

Natural Science

Term 2

The properties of
materials

Grade 7

Term Planner

Week	Topic
1	Properties of materials
2-4	Separating mixtures
5-7	Acids, bases and neutrals
8	Introduction to the Periodic Table of Elements

(CAPS document: Natural Science Grade 7 – 9)

Date: _____ (COPY THIS INTO WORKBOOK)

Investigation of the physical properties of matter and material.

Fact file:

1. Properties of materials will describe their characteristics.
2. We need to know the properties of a material so that we can determine its suitability for a particular task.
3. The most important properties of material are: strength, boiling point, melting point, flexibility, electrical conductivity, heat conductivity.
4. In technology we also have to consider issues like cost, texture and mass when looking at different materials.
5. In science we place a lot of emphasis on environmental issues when choosing materials.
6. Matter: everything around us that has mass and that takes up space.
7. Materials: the substances out of which a thing is made.
8. Flexible: something that bends easily.
9. Conductor: a material through which heat or electrical current moves easily.
10. Magnet: a property of a material that makes it attracted to a magnet.

Date: _____

The different physical properties of materials

Physical properties are characteristics of certain materials. Here are some properties we consider when manufacturing materials:

- Matter – It makes up everything that takes up space and has mass
- Strength
- Boiling point
- Melting point
- Electrical conductivity
- Flexibility
- Heat conductivity

The PHYSICAL PROPERTIES of a material are those properties that can be measured or observed.

The Selection of materials becomes very important when designing and making products. If I build a floor from wood the reasons I should choose wood as my base material is because:

1. Wood is a bad transmitter of heat which makes it a good insulator and this will keep my house warm and not chill my bare feet.
2. Wood is light and easy to work with when cutting and transporting the materials.
3. Wood is fairly strong and can withstand moderate bangs.

Activity one:

Material chosen for a product must suit its purpose and what it is. Think of a window:

What is the purpose of a window?

Based on its purpose, what should a window be made of?



What gives materials their properties?

All materials are made of matter. Matter is the substance that makes up all the objects around us. Matter takes up space and has mass.

Investigating the strength of materials:

Materials that are strong will show the following characteristics:

- They do not bend easily.
- They do not break easily.
- They do not shatter.
- They do not deform or lose their shape.

Activity 2:

Can you think of some **strong** materials?

(WRITE OUT IN WORKBOOK)

Date: _____

Melting and boiling point of materials

Fact file

1. Melting occurs when a solid change into a liquid. The melting point of a solid is therefore the temperature at which it starts melting.
2. Boiling occurs when a liquid changes into a gas. The boiling point of a substance is therefore the temperature at which it begins boiling.
3. To change a substance from solid into a liquid I need to heat it. To change a liquid to a solid I need to cool it down by removing energy.
4. To change a substance from a liquid to a gas I need to add heat. To change a gas to a liquid I need to remove the heat energy.
5. Where a gas changes directly to a solid we call this sublimation. This is how frost forms on very cold nights.
6. When a liquid boils the temperature is said to remain constant. This means that the temperature does not increase as all the energy is being used to turn water to steam.

Date: _____

Properties of matter:

1. Melting and boiling point

Activity 3:

1. What do you think a “melting point” and a “boiling point” is?
2. What is the melting point and boiling point of water?

Boiling point

The boiling point of a material is the temperature at which the material changes phase from a liquid to gas. For example, the boiling point of pure water at sea level is 100°C.

Melting point

The melting point of a material is the temperature at which it changes from a solid to a liquid. For example, water changes from ice to water at a temperature of 0°C.

The melting point of water is 0°C.



DID YOU KNOW

Steam is actually invisible. As water boils, bubbles form and rise to the surface to release invisible steam. As the steam cools it becomes visible as water vapour.

HERE ARE SOME EXAMPLES OF MELTING AND BOILING POINT:

Example	Melting point	Boiling point
Water	0°C	100°C at sea level.
Gold	1064°C	2856°C
Mercury	-38,83°C	356,7°C
Iron	1538°C	2862°C
Lead	327,5°C	1750°C

2. Flexibility

- Flexible materials can bend easily without damaging or breaking.
- In Technology we refer to the ability of a material to bend as having a little ‘give’.
- Plastic is a flexible material because it can stretch or ‘give’ without breaking.
- Plastic and cardboard are flexible, metal and wood are slightly flexible.

3. Electrical conductivity

- Electricity travels through some materials as an electric current.
- Substances that can carry electric current are called electrical conductors.
- Substances that cannot carry electrical current are called insulators or poor conductors.
- Copper, steel and gold are good conductors.
- Wood, plastic and rubber are insulators.

4. Heat conductivity

- A good conductor of heat allows heat to travel easily through it. (Iron, steel and brass).
- Heat travels very badly and sometimes not at all through poor heat conductors like wood, plastic and cotton. This is why we make clothes with cotton. These conductors are called thermal insulators.
- One of the best known good conductors of heat is aluminium.
- Heat travels through matter in the following ways:
 - Conduction: explains how heat is passed along in a solid.
 - Convection: explains how heat is carried by a liquid and gas.
 - Radiation: explains how heat travels through space. (e.g. From the sun to earth).

