

Session 1**Time 1 hour****Classifying materials: SOLIDS, LIQUIDS AND GASES****AIMS:**

- **To recognize solids, liquids and gases according to their properties**
- **Introduce how particles are arranged in solids, liquids and gases**

Activity 1: What are materials like?

Material

- Solid block
- 1 beaker, 1 glass, 1 cup
- orange juice
- 3 syringes from 10 to 20 cm³ with sealed end
- Sand, water, air

Activity development.

- Students are shown different materials and orally brainstorm their properties.
- Students are shown a piece of wood and are asked:
What's this? Can it change shape?
- Students are asked to compare the block of wood to the three containers with orange juice:
Does a liquid take up the shape of its container? Find out more.
- Students are asked to push the plunger of the syringe full of sand:
Can it be squashed? Try the same test for syringes full of water and air.
- Students are asked to complete the grid 1 below:

GRID 1

PROPERTY	SOLID	LIQUID	GAS
Easy to pour			
Easy to squash			
Fixed shape			
Fixed volume			

PowerPoint: SOLIDS; LIQUIDS AND GASES

Students are shown a PowerPoint to consolidate the solids, liquids and gases properties.

Activity 2: Checking States

- Pair work
- Students are given a different handout A and B
- Students sit face to face and student A starts reading the first sentence and student B says if this property is from a solid, a liquid or gas. Student A writes the answer next to the sentence. After that student B does the same and they change roles till the end.
- When they finish they check answers.
- To finish with, students complete grid 2.

Handout: Checking States**Student A**

- They have a definite volume =
 - They have a definite shape =
 - They are easily squashed =
 - They don't flow =
 - They match the shape of the container =
 - They have a very low density =
-

Handout: Checking States**Student B**

- They flow easily =
- They have a high density =
- They always fill the container they're in =
- They become the same shape as the container =
- They are not easily squashed =
- They have medium density =

GRID 2**SOLIDS, LIQUIDS AND GASES HAVE DIFFERENT PROPERTIES**

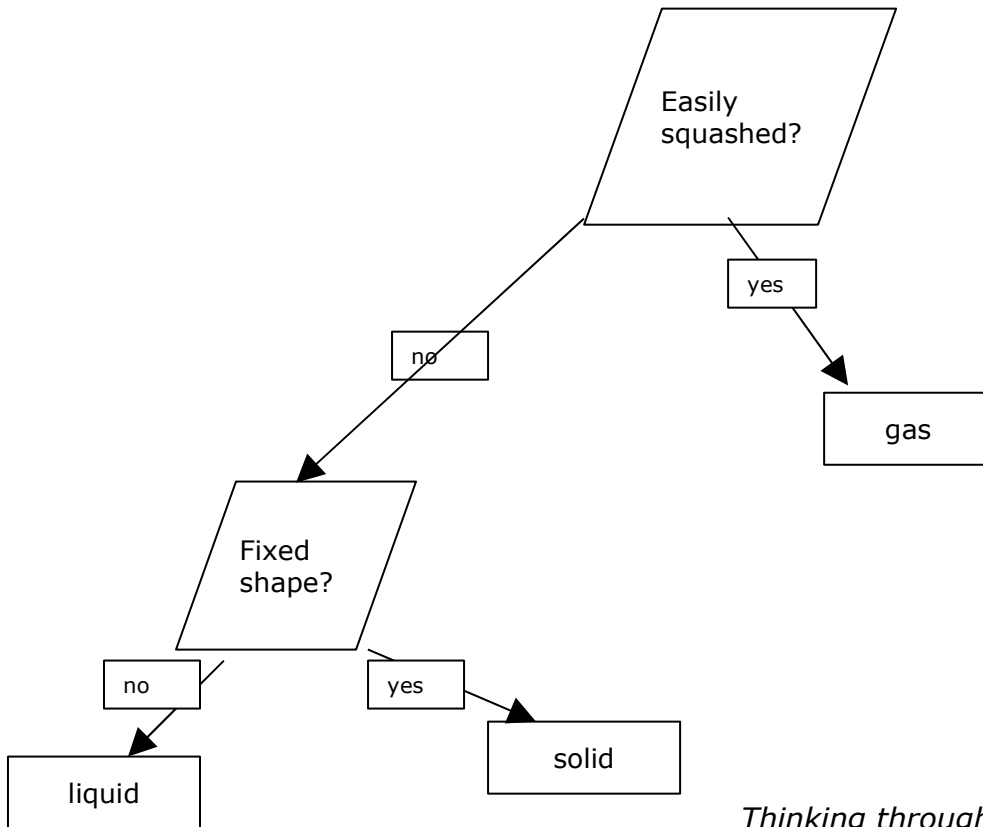
Properties	Solids	Liquids	Gases
VOLUME			
SHAPE			
DENSITY			
COMPRESSIBILITY			
EASE OF FLOW			

