# National Curriculum objective:

## Properties and changes of materials

Pupils should be taught to:

compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets

know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution

use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating

give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic

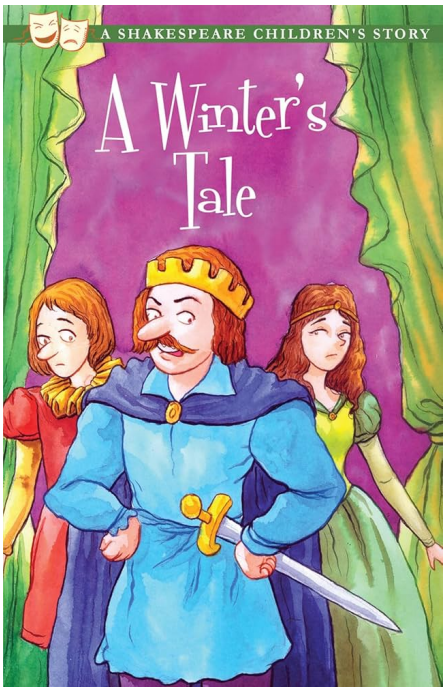
demonstrate that dissolving, mixing and changes of state are reversible changes

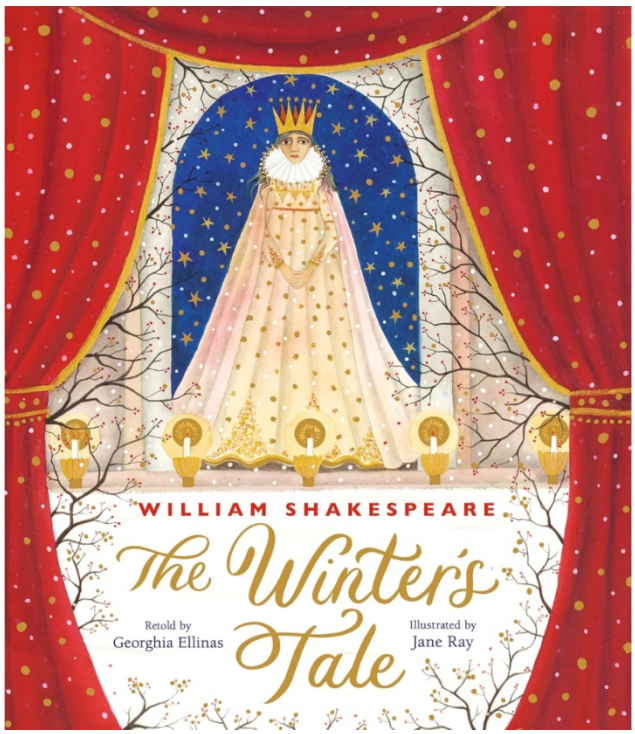
explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda

