Directions for folding filter paper:

1. Fold the filter paper in half. Fold the half in half again.
2. Hold three of the four parts of the filter paper in one hand.
3. Use your other hand to pull out the fourth part of the filter paper, thereby forming a cone.
4. Place the cone into a funnel.



Explore Activity Products and Artifacts:

Lab journal entries for all stations

Explore Activity Materials/Equipment

See materials section of Distillation of Cherry Coke, Calculating Rf Value, and Separating Ink Dyes labs, plastic lid from coffee can, small battery operated motor, D cell battery, D cell battery holder, 8 cm filter paper, dropper bottle with water, iron fillings and sulfur mixture, bar magnets, hot plate, salt water mixture, evaporating dishes, sieve set, mixture of various sizes of beads, filter paper, sand and water mixture, funnels, beakers

Explore Activity Resources

[Capitalizing on Chromatography](#) article (retrieved online 08/29/2008 from:

<http://pubs.acs.org/supplements/chemchronicles2/pdf/075.pdf?sessid=8820>
http://www.woodrow.org/teachers/bi/1995/simulation_wolf.html - DNA Simulation with paper chromatography
<http://antoine.frostburg.edu/chem/senese/101/matter/chromatography.shtml> - What is chromatography?

Explain Activity

Facilitate a student discussion of their explore activity results and have students record important information in their journals as indicated.

Station 1 (Distillation)

Discuss the results of the Cherry Coke distillation with the students.

Discussion Questions

1. Did you smell the cherry flavoring in the distillate? Did it come before or after the water? (before).
The class of chemical responsible for the smell are esters which have distinctive odors which has led to their use as artificial flavorings and fragrances.
2. How many people smelled the flavoring? Did you smell one or two?
3. What was the test for the presence of CO₂? (Reaction with lime water, turning cloudy in lime water is a *chemical property* of CO₂.)
4. Did the flavoring come out before or after the carbon dioxide or sort of in the middle? (students may sense at different times due to individual sensitivity)
5. Based on the density, what was the clear distillate in that was observed last? (water, density 1.00 g/mL))
6. What would be left in the flask? (Anything else in the soda, read the label).
7. Define chemicals. Are there chemicals in your Cherry Coke? (Produced by or involved in the processes of chemistry; all matter is chemicals!)

Go to <http://www.chem.arizona.edu/tpp/chemt/CAn/CAnDistillation.htm#> and have students summarize the information provided in their journal. Suggestions for important ideas to be included in notes are underlined below:

“Distillation is the most widely used separation technique in the chemical and petroleum industry. It's one of the principal methods of purifying a liquid.”

Distillation is a process in which a liquid mixture of two or more substances with different boiling points is separated into its component fractions by vaporizing the liquid, condensing the vapor and collecting the condensate in another container.

There are four different distillation's methods:

- Simple distillation
- Vacuum distillation
- Fractional distillation
- Steam distillation”

Have students use resources available to summarize each of the four types of distillation mentioned.

Have students identify the method of distillation they used in the Distillation of Cherry Coke lab (simple distillation).

Station 2 (Chromatography)

Students will record pertinent information in their journals as it is reviewed.

Go to <http://www.chem.arizona.edu/tpp/chemt/CAn/CAnPaperChromatography.htm#>. Read the “What is Needed” section with students. Using “round robin” facilitation, have students identify the “paper” (filter paper), “developing solvent” (water), and “developing chamber” (beaker) used in their experiment.

Click on the “How do you do it” steps of “spotting”, “running or developing”, and “visualization” and review and compare with the procedure students completed.

Click on “How do you analyze results” and have students compare results from different groups including spot characteristics and retention or retardation factors calculated.

Click on “What did I learn from it” and discuss whether the ink was a pure substance (element or compound) or a mixture (heterogeneous or homogenous). If different types of markers were used, have the groups determine, based on the chromatograms, which groups had the same type of markers.

Station 3 (separation by magnetic properties, evaporation, use of sieves, filtration)

Briefly discuss separation by magnetic properties, evaporation and use of sieves.

For filtration, go to <http://www.chem.arizona.edu/tpp/chemt/CAn/CAnFiltration.htm> and review the information provided. Students are to record notes in their journals from the overview of filtration. Then click on arrow to forward the screen shot and choose “What do you need” for a further description of gravity and vacuum filtration. Ask students, which filtration method did you use (gravity)? If you have a gravity filtration apparatus available, demo to students how it is used.

Have students label the [filtration diagram](#) in their journal (the diagram can be cut and pasted into their journals, or copied from an overhead) with the terms: filter paper, funnel, residue, and filtrate.