Activity 2: Classifying solids, liquids and gases**Aim:**

- to show students that sometimes it is not easy to classify materials and that there are common misconceptions.
- to teach student how to discuss.
- To encourage students to answer questions, write a conclusion and think about that.

Scientists use a key to classify things into different groups. A key can be created by taking some characteristics of the different classifying groups, and asking simple questions that require yes or no answers.

A simple key to classify thing into the three states of matter can be:



Thinking through SCIENCE

Material:

- Two beakers, one half-filled with sand (or an hourglass)
- An eraser
- Jelly
- toothpaste
- Rubber gloves
- A piece of sandstone

Activity development:

- Show/Give students the mentioned above materials .
- Ask students to use the key above to classify them.
- Give them the table 1 below and ask them to complete it.
- Give them the writing frame to be completed

Table 1

2) The classification of some of these materials can surprise you. Tell which classification has surprised you and why?

Questions I need to answer are...	Answers	Extra details
<ul style="list-style-type: none"> • Sand, is it a solid or a liquid? • Can it be poured? • Hasn't it a fixed shape? • Do small grains behave as a liquid? • Look at a piece of sandstone: Can it be poured? • Can an eraser be squashed? • Does the eraser change shape temporarily or permanently? • Are jelly and toothpaste easy materials to classify? • Why? • What material is a rubber glove made of? • Has rubber a fixed volume? • Again, is the glove a single substance? • Do you think that it contains air and that's why it can be easily squashed? 		

Writing Frame 1

Using your frame and the given words complete the paragraph to reach a CONCLUSION:

Density, materials, fixed, shape, classify, container, same, fixed, why, gases, poured, mixtures, small, squashed, solids, difficult, volume, temporally, single, shape.

I want to explain _____ some _____ are difficult to classify.

Sand can be _____ and does not have a _____

This is because it is formed by _____ grains.

Jelly and toothpaste are _____ ant they are

To _____ because they are _____ .

Rubber gloves and eraser can be _____ . Just

Change _____ . They are made from the _____ material and this is certainly does not have a _____ .

This is because it is not a _____ substance.

Session 2**Time: 1 hour****Classifying materials: SOLIDS, LIQUIDS AND GASES****AIM:**

- **To introduce the Particle Theory**

Role play Activity: Particles

This activity is intended to demonstrate how particles move,

Activity development

- Make students pretend they are a:
 - a. Solid particle and give them the following instructions:
 1. Get together with your classmates in rows of five.
 2. Put your left hand on the shoulder of the person to your left.
 3. Put your right hand on the shoulder of the person in front.
 4. Stand in neat rows and jiggle very slightly when you hear the music.
 - b. Liquid particle and give them the following instructions:
 1. In the same way start to move a little more.
 2. Drop your arms and move your legs and your hands when you hear the music.
 3. Stay close to the other pupil.
 - c. Gas and give them the following instructions:
 1. Spread out so that you are far apart.
 2. Move around the room indifferent directions when you hear the music and when you crash with someone separate from him or her.
- Students are asked to answer the following questions
 1. When you were a solid, how did you move? How close were you to the other particles?
 2. When you were gas, how did you move? How close were you to the other particles?
 3. What were the two main differences between being a solid and a liquid?
 4. When did you have the most energy?

Students are asked to Draw a flow diagram for the three stages. This is called **changes of state**.

