

Prior Knowledge

What you should know.

Materials exist as solids, liquids or gases.

Solids keep their shape and they can be cut or shaped.

Liquids take the shape of their container. Liquids can flow or be poured easily. Their volume always remains the same.

Gases are often invisible. They have no fixed shape. They fill all the available space so their volume can change. They can be compressed.

Vocabulary Dozen

absorbent	Able to soak up liquid easily.
conductor	A material that allows heat, electricity, or sound to pass through it easily.
ductile	A metal able to be drawn out into a thin wire.
durable	Hard-wearing. Able to withstand wear, pressure or damage.
flexible	Capable of bending easily without breaking.
insulator	A material that hinders the passage of heat, electricity, or sound.
malleable	A material able to be hammered or pressed permanently out of shape without breaking or cracking.
magnetic	A material that is attracted to a magnet.
permeable	A material that allows liquids or gases to pass through it.
properties	An attribute, quality or characteristic of something.
synthetic	A material made by a chemical process.
rigid	A material that cannot be bent or be forced out of shape; not flexible.

OAK CLASS

Material Properties

Science

Materials

When we use the word material, we often think of fabric or textiles.

In science, the word material means any substance.

Some materials are **natural**. They come from plants, animals or rocks. For example: wool, cotton, wood, coal, sand, gold, diamonds.

Some materials are **converted raw materials**.

For example: pottery, steel, paper and some medicines or drugs.

Some materials are **synthetic**: polyester, nylon, acrylic, polythene and some medicines or drugs.

All materials are made of **atoms**.

Some materials have useful properties.

Key People and Discoveries

Antoine-Laurent Lavoisier

In the late 1700s, Antoine-Laurent Lavoisier, working with other chemists, developed a method for naming new compounds. This enabled him to create a list of thirty-three elements that were distinguished between metals and non-metals. Lavoisier is known as **the father of modern chemistry**.

Dmitri Mendeleev

In 1869, Dimitri Mendeleev rearranged the elements into vertical columns according to similar characteristics. He developed the **periodic table** of elements.

Andre Geim & Kostya Novoselov

Working at the University of Manchester, these two professors isolated **graphene** and created the first ever 2D material. In 2010, they were awarded the Nobel Prize for Physics for their work.

Magnets

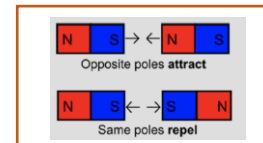
Some materials are magnetic.

A magnet is an object that is made of materials that create a **magnetic field**. Magnets have at least one **north pole** and one **south pole**. A magnetic field is the region in space where a magnetic force can be detected.

Not all metals are magnetic.

Iron, steel and nickel are magnetic.

Aluminium, copper, gold and silver are not magnetic.



Insulators and Conductors

Materials that conduct heat or electricity are known as **conductors**. Materials that do not conduct heat or electricity are known as **insulators**. Insulators and conductors have many useful functions.

Thermal

Materials that allow heat to pass through them easily are called **thermal conductors**. Metals, such as aluminum, copper, steel, and iron, are all good thermal conductors. Thermal conductors can be useful when it is necessary to cool things down, or heat them up, quickly. A metal saucepan allows heat to transfer quickly to the food inside it.

Materials that prevent heat from passing through them are called **thermal insulators**. A good thermal insulator will keep cold objects cold for a long time, and hot objects hot. Wood, plastic, and many fabrics, such as wool and cotton, are good thermal insulators.

Electrical

Materials that allow electricity to pass through them easily are called **electrical conductors**. Examples of these materials include many metals, such as iron, steel, copper, and aluminum. Electrical objects use metal parts to conduct electricity, such as the copper wires inside electrical leads, the metal pins in plugs, and the metal wire filaments in lightbulbs. Carbon is an electrical conductor, even though it is not a metal. Water also conducts electricity, which is why electrical objects should not be used near water.

Materials that do not allow electricity to pass through them are called **electrical insulators**. Examples of these materials include plastic, rubber, wood, and glass. Air is also an insulator. Most electrical objects are made using insulators to keep them safe: plugs have plastic cases, and electrical wires are wrapped in plastic, which is also flexible.

Nano Technology

Atoms are extremely small. Many advances in the science of materials are at the atomic level. New materials such as graphene allow new technologies and products to be developed. Graphene is a sheet of carbon atoms in a honeycomb structure that is one atom thick. It is the first two dimensional material. Graphene has numerous potential uses from medicine to computing to rocket science.