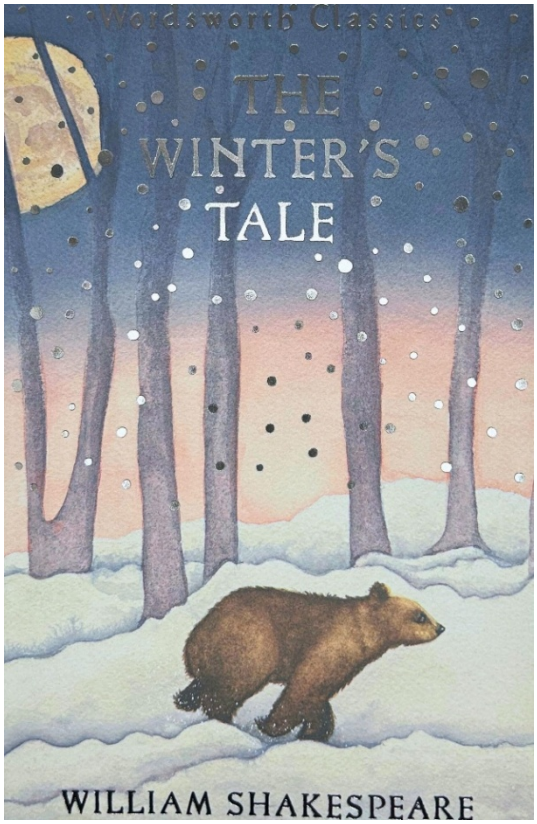
## Working scientifically

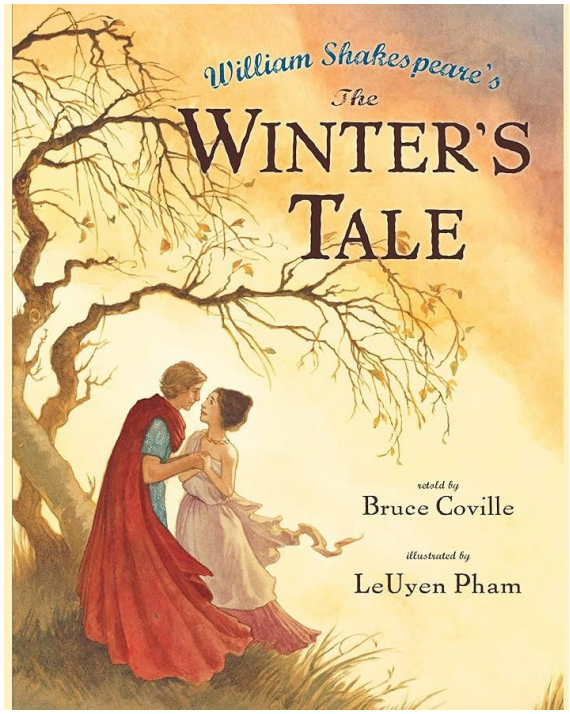
Statutory requirements. During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:

- planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- using test results to make predictions to set up further comparative and fair tests
- reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
- identifying scientific evidence that has been used to support or refute ideas or arguments.


A SHAKESPEARE CHILDREN'S STORY
A Winter's Tale


WILLIAM SHAKESPEARE
The Winter's Tale
Retold by
Georghia Ellinas
Illustrated by
Jane Ray


Wordsworth Classics
THE WINTER'S TALE
WILLIAM SHAKESPEARE


William Shakespeare's
The
WINTER'S TALE
retold by
Bruce Coville
illustrated by
LeUyen Pham

## Context

In science, we learn about **materials** by exploring what things are made from and **why certain materials are chosen for specific uses**. This links directly to our science objective to **compare and group materials based on their properties** and to **give reasons for the uses of everyday materials**.

To help us understand this better, we are linking our science learning to *The Winter's Tale* by **William Shakespeare**. *The Winter's Tale* is a play set long ago, in a time before plastic, electricity, or modern materials. This supports our learning about **how materials were used in the past** and allows us to **compare materials used then and now**.

The characters in the play include **kings, queens, shepherds, and princes**, who use objects made from **natural materials** such as **wood, metal, stone, leather, wool, and glass**. By studying the objects, costumes, buildings, and tools used in the play, we can explore:

- the **properties of materials** (such as strength, flexibility, and hardness)
- **why these materials were suitable for their purpose**
- how people in the past **selected materials based on their properties**

For example:

- A king's crown needs to be **strong and shiny**, so **metal** is a suitable material.
- Shepherds wear clothes made from **wool**, which is **warm and flexible**, making it useful for outdoor work.
- Cups, tools, and buildings were made from materials that were **available at the time** and suitable for their job.

# Year 5 Science: Properties and Changes of Materials

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## Lesson 1: What Are Materials?

**NC Links:** Compare and group materials based on observable properties.

### Starter

Show pupils everyday objects (cloak, crown, cup, stone). Ask: *What are these made from?* Link to *The Winter's Tale*: *What materials might be used for royal objects in a king's court?*

### Working Scientifically

- Asking questions and grouping materials.

### Lesson Outline

1. Introduce the term *material* and common types (metal, wood, plastic, glass, fabric). Go through slides on the link below. Explain what observable properties are. Handout 1

- https://www.thenational.academy/teachers/programmes/science-primary-ks2/units/properties-changes-and-separating-materials/lessons/properties-of-materials#slide-deck

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Handout 1

## The physical properties of materials

Explanation

Our world is full of different **materials**.

Explain to a partner what we mean by materials.

A material is the substance from which something is made.

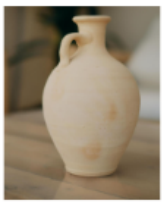
Different objects are made from different materials.