1. Activity (sheet 2)

Marbles in a box

See students handout

You will need:

- Marbles and boxes (Tupperware)

Identify the diagrams with a solid, liquid or gas

Finally write a conclusion after answer some questions

2. Activity

Scrambled groups

- a) The class is divided into groups of three. Each group is given a topic.***
- b) They have to understand the text and memorize the most important things***
- c) The teacher gives each person a letter, for example if we have 27 students in the classes at the beginning we have nine groups of three. In this stage at five first groups gives letters A, B, C and the last four D,E,F. This determines which new group each student will move into.***
- d) The groups are rescrambled. All the As forma a group, all the Bs form a group, all the Cs and so on. This means that each of the new groups has one member from all original groups.***
- e) Complete the sheet with the experience and collaboration of all the group.***

SOLIDS

In a solid, the particles are held together. There are strong forces of attraction between them and have fixed positions in a very regular arrangement. The particles in a solid cannot move around, but they can only vibrate from side to side.

As the particles don't move from their position, all solids keep a definite shape and its volume stays the same, and cannot flow like liquids.

Solids cannot easily be compressed because the particles are already packed very closely together.

Solids are usually dense, as there are lots of particles in a small volume.

LIQUID

In a liquid, the particles are almost as close together as they are in a solid. There are some forces of attraction between the particles. The particles in a liquid are still held together, but not as strongly as in a solid. They are free to move past each other, but they do stick together. The particles are constantly moving in all directions.

Liquids don't keep a definite shape and they flow and fill the bottom of the container but they do keep the same volume.

Liquids won't compress easily because the particles are packed closely together.

Liquids are quite dense, as there are quite a lot of particles in a small volume.

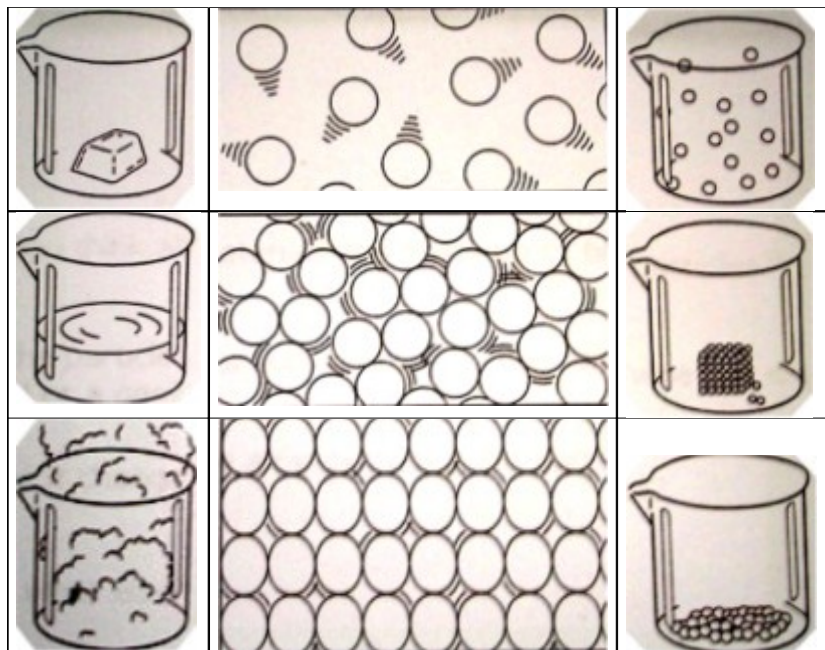
GASES

In a gas, the particles are very far apart. There are very weak forces of attraction between the particles. They are free and can move quickly in all directions.

Gases don't keep a definitive shape or volume and will always expand to fill any container. Gases can be compressed easily because there is space between the particles.

The particles of a gas are not in a regular pattern.

Gases have very low densities, because there are not many particles in a large volume.