Explain Activity Products/Artifacts

Entries in student journals

Explain Activity Materials/Equipment

Student journals, colored pencils, internet, LCD projector, [filtration diagram](#)

Explain Activity Resources

http://en.wikipedia.org/wiki/Distilling#Simple_distillation
<http://www.chem.arizona.edu/tpp/chemt/CAn/CAnPaperChromatography.htm> - Chromatography
<http://www.chem.arizona.edu/tpp/chemt/CAn/CAnDistillation.htm> - Distillation
<http://www.chem.arizona.edu/tpp/chemt/CAn/CAnFiltration.htm> - Filtration
Chemistry and Technology of Flavors and Fragrances by David Rowe,
<http://www.blackwellpublishing.com/book.asp?ref=1405114509&site=1>)
http://personal.ashland.edu/~bmohney/ket_scholars/esters.html
<http://en.wikipedia.org/wiki/Ester>

Elaborate Activity

Re-introduce the problem that students have to solve:

To: Class
From: ABC Environmental Testing Services
Re: Samples from superfund site

Within the week, you will receive soil samples from a high priority superfund site. The multiple components of the sample soil mixture must be physically separated into their individual components before chemical analysis on each component can be completed. It is not known how many different components are present. It is imperative that the samples are purified to the greatest extent possible and that all samples are conserved, as we only have a limited amount of sample available.

Separating an Unknown Mixture –

Teacher preparation:

Thoroughly mix together:

iron fillings
sand
gravel
salt
wood shavings or small seeds that float

Approximately 2 oz of mixture will be needed per group. For each group of 3-4 students provide:

Two beakers, 200 mL capacity
Two bar magnets
Two magnifiers
Stirring rod
Plastic spoon
Funnel two filter paper disks to fit funnel
Evaporating dish
Heat source
Screen sieve set
Paper towels
Water
balance

Procedure:

The students task is to devise and execute a plan to separate the mixture using the labware provided. Do not tell them what the components are or how many there are. Inform students that the separated components will be checked for purity with a magnifier and that the total quantity of the separated components must be nearly equal to the quantity of the original mixture with which they began.

It is very important that students examine the mixture closely and write a plan for separating out the various components. Each group should submit their plan to you for approval. If you notice any potential problems, ask them leading questions to help them recognize and correct their mistakes.

Sample student plan:

Two students will each work on a small portion of the mixture, removing iron fillings with magnets. The “cleaned” portions will be given to another student who will dump them into water in a beaker. Meanwhile, the iron fillings removers continue their work with another small portion of the mixture. The floating material is scooped off the surface of the water and set on a paper towel to dry. The remaining water mixture is stirred to dissolve any soluble materials, and is poured into the filter paper in the funnel and allowed to drip into the other beaker. The filtered solution is put onto an evaporating dish and heated to evaporate the water.

Elaborate Activity Products and Artifacts

Student plan for separation of mixture
Journal entry of results

Elaborate Activity Materials/Equipment

iron fillings, sand, gravel, salt, wood shavings or small seeds that float, 200 mL beakers, bar magnets, magnifiers, stirring rods, plastic spoons, funnels, filter paper disks to fit funnel, evaporating dishes, heat source, screen sieve sets, paper towels, water, balance

Elaborate Activity Resources

<http://antoine.frostburg.edu/chem/senese/101/matter/separation.shtml>
<http://www.rsc.org/education/teachers/learnnet/jesci/separate/students.htm>

Evaluate Activity

Students complete a lab practical (14 stations total; can be set-up in duplicate for large classes) as follows (see [WhatsTheMatter_Evaluate.pdf](#) for student instructions for each station). Students should spend 2 -2.5 minutes at each station:

1. Set-up six different stations throughout the lab, each station showcasing a physical separation technique including gravity and/or vacuum filtration, distillation, magnets, evaporation (heat source and evaporating dish), paper chromatography and sieves. Students are to identify and briefly describe the separation technique using the vocabulary terms provided in their description.
2. Set-up six different stations, at each station the student is to determine the most appropriate separation technique for six different mixtures: salt water, sand/ water, ground spinach slurry, rocks/gravel/pyrite/sand, grape soda, ground cereal (provide samples in small vials of each mixture, labeled with contents at each station respectively)
3. Set-up two stations with sample problems calculating and using R_f values.

Evaluate Activity Products and Artifacts

Students' lab practical responses

Evaluate Activity Materials/Equipment

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Station activity cards, gravity filtration set-up, distillation set-up, bar magnets, heat source and evaporating dish set-up, paper chromatography set-up, sieves set-up, small vials of mixtures noted in evaluate activity #2.