5. Other properties of matter

- Cost:
Here one needs to consider the cost of materials. Will it be cheaper to use plastic or glass to make a cold drink bottle? BUT! Remember! I can recycle glass or reuse a glass bottle?? This in technology is referred to as “life cycle costs”.
- Colour:
We chose colour for **aesthetics** (how nice it looks), and also dark colours absorb heat energy so tend to ‘warm’ while light colours reflect heat away and tend to ‘cool’.
- Texture:
This describes how the material feels to the touch. Cotton feels soft and makes nice vests and t-shirts while tiles are rough so that we don’t slip on the floor while plastic is smooth and makes nice eating utensils.

Activity 4:

1. If you were to design a sandwich toaster you would have to plan very carefully what materials to use for each component. Draw the table below in your book, list the items in each category that you would have to consider in your design regarding their special properties.

Flexibility	Strength	Electrical conductivity	Heat conductivity	Cost	Colour	Texture
Hinges	Spring	Plug	Griller	Good warranty		Smooth

2. Now choose one item from each group and explain the property. E.g. I will use plastic for the legs so that they don’t burn the counter top. Plastic is a thermal insulator.

Date: _____

Impact of matter and materials on the environment.

Fact file:

1. Environment: all the living and non-living things found in an area.
2. Disposal: getting rid of.
3. Pollution: when the environment becomes spoilt by things that should not normally be there.
4. Synthetic materials: are materials made by man and are non-natural. (Plastic)
5. Processed natural materials: are natural materials that are used in their natural state like gold or wood.
6. Natural resources: are resources made by nature that are used to produce other materials like iron is used to make steel, wood to make paper and crude oil to make plastic.
7. Rehabilitate: to repair damage done to nature by mining and construction. Here we attempt to restore the environment to the condition it was in before mining for example. The sand in mine dumps is used in building.

Environmental impact of mining.

Mining leads to huge environmental problems because;

- It involves the digging up of rock and the dumping the rock and sand at another site. These dumps are exposed to wind which causes dust pollution of the air.
- It means purifying the ore and cleaning what has been mined like coal, both causing chemical pollution as well as dirtying water.
- The processing of gold ore to make pure gold involves the use of harmful chemicals like sulphur that causes water pollution and destroys plant life.
- Chemicals and pollutants mix with groundwater like sulphuric acid and this becomes a major problem for farms and agriculture that uses groundwater for irrigation.
- Mining companies are now compelled to implement plans to rehabilitate areas that have been affected by mining operations or, to rehabilitate areas where mines have closed down.

Environmental impact on plastics

Plastic is very useful due to its properties like strength, flexibility, light mass and cost. Plastic synthetic and is made with polyethylene which comes from crude oil, making it very difficult to bio-degrade. It is for this reason that it has become a huge problem as pollution. Plastic causes the following environmental problems:

- Litter that does not bio-degrade easily.
- Plastic products wash into the sea and rivers where it sticks to and entraps water animals.
- Animals eat the plastic and choke on it or suffer from abdominal blockages.

- Plastic becomes tied around animal's legs causing them to starve as they cannot move about freely.
- It is very hard to dispose of plastic. Burning it does not help as plastic burns at a low temperature causing thick poisonous smoke.

Activity 5:

1. Plastic can be recycled and used again however the recycled product is of inferior quality. Give another two examples of how we can make plastic less wasteful.

Environmental impact of fuels

Fossil fuels are very cheap and easy sources of energy for us e.g. Coal, oil and gas.

1. Coal is used to fire furnaces in power stations but by burning coal we produce large quantities of CO₂, Carbon monoxide and Sulphur dioxide. Power stations also have to get rid of large quantities of ash which leads to ash dumps thus causing the same problems with mine dumps in gold mining.
2. We use crude oil to make petrol and diesel fuel. Mining crude oil also has its problems!
 - Crude oil is pumped up from layers in rock thus leaving huge holes or crevasses (a deep open crack).
 - Oil is pumped in pipes that can be dangerous when they leak and, also look unsightly.
 - Crude oil is refined in huge refineries that pollute the air.
 - Oil tankers can have accidents but they also have to be washed out between journeys.

Activity 6: Matter and Materials

Answer the following questions in your workbook:

1. What is a synthetic material and how does it differ from a processed natural material? Give one example of each.
2. Give two environmental problems caused by:
 - a. Plastic, mining and fuels
3. How does processing of crude oil affect the environment? Give 4 facts.
4. Give a scientific definition for a strong material.
5. Explain the difference between a strong material and a flexible material.
6. When can I say that a substance is a good conductor of electricity?
7. When would I call a substance an insulator?
8. When can I call a substance a good heat conductor?
9. When do we call a substance a thermal insulator?
10. What is the difference between melting and boiling points in science?
11. Do all substances have the same melting point? Why do you say this and give some examples?