Summary - Solids, liquid, gases

Description of the substance

Description of the particles

<p>SOLIDS</p> <div data-bbox="226 262 395 501" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • • 	<div data-bbox="719 262 888 501" style="border: 1px solid black; height: 100px; width: 100%;"></div> <div data-bbox="951 262 1361 501" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • •
<p>LIQUIDS</p> <div data-bbox="226 884 395 1124" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • • • 	<div data-bbox="758 884 919 1124" style="border: 1px solid black; height: 100px; width: 100%;"></div> <div data-bbox="951 900 1361 1124" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • •
<p>GASES</p> <div data-bbox="226 1458 395 1697" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • • • 	<div data-bbox="735 1447 903 1686" style="border: 1px solid black; height: 100px; width: 100%;"></div> <div data-bbox="951 1458 1361 1697" style="border: 1px solid black; height: 100px; width: 100%;"></div> <ul style="list-style-type: none"> • • •

ROLE PLAY : Particles

Aim: To learn about particles in a fun context through modelling

Activity Development:

Pretend you are

Solid particle

1. Get together with your classmates in rows of five.
2. Put your left hand on the shoulder of the person to your left.
3. Put your right hand on the shoulder of the person in front.
4. Stand in neat rows and jiggle very slightly when you hear the music.

Liquid particle

5. In the same way start to move a little more.
6. Drop your arms and move your legs and your hands when you hear the music.
7. Stay close to the other pupil.

Gas particle

8. Spread out so that you are far apart.
9. Move around the room indifferent directions when you listen the music and when you crash with someone separate from him or her.

Answer these questions:

- **When you were a solid, how did you move? How close were other particles?**
- **when you were gas, how did you move? How close were the other particles?**
- **What were the two main differences between being a solid and a liquid?**
- **When did you have the most energy?**
- **Draw a flow diagram for the three stages. This is called changes of state.**

Marbles in a box (sheet 2)

Movement of the particles

Frame

How to show the movement of particles by shaking some marbles in a box

You will need:

Box and marbles

- 1. First**, for a solid tilt the box slightly so that the marbles run down to one end.

Show that particles are packed closely together and take up a fixed volume and shape

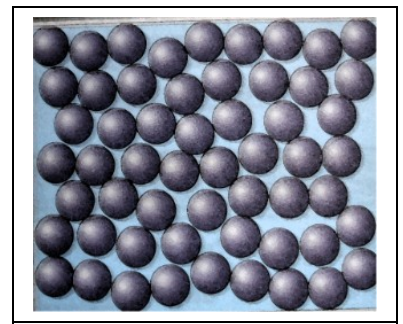
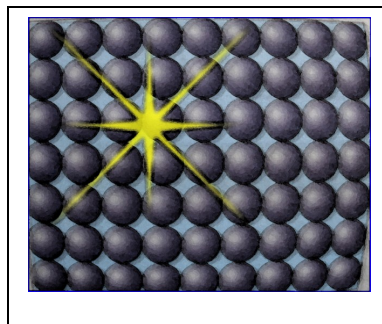
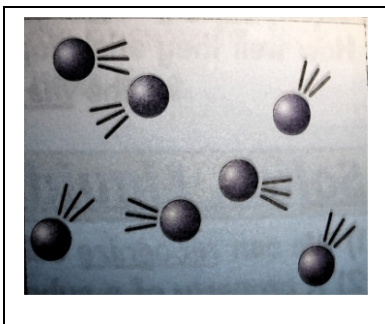
2. **Then**, for a liquid, more vigorous movement of the box cause the particles to swap positions and “flow” around the box.

They are still very close together but they don't have a fixed shape.

3. **Next**, for a gas, remove most of the marbles and vigorously shake the box.

The particles are far apart and moving very quickly

Finally, identify which of three diagrams show the particles in a box containing a solid liquid and gases.

**Session 3**

Time: 1 hour

Classifying materials: SOLIDS, LIQUIDS AND GASES**AIMS:****Changes of state****Activity 1****Power point to introduce the content****Activity 2****Experiment about changes of state**

Aim: Melt a solid by heating it and then we will let the liquid cool slowly.

What do you think will happen?

Before doing this experiment order each step and then fill your planning sheet.

Measure 100 cm³ of water in a beaker
Put the Bunsen under the beaker and switch on
Heat up the water beaker until 75°C. Switch off your Bunsen
Put a spatula of butter in a test tube
Introduce the test tube with butter in a warm water bath and start your stop clock
Leave the substance to cool
Take de temperature every minute as it cools and record it in the table
Plot a graph of your results

Investigation planning sheet

Name _____

Date _____

Class _____

What are you trying find out?