Evaluate Activity Resources

Spinach Chromatography: <http://resources.wardsci.com/resources-and-tips/chromatography-of-spinach/>

Spinach chromatography:

http://biology.clc.uc.edu/Fankhauser/Labs/BioLab_112/Photosynthesis_chromatography.html

Plant chromatography: http://nasaexplores.com/show_912_student_st.php?id=03010795217

Iron in Cereal: <http://www.mcrel.org/whelmers/whelm07.asp>

Extracting iron in cereal: http://www.uark.edu/depts/foodsci/mystery/extra/07_extractingiron.html

Attachment 1

Classification Stations




Compound: Sugar

The *compound* **glucose** (molecular model shown), a monosaccharide (or simple sugar), is an important carbohydrate in biology. The living cell uses it as a source of energy. Glucose is one of the main products of photosynthesis and starts cellular respiration in both prokaryotes and eukaryotes. The name comes from the Greek word *glykys* (γλυκύς), meaning "sweet", plus the suffix "-ose" which denotes a sugar.

Sucrose (common name: **table sugar**) is a disaccharide of glucose and fructose, with the molecular formula $C_{12}H_{22}O_{11}$. Pure sucrose is most often prepared as a fine, white, odorless crystalline powder with a pleasing, sweet taste. Like other carbohydrates, sucrose has a hydrogen to oxygen ratio of 2:1. Sucrose is the most common food sweetener, although it has been replaced in American industrial food production by other sweeteners such as high fructose corn syrup. Sucrose is the most important sugar in plants, and can be found in the phloem sap. It is generally extracted from sugar cane or sugar beet and then purified and crystallized. Other (minor) commercial sources are sweet sorghum and sugar maples. Sucrose is ubiquitous in food preparations due to both its sweetness and its functional properties. It is common in many processed and so-called "junk foods."

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Hydrogen	H
	Carbon	C
	Oxygen	O

Compound: Table Salt

The compound **sodium chloride** is also known as **common salt**, **table salt**, or halite. Sodium chloride is the salt most responsible for the salinity of the ocean and of the extracellular fluid of many multicellular organisms. As the major ingredient in edible salt, it is commonly used as a condiment and food preservative. Salt is currently mass-produced by evaporation of seawater or brine from other sources, such as brine wells and salt lakes, and by mining **rock salt**, called halite. As well as the familiar uses of salt in cooking, salt is used in many applications, from manufacturing pulp and paper to setting dyes in textiles and fabric, to producing soaps, detergents, and other bath products. In cold climates, large quantities of rock salt are used to help clear highways of ice during winter.

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Chlorine	Cl
	Sodium	Na

Element: Copper

The element **copper** is a ductile metal with excellent electrical conductivity and has a pinkish luster which is (beside gold) unusual for metals which are normally silvery white. It finds use as a heat conductor, an electrical conductor, as a building material, and as a constituent of various metal alloys. It is an essential trace nutrient to all high plants and animals. In animals, including humans, it is found primarily in the bloodstream and in copper-based pigments. However, in sufficient amounts, copper can be poisonous and even fatal to organisms.

Copper has played a significant part in the history of mankind. Several early civilizations have early evidence of using copper. During the Roman Empire, copper was principally mined on Cyprus, hence the origin of the name of the metal as Cyprium, "metal of Cyprus", later shortened to Cuprum. A number of countries, such as Chile and the United States, still have sizable reserves of the metal which are extracted through large open pit mines, however like tin there may be insufficient reserves to sustain current rates of consumption. High demand relative to supply has caused a price spike in the 2000s.

Copper also has a significant presence as a decorative metal art. It can also be used as an anti-germ surface that can add to the anti-bacterial and antimicrobial features of buildings such as hospitals.

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Copper	Cu
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Element: Carbon

The element **carbon** is a nonmetallic element that presents several allotropic forms of which the best known are graphite (used in pencils) and diamond. Carbon is one of the few elements known to man since antiquity. The name "carbon" comes from Latin language *carbo*, coal, and in some Romance languages, the word carbon can refer both to the element and to coal. It is the fourth most abundant element in the universe by mass after hydrogen, helium, and oxygen. It is present in all known life forms, and in the human body, carbon is the second most abundant element by mass (about 18.5%) after oxygen. This abundance makes this element the chemical basis of all known life.

The physical properties of carbon vary widely with the allotropic form. For example, diamond is highly transparent, while graphite is opaque and black. Diamond is among the hardest materials known, while graphite is soft enough to form a streak on paper. Diamond has a very low electric conductivity, while graphite is a very good conductor. Also, diamond has the highest thermal conductivity of all known materials under normal conditions. All the allotropic forms are solids under normal conditions.

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Carbon	C
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Homogeneous Mixture: Air

Composition of the Earth's Atmosphere

Gas	Abundance percent by volume	Abundance parts per million by volume
Nitrogen	78.084%	780,840
Oxygen	20.9476%	209,476
Argon	0.934%	9,340
Carbon Dioxide	0.0314%	314
Neon	0.001818%	18.18
Helium	0.000524%	5.24
Methane	0.0002%	2
Krypton	0.000114%	1.14
Hydrogen	0.00005%	0.5
<u>Xenon</u>	0.0000087%	0.087

What is the most common gas in our atmosphere? Does this surprise you?

