Solid materials

EPS Gr4 Exam Revision:

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M.S.T.:

Properties of Raw & Manufactured Materials

Solid materials all around us

Almost everything around us is made of materials. The shoes you wear, the pen you write with, the glass you drink out of, cellphones, a soccer ball, all your toys, the chair you sit on are all made of materials.

- **We use materials to make useful objects.**
- **We choose materials for a specific purpose when we make the object.**

Raw and manufactured materials

Every day we use different products made from different materials. The chair you are sitting on is made of a material called wood or plastic. Wood is from a tree. Wood comes from a natural resource. It can be used as a raw material by humans to make furniture.

What does raw and manufactured mean?

Where have you heard the word "raw" before? Perhaps it was when someone was talking about your food and they said the meat or vegetables were still raw as they had not been cooked yet. When we talk about raw food, it means the food has not been processed by cooking.

When we process something we do something to it to turn it into something else with different properties. We can also talk about raw materials. This is when the material is in its natural state. It has not been processed yet. We find raw materials in the environment around us, such as the trees in a forest, or coal and oil underground. But, when this raw material has been processed, meaning humans have changed it, then we call it a manufactured material. Examples of a raw materials are wood and plant fibre. Once wood and fibre have been processed, humans make it into paper. Paper is a manufactured material.

Raw materials in our environment are used to make other materials which are very useful. Let's look at some.

Examples of raw materials used to make other materials

- Animal skin is a raw material and is processed into leather to make shoes, handbags and belts.
- Animal wool is used to make clothes, such as jerseys and scarves
- Sand is a natural, raw material. Sand is heated to extremely high temperatures and melted to make glass.
- Clay is moulded and burned to make ceramics, such as teacups, teapots and vases.

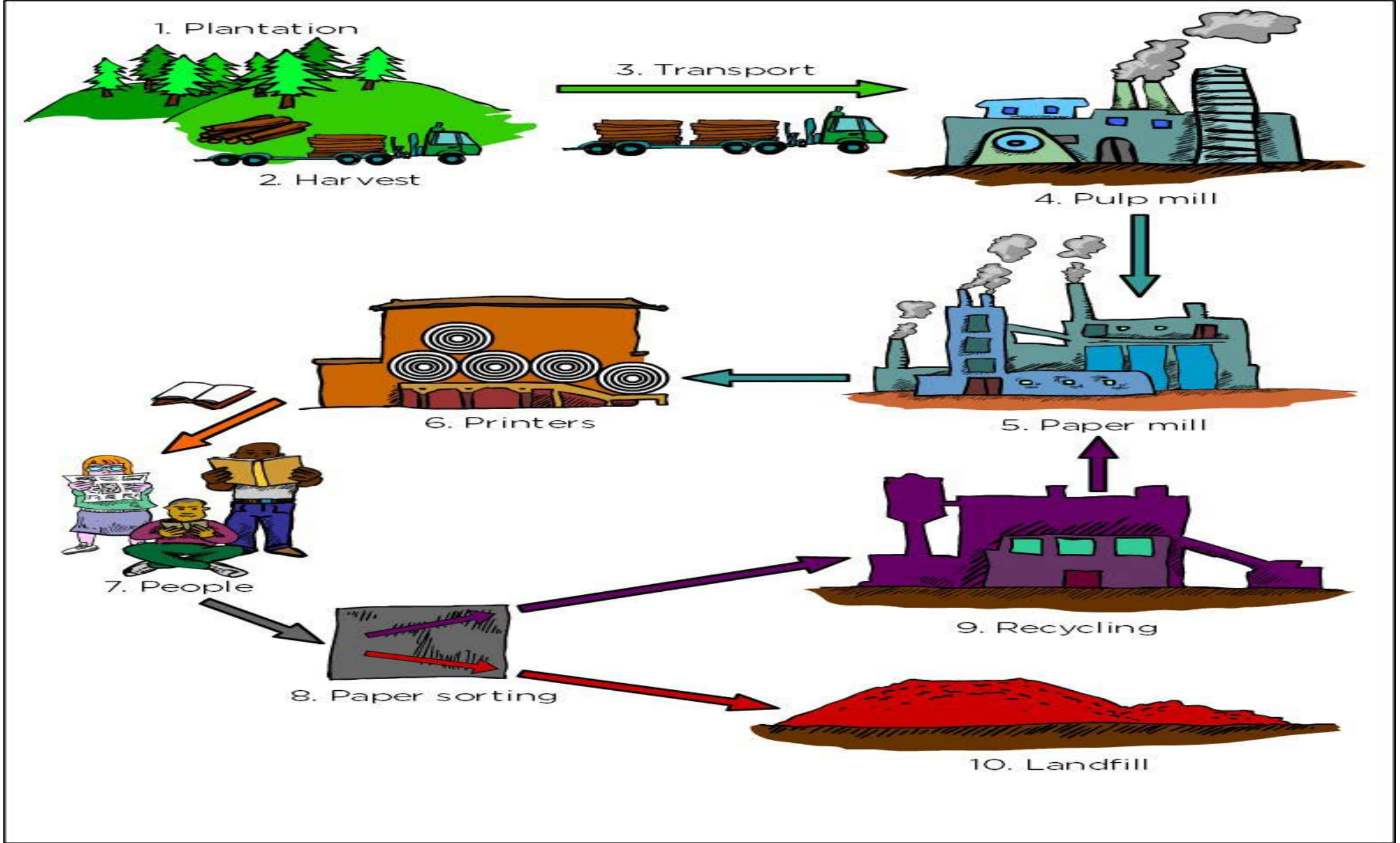
- Coal and oil are used to make plastics, paints and fabrics.
- Wood and plant fibres are used to make paper.