I am trying to find out ...

How are you going to find out? Write a method for your experiment here and draw a diagram.

<p><i>First of all I will ...</i></p> <p><i>Next...</i></p> <p><i>Then I will...</i></p> <p><i>I will measure...</i></p> <p><i>I will observe...</i></p> <p><i>I will need...</i></p> <p><i>Finally I ...</i></p> <p>Results (attach your tables and graphs)</p>	<p>Diagram</p>
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Analyse and conclude

I have found out ...

What I thought would happen was ...

If I compare my results with my prediction, I can see that ...

My graph shows that ...

This is because...

Evaluate

I found it easy to ...

Although, it was hard to ...

My results ...

Resources

Time: 1 hour

Unit 1. Classifying materials: SOLIDS, LIQUIDS AND GASES

AIMS:

Changes of state**Activity 1****Power point to introduce the content****Activity 2****Experiment about changing state**

Aim: Melt a solid by heating it and then we will let the liquid cool slowly.

What do you think will happen?

Before doing this experiment order each step and then fill your planning sheet.

Measure 100 cm³ of water in a beaker
Put the Bunsen under the beaker and switch on
Heat up the water beaker until 75°C. Switch off your Bunsen
Put a spatula of butter in a test tube
Introduce the test tube with butter in a warm water bath and start your stop clock
Leave the substance to cool
Take de temperature every minute as it cools and record it in the table
Plot a graph of your results

Investigation planning sheet

Name _____

Date _____

Class _____

What are you trying find out?

I am trying to find out ...

How are you going to find out? Write a method for your experiment here and draw a diagram.

First of all I will ...

Next...

When I will...

I will measure...

I will observe...

I will need...

Finally I ...

Diagram

Results (attach your tables and graphs)

Analyse and conclusion

I have found out ...

What I thought would happen was ...

If I compare my results with my prediction, I can see that ...

My graph shows that ...

This is because...

Evaluate

I found it easy to ...

Although, it was hard to ...

My results ...

Session 4**Time: 2 hours****Unit 1. Classifying materials: SOLIDS, LIQUIDS AND GASES****AIMS:****Changes of state, energy and particle movement****1. Activity****Work in groups of four****Give the text and the activities**

First, read the text and then make these activities:

1. Tell what is a change of state? (knowledge)
2. Could you make a drawing summarizing changes of state. (Comprehension)
3. Explain what happens when we heat butter (Application)
4. Explain the relation between particle movement and energy (Analyse)
5. Design an experiment to show the relationship between heat and state change. (Synthesis)
6. Compare in practice the processes that take place when you heat 100 g of ice and 100 g of butter. Give some conclusions. (Evaluation)
7. Summarize all these activities in a poster and explain your work to the rest of the group.

Changes of state

Water is a unique substance which we can find at home in **the** three states: Solid, liquid and gas.

We can take water as an example of how to study the changes of matter.

What is a change of state?

- A change of state is when a substance changes from one state of matter to another.
- In a change of state the particles don't change, just their arrangement or their energy.

In a solid the particles are joined together and very close to each other and they cannot move very far. We say that they are vibrating. When a solid is heated, its particles gain more energy, and the particles move more and the forces which hold the solid together weaken. This makes the solid expand.

At certain temperatures, the particles have enough energy to break free from their positions, the fixed particles of matter begin to move around, flowing over each other. The result is the change to a liquid state. The shape becomes indefinite. This is called **melting**, and it is what happens when a solid changes to a liquid. The opposite of this is **freezing**. The particles slow down as they get colder. They get closer together and form a solid.

In a liquid, the particles are not lined up in rows, so they take up a bit more space. They are not joined very tightly. The particles in a liquid can move about more than the particles in a solid. They can slide over each other.

When energy is applied to a liquid, the particles get even more energy. This energy makes the particles move faster which weakens and breaks the unions (bonds) holding the liquid together. The result is the change to a gas state. The shape is indefinite, and the volume became indefinite. This is called **vaporization**, and it is what happens when a liquid turns into a gas. The opposite of this is condensation. The particles slow down as they lose thermal energy. They get closer together and form a liquid.

