Mixtures – Workshop Plan

Age group: 10-12 years old

Subject: Chemistry – mixtures

Workshop focus and goals:

Aim: To learn about mixtures, mass, and volume

Objectives:

- Make different mixtures
- Differentiate heterogeneous and homogeneous mixtures
- Identify air as a homogeneous mixture of gases
- Calculate volumes, and weigh masses
- Write scientific protocols
- Determine that 1 L of water is 1 kg of water and 1 dm^3

Materials needed:

- Solids: salt, pepper, sugar, sand, rocks
- Liquids: water, oil, syrup, flavored extract
- Gas: CO_2 sensor, hotplate (can be used to boil a nice smelling liquid for it to evaporate = gas/gas homogeneous)
- Many containers of different volumes
- 1 dm^3 cube
- Measuring cups (at least 1 L one)
- Scale

Workshop structure:

Total duration: 400 min = 6 h 40 min

Note: This workshop is quite long, but it can be split up into different sessions which can be done individually.

Workshop unfolding:

Session 1 – Classifying Mixture (100 min = 1 h 40 min)

Setup: place two different materials and an empty container on the available tables. Try to have different mixture types available (solid-liquid homogeneous, liquid-liquid heterogeneous, …).

5 min – Welcome students to class + Introduction the topic (mixtures are everywhere around us)

15 min (p. 1) – Ask students for their definition of mixtures + Come up with a sentence everyone agrees on

5 min – Group the students at the available tables with the setup materials

5 min – Explain that students will be making their own mixtures: ask them to mix the two components and write down what they observe

20 min (p. 1) – Let the students make their mixtures, and write down their observations

20 min (p. 1) – Go through the different groups and have them explain to the rest of the class what their mixture was and what they observed (the table should be big enough to write down other group's mixtures and observations)

10 min (p. 2) – Introduce the new vocabulary (homogeneous/heterogeneous)

20 min (p. 2) – Collaboratively fill out the summary table
/!\ most boxes will be mixtures students have made, but others may need some teachers help:

- Solid-solid homogeneous: stainless steel = iron (Fe) + carbon (C)
- Gas-gas heterogeneous: isn't possible because gas molecules diffuse too fast so will always become homogeneous
- Solid-gas homogeneous: isn't possible because solid molecules are always much bigger than gas molecules and can therefore never mix homogeneously
- Insist that the air around us is a mixture of gases

Session 2 – Mass and Volume (190 min = 3h 10 min)

Setup: Place a scale, a material, and a container on the available tables.

10 min (p. 3) – Link "mixtures" with "mass" and "volume": for different proportions, homogeneous OR heterogeneous mixtures can be made + Remember the mass and volume definitions and units

5 min – Explain to the students they will be linking mass and volume: ask them to weigh specific volumes of their choice of the different materials and fill out the table
/!\ Tare the scale and write down the units!

20 min (p. 3) – Let the students weigh different volumes of different materials

20 min (p. 3) – Put together the entire class's measurements + Fill out the data table if some groups have missing rows

10 min (p. 3) – Make sure that in the data table, there are two different liquids with the same volume (e.g. water 0.4 L 400 g & oil 0.4 L 368 g): if needed calculate how much a specific volume would be based on the available data (e.g. if you have a 0.2 L of water row, multiply it by 2 to match the 0.4 L of oil)

10 min (p. 4) – Fill out the first section comparing the same volume of two different liquids using the available data in the table

5 min – Explain that now the same mass of two different liquids will be compared

20 min (p. 4) – Ask the groups to measure the volume of a chosen mass of two different liquid and write down their data

10 min (p. 4) – Go over the second section comparing the same mass of two different liquids + Make sure everyone correctly filled out their paper

5 min (p. 4) – Explain that next, the class will link mass and volume of water: ask the different groups to weigh exactly 1 L of water

10 min (p. 4) – Let the students weight 1 L of water
/!\ In theory, it should weigh 1 kg, but the measuring cups might not be accurately calibrated, and this is true only for pure water

10 min (p. 4) – Discuss with the entire class what they observed and fill out the last section linking mass and volume of water

5 min (p. 5) – Explain that next the different volume units will be linked + Ask the students to find different containers and test if 1 L of water fits in it

20 min (p. 5) – Let the students have a go at trying to fit 1 L of water in different containers
/!\ This is a great opportunity to revise volume formulas (e.g. cube volume = side x side x side)
/!\ Make sure students try to fit 1 L in a 1 dm^3 container

20 min (p. 5) – Have the entire class discuss the different containers they tested and fill out the table

10 min (p. 5) – Insist on the fact that 1 L of water fits perfectly in 1 dm^3, linking different volume units

Session 3 – Scientific Protocol (90 min = 1 h 30 min)

Setup: Place a scale, a measuring cup, two different materials and an empty container on the available tables. Try to have different mixture types available (solid-liquid homogeneous, liquid-liquid heterogeneous, …).