Raw and manufactured materials have different properties. We know that materials are used to make different objects. You have now learned that some materials are called raw or natural materials and some are called manufactured or man-made materials. We can group matter according to how it is used. This grouping of matter is called classifying.

The paper story

Can you imagine a world without paper? There would be no books, newspapers, magazines or even a sheet of music when you want to play piano. No paper means no more paper food labels or paper packaging. Not even toilet paper or kitchen wipes.

Paper is a very important material in our lives today. Let's find out how paper is made. Paper is made from the wood and plant fibre from trees growing in plantations all over the world.


1. Plantation
2. Harvest
3. Transport
4. Pulp mill
5. Paper mill
6. Printers
7. People
8. Paper sorting
9. Recycling
10. Landfill

1. Plantation

- Trees are planted in well-managed forests. These are called plantations.
- The trees are allowed to grow for several years before being cut down.
- The main types of trees used to make paper are the Eucalyptus (gum trees) and Pine trees.

2. Harvest

- Once the trees reach a certain height they are cut down.This is called harvest.
- The logs are cut into smaller pieces so that they can be transported.

3. Transport

- The logs are all loaded onto big trucks and transported to the mills

4. Pulp mill

- The logs are first debarked, meaning all the bark is taken off, and then chopped up into smaller pieces, called chips
- The chips are mixed with water and other chemicals to make a soft pulp
- Pulp consists of wood fibres and water

5. Paper mill

- The pulp then flows to the paper mill
- At this mill the pulp is washed, bleached and cleaned before the paper is made.
- The pulp is pressed and dried and then rolled or cut into sheets of paper.

6. Printers

- The paper is transported to other buyers and printers in big rolls
- These printers make the paper into other products such as books, magazines and newspapers

7. People

- The finished products are transported to shops where people buy the products
- When people are finished using the paper products, such as reading a newspaper, they throw it away in the dustbin or recycle it.

8. Paper sorting

- All the rubbish paper is collected after it has been thrown away and it is sorted
- Some paper can be recycled, but some cannot, so the paper is sorted into two different groups

9. Recycling

- Used paper can be collected and used again. This is called recycling. The paper that can be recycled is converted into other products or it is made into recycled fibre which can then be used at the paper mill again

10. Landfill

- Paper which cannot be recycled is taken to the landfill sites where it is dumped
- Landfill sites have a negative impact on the environment, so it is best to try hard to reduce the amount of waste which ends up at landfill sites by recycling

We mentioned recycling as a part of the papermaking process. Recycling is a very important process as it allows us to reduce our waste and use things over again. Not only paper can be recycled. You can also recycle glass, tin and plastic.

Properties of materials

Raw and manufactured materials have specific properties. The properties of a material help determine how it is used. For example, plastic is waterproof so some rain jackets are made of plastic to keep the rain off and keep you dry. A rain jacket made from wool or fibre would not be waterproof and you would be soaked! This is because the wool is an absorbent material (it absorbs water).

Hard or soft?

A material is described as hard when you cannot scratch it, you cannot cut it and you cannot dent it. Hardness measures how difficult or easy it is to change the shape of the material, either by denting, cutting or scratching it. A diamond is an example of a hard material as diamond cannot be scratched by other objects. In fact, diamond is so hard it is used on drill bits to drill through rocks and many other materials. The opposite of hard is soft! Think of wet, raw clay. This clay is soft and can therefore be moulded into a new shape.

Tough or fragile?

A material is **tough** if it is hard to break. Kevlar is used to make bullet proof vests. This material will not let bullets go through. If you hit a metal coin with a hammer, there will be no or little damage. If you hit a piece of chalk with a hammer it will break into pieces. The metal coin is tough compared to the chalk. The chalk is very fragile. **Toughness** measures how much energy is needed to break a material.

Stiff or flexible?

Stiffness and flexibility are ways of describing how an object behaves when a force is applied to it. A stiff material will not bend when you apply a force (push on it). But a flexible material will bend. When builders choose materials for building structures, sometimes they need flexible materials and other times they need stiff materials.

Some situations require that materials be strong in compression (be able to withstand pushing forces) and other situations where materials need to be strong in tension (be able to withstand pulling forces). The vertical (upright) steel poles of the water tower that are supporting a great weight have to be strong in compression in order to hold up the weight of the water tank. The rope supporting the bungee jumper needs to be strong in tension to ensure that the rope does not break and that the jumper survives his experience.

When deciding which material to use, it is important to consider the type of material, the size of the material, the shape of the material and the forces the material will experience.

<u>Different materials for the same object</u>

The *use* of the object determines the type of material it should be made of. Imagine a bicycle with wooden wheels. Do you think the wheels will turn and work as well as steel and rubber? Materials are chosen and used for the *properties* they have.

Similar objects such as balls used in sport, can be made from very different materials, depending on what the object is used for.

<u>KEY CONCEPTS</u>

- **Raw materials are those which have not been processed and they come directly from natural products.**
- **Manufactured materials have been made from raw materials**
- **Raw and manufactured materials have specific properties**
- **If a material is hard, it is strong and tough to scratch or break**

- **If a material is stiff, it is firm and does not bend easily. Stiff is the opposite to flexible.**
- **Other properties to describe materials are: strong, weak, light, heavy, waterproof and absorbent**