There are some substances which can go from being a solid, directly to the gas state, which is called **sublimation**. Solid carbon dioxide, commonly known as Dry Ice, bypasses the liquid state altogether when it changes to a gas.

The last change of state is matter going from a gas, directly to the solid state, which is called **deposition**. Water vapours in the air during winter fall in the form of snow, a solid.

Session 5**Time: 1 hour****Unit 1. Classifying materials: SOLIDS, LÍQUIDS AND GASES**

AIMS: Revision of materials and their properties, particle theory and changing state.

1. Activity**Play Say and hear****Instructions to play**

Go and sit in groups of 5

We play HEAR and SAY

Each group has 5 cards and each card has two columns headed HEAR ANS SAY

One person of your group has a card with the word underlined in the say column – this is a definition of something to do with KEY IDEAS IN STATES OF MATTER. He or she starts and says the words aloud. The student who thinks he or she has the KEY IDEA defined by that statement in the HEAR column, says this aloud and then gives the definition for the next key idea (in the box directly opposite to the statement he or she has just read out.).

The game finishes when the group reaches the instruction END.

Consolidation exercise

Spelling and listening

(Cada grup de 5 te un full diferent, pero n'hi ha un que te una frase subratllada).

HEAR	SAY
Compressibility of liquids 2	There are strong forces of attraction between particles 3
Shape of liquids 10	There are very weak forces of attraction between the particles 11
Condensing 18	Gas turns into a solid 19
Density of liquids 7	Flow easily and diffuse 8

HEAR	SAY
When you increase the temperature 17	Gas turns into a liquid 18
Pressure increase	Fill the container they're in 1
Liquids particle theory 6	Have medium density 7
Density solids 12	Become the shape as the container 13

HEAR	SAY
Subliming 19	END
Volume gases 1	Not easily squashed 2
Easy of flow gases 8	Have a very low density 9
Melting 15	Liquid turns into a gas 16

HEAR	SAY
Boiling 16	The particles move faster 17
Compressibility gases 5	The particles are close together but they can move 6
Shape gases 13	It's particles gain more energy 14
Solids particle theory 3	Don't flow 4

HEAR	SAY
Ease of flow solids 4	Are easily squashed 5
When a solid is heated 14	The solid turns into a liquid 15
Gases particle theory 11	Have a high density 12
Density gases 9	Match the shape of container 10

2. Activity

STATES OF MATTER

Activities

Choose just one answer, a , b, c or d.

1. How are the particles arranged in solids?

- a) close together
- b) very far apart
- c) fairly well separated
- d) fairly close together

2. How do the particles in a liquid move?

- a) relative to each other, so liquids can flow
- b) very quickly, in all directions
- c) they vibrate about fixed positions
- d) they cannot move

3. Which state of matter has the strongest forces of attraction between particles?

- a) gas
- b) liquid
- c) solid
- d) steam

4. Which state of matter has a definite volume, but does not have a definite shape?

- a) gas
- b) solid
- c) steel
- d) liquid

5. Which state of matter is the easiest to compress?

- a) liquid
- b) water
- c) solid
- d) gas

- Complete the table below to show the state of the elements shown at room temperature (25°C)

ELEMENT	MELTING POINT (degrees °C)	BOILING POINT (degrees °C)	STATE AT ROOM TEMPERATURE
Chlorine	- 101	-35	
Bromine	- 7	59	
Rubidium	39	686	

- Complete the sentences below using these words:**

More, vibrate, particles, solids, gas, gas, volume, quickly, more/faster, expands, liquid.

In a solid the are close together. They have fixed positions, but they do When a solid is heated the particles move so they take up space.

The particles in a are quite close together, but they do move relative to each other. This means that liquid have a fixed but not a fixed shape. When a liquid is heated the particles move around more so the liquid Liquids expand more than on heating.

The particles in a are far apart and moving very
In all directions. A Will fill any container in which it is placed.

Session 6

Time: 4 hours

Unit 1. Classifying materials: SOLIDS, LÍQUIDS AND GASES

Aim: Relationship between changes of state and global warming

Activity

WEBQUEST about Global Warming:

- **Climate change?**
- **Causes and effects**
- **Let's do something to save the Earth!**