10 min (p. 6) – Remind everyone why mass and volume are important in mixtures: different proportions of components can make homogeneous OR heterogeneous mixtures + Explain that scientific protocols can be used to tell other scientists about the correct proportions to make the same mixture

10 min (p. 6) – Explain to everyone that they will write a scientific protocol so other groups can make the same mixture as them + ask students to group around the table with the components they want to use

20 min (p. 6-7) – Let the students measure mass and volume of their different components and write the scientific protocol to make their mixture

10 min – Change the groups around: everyone should be at a new table with new components

20 min – Let the groups try to reproduce the mixture of their new table

20 min (p. 7) – Ask the students if they were able to make the expected mixture + Correct the scientific protocols as needed

Session 4 – Summary & Exercises (20 min)

Setup: Make sure the students are no longer distracted by the equipment used so far and are ready to listen.

20 min (p. 8) – Go over the different definitions of the new vocabulary learned during this workshop and the link between volume units and mass of water

Exercises (p. 9-11) are left to the teacher to organize: they can be done in class, as homework, as a test, …

Assessment:

The students have extra exercises available to practice their new skills.

Name	Science Mixtures 1 – Classifying Mixtures	Number Date

All around us, there are many **mixtures**, almost everything is a mixture! Even air for example! Let's talk more about them!

What do you think a mixture is?

Let the students build a sentence together. Here's an example:

A mixture is a combination of 2 or more components.

1. Classifying mixtures

Let's make mixtures and study them. Your teacher has gotten ready many different materials. Mix some together and fill out this table with what you observed.

Here are ideas of materials to have available: rocks, sand, salt, sugar, pepper, flour, water, oil, syrup, …
If you have a way of measuring gases (gas sensors like CO_2 detector), you could bring that as well to showcase the gaseous mixtures: students can breathe into the sensor.

What did you mix?	What did you observe?
sand + water	The sand was at the bottom, the water was at the top.
water + sugar	The sugar dissolved into the water.

Name	Science Mixtures 1 – Classifying Mixtures	Number Date

If after mixing some components together, they are no longer identifiable, they formed a ***homogeneous*** mixture.

If some components are still identifiable even after mixing them together, this is a ***heterogeneous*** mixture.

Some materials were in the ***solid*** state, and others in the ***liquid*** state. ***Gaseous*** materials can also be mixed.

A good way to classify mixtures is to use these new words. Fill out this table with examples for the different types of mixtures.

Type of mixture	Homogeneous	Heterogeneous
Solid-Solid	Steel = Iron + Carbon (can bring a pan to showcase)	Sugar + Rocks, Sand + Pepper, even sand itself!
Liquid-Liquid	Water + Syrup	Water + Oil
Gas-Gas	Air = nitrogen 78% + oxygen 21% + other gases 1% (CO2)	Doesn't exist! Gas molecules diffuse too fast and will always become homogeneous!
Solid-Liquid	Water + Sugar, Water + Salt	Water + Rocks, Water + Sand
Solid-Gas	Doesn't exist! Solid molecules are much too big compared to gas molecules.	Smoke = solid particles + air
Liquid-Gas	Air + Water vapor (isn't visible)	Fog = Air + Water Droplets (are visible)

Name	Science Mixtures 1 – Classifying Mixtures	Number Date

2. Mass, and volume

While making mixtures, you may have noticed that you could make both homogeneous and heterogeneous mixtures with the same components depending on the quantities you mixed.

Solubility is the maximum mass of a component that can dissolve in a specific volume of liquid to form a homogeneous mixture.

Mass (m) is the measure of how much matter is in an object. Its units are kilograms (kg) or grams (g). **Volume (V)** is the measure of how much three-dimensional space an object occupies. Its units are cubic decimeters (dm^3), cubic centimeters (cm^3), liters (L), or milliliters (mL).

Both mass and volume can be linked. Weigh a certain volume of different materials and write down your data. Make sure to write down the units! (Don't forget to put your scale to zero!)

What did you weight?	What volume?	What mass?
Water	10 mL 0.4 L	10 g 400 g
Oil	0.4 L	368 g
Salt	0.4 L 200 mL	512 g 256 g
Sugar	0.4 L	338 g

Name	Science Mixtures 2 – Mass and Volume	Number Date

Let's focus on liquids a bit more. Weigh the same volume of two different liquids. Do they have the same mass?

Liquid 1 = water Volume = 0.4 L Mass 1 = 400 g

Liquid 2 = oil Volume = 0.4 L Mass 2 = 368 g

Water is more heavy than oil.