Your Task: On the form provided, create a colored diagram of the molecular models shown (the two most abundant gases in our atmosphere) and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Nitrogen	N
	Oxygen	O

Homogeneous Mixture: Salt Water





--Sri Sathya Sai Baba
"The cure for anything is salt water - sweat, tears, or the sea."

An **ocean** (from Greek *Ωκεανός*, *Okeanos* (Oceanus)) is a major body of saline water. Approximately 71% of the Earth's surface is covered by ocean. Did you ever wonder why the oceans are filled with salt water instead of fresh? Just where did the salt come from? And is it the same salt you find on a dining room table? Most of the salt in the oceans came from land. Over millions of years, rain, rivers, and streams have washed over rocks containing the compound sodium chloride (NaCl), and carried it into the sea. You may know sodium chloride by its common name: table salt. Some of the salt in the oceans comes from undersea volcanoes and hydrothermal vents. When water **evaporates** from the surface of the ocean, the salt is left behind. After millions of years, the oceans have developed a noticeably salty taste.

Have you ever wondered why the ocean is blue? A common misconception is that the oceans are blue primarily because the sky is blue. The fact is water has a very slight blue color that can only be seen in large volumes. While the sky's reflection does contribute to the blue appearance of the surface, it is not the primary cause. The primary cause is the absorption by the water molecules' nuclei of red photons from the incoming light. Water absorbs more of the red light in sunlight; the water also enhances the scattering of blue light. Be aware though that not all oceans are blue. For example, the Red Sea often looks red because of red algae that live in this sea. The Black Sea looks almost black because it has a high concentration of hydrogen sulfide (which appears black).

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Hydrogen	H
	Chlorine	Cl
	Oxygen	O
	Sodium	Na

Heterogeneous Mixture: Water and Sand

"In every curving beach, in every grain of sand there is the story of the earth." – Rachel Carson

Silicon dioxide, also known as **silica** or **silox** (from the Latin "silex"), is the most common constituent of sand, usually in the form of quartz. The composition of sand is highly variable, depending on the local rock sources and conditions. The bright white sands found in tropical and subtropical coastal settings are eroded limestone and may contain coral and shell fragments in addition to other organic or organically derived fragmental material. The gypsum sand dunes of the White Sands National Monument in New Mexico are famous for their bright, white color. Arkose is a sand or sandstone with considerable feldspar content, derived from the weathering and erosion of granite. Some sands contain magnetite, chlorite, glauconite or gypsum. Sands rich in magnetite are dark to black in color, as are sands derived from volcanic basalts and obsidian. Chlorite-glauconite bearing sands are typically green in color, as are sands derived from basalt (lava) with a high olivine content. Many sands, especially those found extensively in Southern Europe, have iron impurities within the quartz crystals of the sand, giving a deep yellow colour. Sand deposits in some areas contain garnets and other resistant minerals, including some small gemstones. Sand is transported by wind and water and deposited in the form of beaches, dunes, sand spits, sand bars and related features

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Hydrogen	H
	Oxygen	O
	Silicon	Si

Heterogeneous Mixture: Salt and Sand


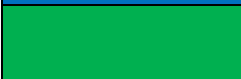


Our world is full of beaches; some beaches are famous for their beauty while others are hidden away. The famous beaches are probably famous because they were more easily accessible so more and more people flocked to them. Some of these famous beaches however were soon out of the top ten beaches of the world list due to pollution. Therefore if you think any of your favorite beaches deserves to be listed among the list of famous beaches or the world's top ten beaches, contribute to maintaining its everlasting beauty.

Listed here are the top ten beaches of the world; have you ever visited any of these?:

1. Anguilla, Caribbean
2. Barcelona, Spain
3. Bora Bora, French Polynesia
4. Fernando de Noronha, Brazil
5. Harbour Island, Bahamas
6. Mykonos Island Beach, Aegean Sea
7. Oahu, Honolulu
8. Palm Beach - Aruba, World's Top Beaches
9. Tulum Beach - Cancun
10. Horseshoe Bay - Bermuda

Your Task: On the form provided, create a colored diagram of the molecular models shown and complete the chemical formulas in the boxes provided. Write element symbols in the large boxes and record how many atoms of that element are present in the small boxes. Write the resulting chemical formula below the boxes. Record whether the substance is an element, compound, or mixture (specify homogenous or heterogeneous) in the final column.

Model Key

	Sodium	Na
	Chlorine	Cl
	Silicon	Si
	Oxygen	O

Attachment 2

Frayer Model

Definition (in your own words):	Facts/Characteristics:
Examples:	Non-examples:

Concept