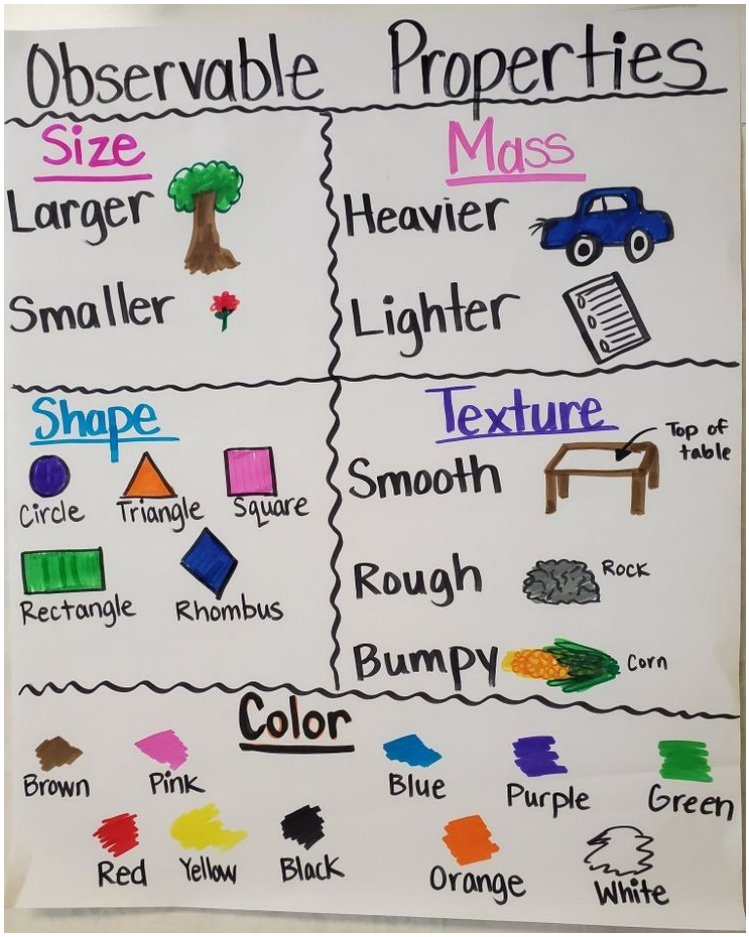

plastic bin


wooden chair


metal chair


stone statue


clay vase




Small-group activity: sort objects by material. Chn to explain how they know it is that particular material. Chn to then discuss the materials using the vocabulary below. Handout 2

Handout 2


Discuss why certain materials were common in Shakespeare's time- see handout 3 for more information.

## Handout 3

### 1. Fabrics and Social Status

Materials were a primary marker of class.

- **Wool and Linen:** *The backbone of English fashion. Wool was England's primary export,* while linen was favored for undergarments to absorb sweat and oil, as it was easier to wash than outer layers.
- **Silk and Velvet:** *Reserved for the elite. Using these imported materials without the legal right could result in fines or imprisonment.*

### 2. Building and Structural Materials

*The construction of iconic playhouses like the* **Globe** *relied on traditional, readily available materials.*

- **Timber and Wattle-and-Daub:** *Most structures used timber-framed walls filled with a* mixture of sticks, hair, and plaster (wattle-and-daub).
- **Thatch and Tile:** *Roofs were typically thatched with straw or reed, though tile was also used for its durability and fire resistance.*

### 3. Metallurgy and Innovation

Advances in metalworking influenced both daily life and the theatre.

- **Iron:** Used for "hard" items like tools and weapons. Hammered iron was common for armour, while the newly introduced cast iron was used for cannons and shot.
- **Steel:** Rare and expensive, steel was often used only for the edges of blades to keep costs down.

## 4. Daily Life and Hygiene

- **Iron Gall Ink:** Made from oak galls and iron sulphate, this was the standard permanent ink for writers like Shakespeare.
- **Leather:** Essential for everyday items such as gloves, belts, and purses. Notably, Shakespeare's father was a glover and leather-worker.
- **Cosmetics:** To achieve the pale look popularized by Queen Elizabeth I, women used a hazardous mixture of white lead and vinegar known as ceruse.

## 5. The Sensorial Theatre

Stage effects used organic materials to create a "smorgasbord for the senses".

- **Animal Blood:** Used for realistic "gore" during fight scenes.
- **Gunpowder:** Combined with thick paper to create firecrackers for magical appearances or "fire-breathing" devils.

## Plenary / Assessment

- **Key Questions:** What is a material? Can one object be made from more than one material?
- **Exit Ticket:** Name one object from *The Winter's Tale* and the material it could be made from.