Now let's do the opposite. Measure the volume of the same mass of two liquids. Do they have the same volume?

Liquid 1 = water Mass = 40 g Volume 1 = 40 mL

Liquid 2 = oil Mass = 40 g Volume 2 = 43 mL

Water takes less space than oil.

Weigh exactly 1 L of water. How much does it weigh?

1 L of water weighs 1 kg.

What did you notice? What connection did you find between mass (kg) and volume (L)?

Water has the same number of mass (**1** kg) and volume (**1** L).

Name	Science Mixtures 2 – Mass and Volume	Number Date

Can we change the volume units? Find containers with different volumes that can hold 1 L of water. Write down the volumes and containers you found.

Container	Volume	Does exactly 1 L of water fit?
Ice-cream tub	20 x 10 x 10 cm = 2000 cm^3 = 2 dm^3	Yes, there is still some space.
Drinking cup	5 x 5 x 10 cm = 250 cm^3 = 0.25 dm^3	No, the glass is too small.
Plastic cube	10 x 10 x 10 cm = 1000 cm^3 = 1 dm3	Yes, it fits perfectly.
Measuring cup	1 L	Yes, it fits perfectly.

Try fitting 1 L in a dm^3 volume. Does it work?

Yes, 1 L of water fits perfectly in 1 dm^3.

Overall, 1 L of water = 1 kg = 1 dm^3.

3. Writing a scientific protocol

Now that you understand homogeneous, heterogeneous mixtures, solid, liquid, gas materials, mass, and volume. Pick one of the mixtures (e.g. solid-liquid homogeneous) you made

and write a scientific protocol (precise instructions) so your friends can replicate your mixture.

Title: Water/salt homogeneous mixture.

The aim of this protocol is to make a liquid/solid homogeneous mixture.

Equipment:

- A scale
- A measuring cup
- Salt
- Water
- A minimum 0.2 L. container

Name	Science Mixtures 3 – Scientific Protocol	Number
		Date

Procedure:

1. Using the scale, weigh exactly 5 g of salt in the container.

2. Using the measuring cup, measure exactly 20 mL of water.

3. Poor the water in the container with the salt.

4. Stir the water and salt mixture until all the salt grains disappear.

5. …………………………………………………………………..

Notes/Comments about your protocol:

If you don’t measure the mass and volume exactly, you might make a heterogeneous mixture. It might take a lot of stirring to dissolve the salt.

Were you able to replicate your friend’s mixture?

Yes, I was able to make a liquid-liquid homogeneous mixture.
No, I was not able to make a solid-solid heterogeneous mixture.

Name	Science Mixtures 4 - Summary	Number Date

4. Summary

A **component** is a pure material that is part of a mixture. They can be **solid**, **liquid**, **gaseous**.

A **homogeneous mixture** is the same everywhere you look at it.

A **heterogeneous mixture** has visible components.

Air is a homogeneous mixture made of nitrogen, oxygen, and other gases including carbon dioxide (CO_2).

Mass is the quantity of matter, expressed in kg or g.

Volume is the space that matter occupies, expressed in dm^3, cm^3, L, or mL.

1 L of water weighs 1 kg and is also 1 dm^3.

Name	Science Mixtures 5 - Exercises	Number Date

5. Practice further!

Exercise 1. Put a cross in the correct column for each mixture.

Mixture	Homogeneous	Heterogeneous
Water + Salt	X	
Rocks + Sand		X
Flour + Eggs	X	
Ketchup + Mayonnaise	X	
Cooking smells + Air	X	
Fruit salad		X
Ice cubes + Orange juice		X

Exercise 2. Is air a homogeneous or heterogeneous mixture? Why? What is it made of?

Air is a homogeneous mixture. Its components are not distinguishable. It is made of nitrogen, oxygen and other gases including water and CO_2.

Name	Science Mixtures 5 - Exercises	Number Date

Exercise 3. Connect the elements that go together.

Mass	Mixture components are no longer visible
Component	Space matter takes up
Homogeneous	Quantity of matter
Volume	Mixture components are visible
Heterogeneous	Solid, liquid, or gaseous materials that are part of a mixture

Exercise 4. True or false? If it's false, correct it.

- Objects with the same mass can have different volumes. T

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- Objects with the same volume can have different masses. T

/

- Objects with the same volume always have the same mass. F

Objects with the same volume can have different masses.

Name	Science Mixtures 5 - Exercises	Number Date

Exercise 5. Use your mixture worksheets to define the following words:

- Component: A component is a pure material that is part of a mixture. They can be solid, liquid, gaseous.
- Volume: Volume is the space that matter occupies, expressed in dm^3, cm^3, L, or mL.
- Oxygen: Oxygen is one of the gas components of air.
- Mass: Mass is the quantity of matter, expressed in kg or g.