# Lesson 2: Properties of Materials

**NC Links:** Describe properties such as hardness, transparency, conductivity, flexibility.

## Starter

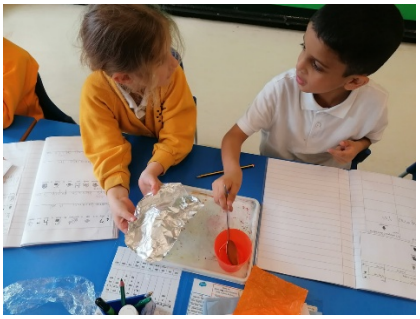
- Mystery bag: pupils feel an object without looking and describe its properties. Handout 1
- Link: *What properties would a king need in a strong crown?*

## Working Scientifically

- Making careful observations and using scientific vocabulary.

## Lesson Outline

1. Define key properties with examples. Activity 1
2. Test materials (bend, scratch lightly, shine torch for transparency).
3. Record results in a simple table. Activity 2
4. Link to costumes and props in *The Winter's Tale*.



# Handout 1- starter

## Key Vocabulary to Use

- **Hard / Soft**
- **Rough / Smooth**
- **Flexible / Rigid**
- **Strong**
- **Light / Heavy**
- **Waterproof / Absorbent**
- **Transparent / Opaque** (if appropriate)
- **Material**
- **Property**
- **Suitable**

## Sentence Stems (Support for Chn)

Pupils can choose one or more:

- *The material feels...*
- *One property of this material is...*
- *The material is **flexible/rigid** because...*
- *I think the object is made from... because...*
- *This material would be suitable for... because...*

**Challenge Sentence Stems (Greater Depth)**

- The properties of this material suggest that...
- This material would not be suitable for... because...
- Compared to ___, this material is...

Activity 1

| | |
|---|---|
| Magnetic | |
| Reflective | |
| Absorbent | |
| Permeable | |
| Translucent | |
| Flexible | |
| Hard | |
| Flammable | |
| Insulating | |
| Transparent | |

## Activity 2

**Record your results below.**

| Material | Properties | | | | |
|---|---|---|---|---|---|
| | Magnetic Y or N | Hardness 1 - 5 | Transparent Y or N | Flexibility 1 - 5 | Permeable Y or N |
| | | | | | |
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### Plenary / Assessment

- **Key Questions:** Why is metal good for armour? Why not use glass?
- **Exit Ticket:** Write one property and a material that has it.

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## Lesson 3: Uses of Materials

**NC Links:** Give reasons, based on properties, for the uses of everyday materials.

### Starter

- Show an image/description of a shepherd's crook and royal robes. Handout 1
- Ask: *Why are these made from different materials?*
- Show the images (or describe them) and ask pupils:
- *What do you notice about the materials used?*
- *Why might a shepherd's crook be made from wood?*

- *Why are royal robes often made from rich fabrics like velvet or silk?*
- **Key vocabulary to encourage:**

  *material, property, strong, flexible, soft, warm, suitable*

## Working Scientifically

- Using evidence to explain choices.

*Handout 1*

## Lesson Outline

1. Recap properties.

   https://www.bbc.co.uk/bitesize/topics/zq4skhv/articles/zk2d96f#z3w44xs
2. Matching activity: objects ↔ suitable materials. Use real materials. Materials suggested below. Use your imagination for some. Find resources which will match the material.

## Instructions for Pupils

Match each object to the **most suitable material** .

Be ready to **explain your choice using the properties of the material** .

**Objects**

1. Shepherd's crook
2. King's crown
3. Royal cloak
4. Drinking cup
5. Window
6. Cooking pot
7. Tool handle

**Materials**

- Wood
- Metal
- Wool
- Glass
- Leather
- Stone

**Example Matches (Teacher Guide)**

- Shepherd's crook → **Wood**
- King's crown → **Metal**
- Royal cloak → **Wool**
- Drinking cup → **Glass**
- Cooking pot → **Metal**
- Tool handle → **Wood / Leather**
- Window → **Glass**

3. Design challenge: choose materials for a stage prop from *The Winter's Tale*. Handout 2

Handout 2

**Challenge Brief (For Pupils)**

You are a stage designer for a play of *The Winter's Tale*. Your job is to **choose suitable materials** to make a **stage prop** that will be used during the performance.

You must think carefully about the **properties of materials** and explain **why your choices are suitable** .

**Choose ONE Stage Prop**

- A king's crown
- A shepherd's crook
- A royal cloak
- A drinking cup for a feast
- A palace window or door

**Materials You May Choose From**

- Wood
- Metal
- Fabric (wool / felt)
- Leather
- Glass (or clear plastic as a modern alternative)
- Cardboard (for stage use)

**Sentence Stems (Support)**

- *I have chosen ___ to make the ___.*
- *This material is suitable because it is...*
- *One important property of this material is...*
- *This material would not be suitable because...*

**Plenary / Assessment**

- **Key Questions:** What would happen if the wrong material was used?
- **Exit Ticket:** Explain one material choice using a property.

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## Lesson 4: Changes to Materials

**NC Links:** Observe changes such as dissolving, mixing, heating, cooling.

**Starter**

- Ice cube on tray: *What will happen? Is it a new material?*
- Link: *How might food be prepared at a royal feast in the play?*

**Working Scientifically**

- Observing changes over time and recording results.

**Lesson Outline**

1. Explain reversible and irreversible changes. Watch video and take notes in books or on whiteboards. https://www.youtube.com/watch?v=I1XovwvQmUM

2. Simple investigations: melting chocolate, dissolving salt. Activity 1 or Activity 2

   Discuss which changes can be undone.

## Activity 1

# Changing State
# Chocolate Experiment

**The Experiment**

1. Place a piece of chocolate in your hand.
2. Count to 100 (keep your hand closed) or you can say the alphabet 5 times (keep your hand closed).
3. When you have finish counting to 100 or saying the alphabet times open your hand.

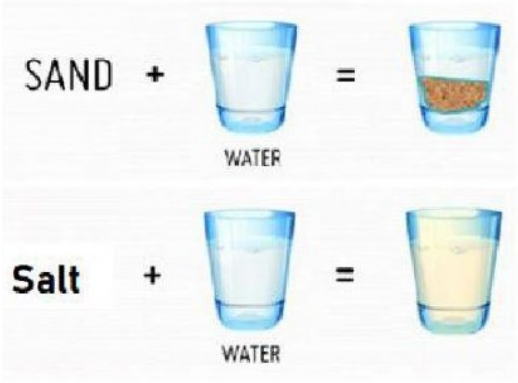
What has happened to the chocolate?

3. _____

Why do you think this happened?

Activity 2

* Match :




- Dissolve

- Does not dissolve

• Look, read and complete :

Word bank **Solubility - Material**

1- A ..... is the type of matter that makes up solids.

2- ..... if a material will dissolve or not .

## Plenary / Assessment

- **Key Questions:** Is melting reversible? Why?
- **Exit Ticket:** Name one reversible and one irreversible change.

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Lesson 5: Materials Through Time Then and Now

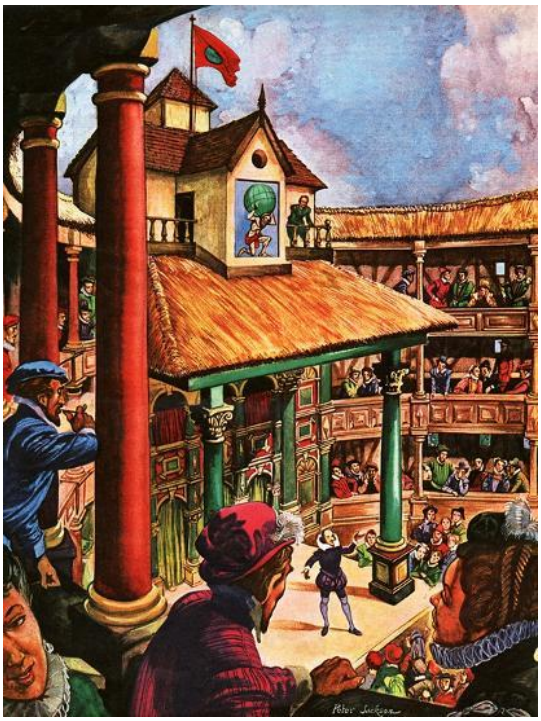
**NC Links:** Compare uses of materials today and in the past.

## Working Scientifically

- Researching and communicating findings.

## Starter

- Timeline images: Shakespearean theatre vs modern theatre. Handout 1
- Ask: *What materials have changed?*



Handout 1

## 🎭 Shakespearean Theatre (Around 1590 –1613)

**Suggested timeline image ideas:**

- The **Globe Theatre** (open-air, wooden building)
- **Daylight performances** (no electric lighting)
- **All-male actors** (boys played female roles)
- **Simple costumes** but rich fabrics
- **Very few props or sets**
- Audiences **stood in the yard** or sat in galleries
- Plays performed **without microphones or speakers**

**Caption idea:**

*"Plays were performed in daylight with simple sets and all-male actors."*

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## 🎬 Modern Theatre (1900s –Today)

**Suggested timeline image ideas:**

- A **modern theatre stage** with curtains
- **Electric stage lighting** and spotlights
- **Male and female actors**
- **Detailed scenery and digital backdrops**
- **Sound effects and microphones**
- Comfortable **audience seating**

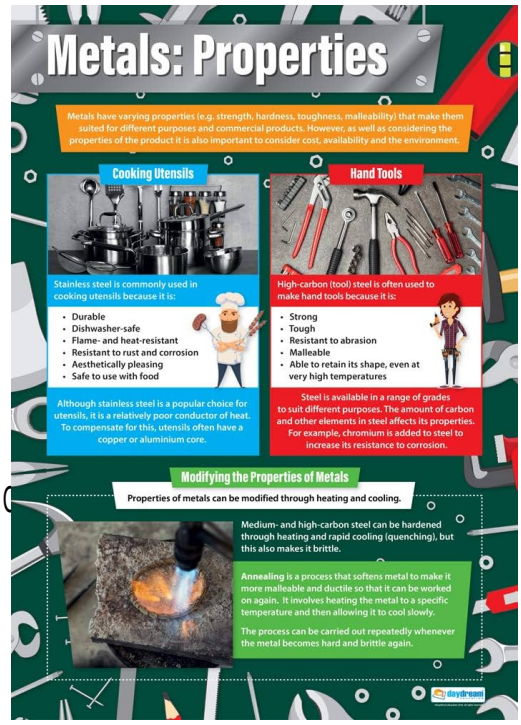
- **Special effects** (fog, projections, moving sets)

## Caption idea:

*"Modern theatre uses technology, lighting, sound, and detailed scenery."*

## Lesson Outline

1. Compare materials used in Shakespeare's time with today. Handout 2. Chn to create a mind map with material they use today.
2. Then add materials
3. Group discussion: advantages of modern materials.




C about uses of materials today and in the past. Use handout 2 for support.

## Plenary / Assessment

- **Key Questions:** How has science changed the materials we use?
- **Exit Ticket:** One material used today that Shakespeare didn't have, and why it's useful.

Handout 2

## Clothing Materials

### Shakespeare 's Time

- **Wool** ~ warm everyday clothing
- **Linen** ~ shirts and undergarments
- **Silk** ~ worn by rich people
- **Leather** ~ shoes, belts, gloves
- **Natural dyes** ~ from plants and insects

**Properties:** Heavy, natural, handmade, breathable

### Today

- **Cotton** ~ T-shirts and casual clothes
- **Polyester & nylon** ~ sportswear
- **Denim** ~ jeans
- **Synthetic fabrics** ~ stretchy and lightweight
- **Machine-made dyes** ~ bright and long-lasting

**Properties:** Lightweight, stretchy, easy to wash, mass-produced

## 🛠 Tools & Household Items

### Shakespeare 's Time

- **Wooden tools** ~ handles, farming tools
- **Iron tools** ~ knives, hammers
- **Clay & pottery** ~ bowls, plates
- **Stone** ~ grinding tools
- **Candles** ~ made from wax or tallow

**Properties:** Heavy, handmade, breakable, slow to produce

### Today

- **Plastic tools** ~ lightweight
- **Steel & aluminium** ~ strong and rust-resistant
- **Electric tools** ~ drills, mixers
- **Glass & ceramic** ~ cups and plates
- **LED lights** ~ bright and energy efficient

**Properties:** Durable, lighter, faster to use, mass-produced

## 🍽 Kitchen & Food Tools

### Shakespeare 's Time

- **Wooden spoons and bowls**
- **Iron pots and pans**
- **Clay ovens**
- **Glass bottles (rare and expensive)**

**Today**

- **Stainless steel cookware**
- **Non-stick pans**
- **Plastic containers**
- **Electric ovens and microwaves**

## Home & Living Materials

**Shakespeare 's Time**

- **Wood and stone** for furniture
- **Straw mattresses**
- **Wool blankets**
- **Paper made from rags**

**Today**

- **Foam mattresses**
- **Flat-pack furniture (wood composites)**
- **Synthetic carpets**
- **Recycled paper**

The Primary Shakespeare Company