



Theatre of Science Materials Module



Thanks for watching! My business model is, all my lessons and print outs are available to all, and if you think they're worth £5 a month you can sign up to support me at <https://ko-fi.com/theatreofscience>. I will send you a rainbow glasses, stickers and magazines to say THANK YOU! It's because of you that this is my job, and it's the best job I can imagine!

These lessons are designed to suit all ages (you might want to pause them at points for younger children!) To plan them, I started with the Cambridge and Pearson IGCSE Design and Technology specifications, so they provide an excellent grounding for students wanting to take those exams.



Theatre of Science Materials 1: Hard, Tough or Strong?!

THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5/£6/£10 a month! It's the only way this can be my job xx

Bring: A cup, flour, water, teaspoon, crispy food (eg cereal), metal spoon, elastic band.

Today we'll be hearing about:

These definitions!

We'll be using and recapping these words pretty much every lesson so don't worry if you don't get some of them!

Deformation: A material changing shape.

Elastic deformation: Material goes back to its original shape when the force is taken away.

Plastic deformation: Material stays deformed when the force is taken away.

And start to understand that there's a difference between 'strong' 'tough' and 'hard'.

I'm hoping you'll remember these

Brittle: Doesn't plastically deform, just breaks (eg glass)

Ductile: Does plastically deform when pulled - can form wires (eg copper)

Malleable: Plastically deforms when pushed - can be hammered into shape (eg tin)

Tough: Plastically deforms but doesn't break easily (can absorb lots of energy) (eg steel in a car)

Strong: Doesn't plastically deform or break easily. (eg steel)

Hard: Doesn't scratch easily (eg diamond)

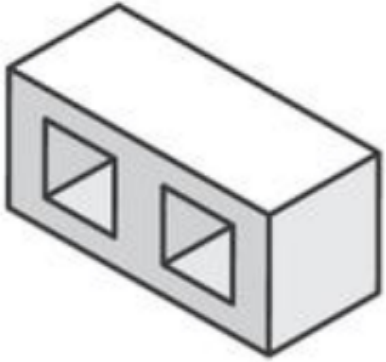
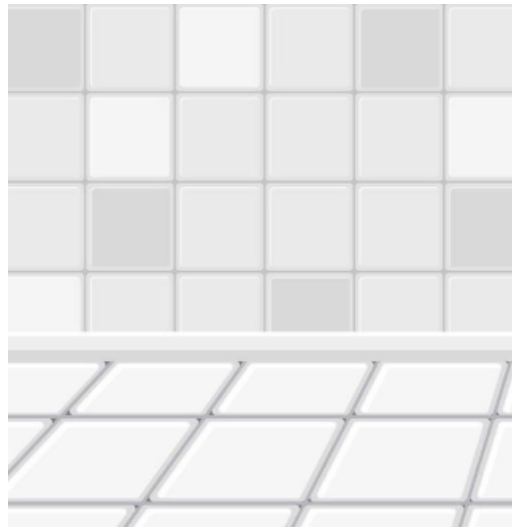
I'm hoping you'll remember some of these

1. Which of these materials are brittle*? *(Something that doesn't change shape, it shatters.)

Mug



Bathroom tiles

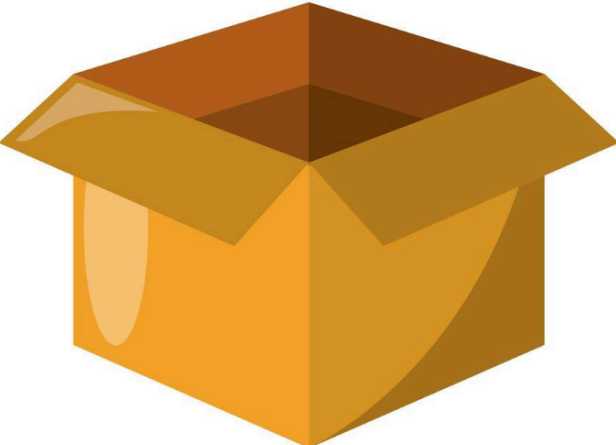


Concrete

Wine glass



Football



Cardboard box



T.Shirt



Graphite
(what the middle of pencils is made of)

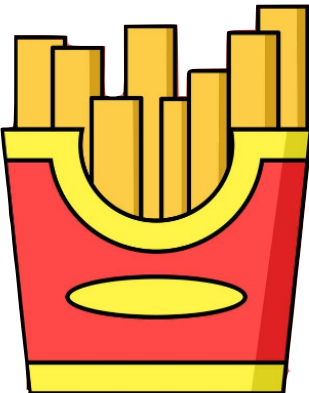


Car tyre



Plastic bottle

Chips



2. Think of two situations where a material being brittle would be useful.
(I can only think of two!!)

3. How would an object behave that was the opposite of brittle?

~~GCSE~~ A Level questions!

1) What is a ductile material? (1)

- a) One that doesn't scratch easily
- b) One that shatters if a sudden force is applied
- c) One that can be drawn into a long length

2) In winter ice forms over a garden pond.

The owner hits it with a hammer. What property of ice means it can be broken with a hammer? _____ (1)

3) Ice is hard. What does it mean if a material is hard? (1)

4) These words describe copper:

Ductile Malleable Tough

Circle the word that makes copper suitable for being made into wires (1)

5. In 2006, three 17th Century Chinese vases were smashed when a man fell down the stairs at the Fitzwilliam Museum in Cambridge. The vases were made of porcelain. A restoration expert put them back together. She said, "It was easy. The pieces fitted back together perfectly." Explain why it was possible to fit the pieces back together perfectly. (2)

Summary questions!

1. Match the words to the description:

Elastic deformation	Shatters when you hit it!
Plastic deformation	Springs back into shape
Brittle	Not easily scratched
Hard	Doesn't spring back into shape
Tough	Can absorb a lot of energy

Explain why spider silk has to be tough and not brittle.



Theatre of Science Materials 2: Plastic

THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5/£6/£10 a month! It's the only way this can be my job xx

Today we'll be hearing about:

How the scientific name for plastics is 'polymer',
How polymers are formed when smaller molecules called monomers join together
How the monomers and manufacturing processes used decides the properties of the polymer.

I'm hoping you'll remember these

How LDPE and HDPE are made of the same monomers but have different properties.
How some polymers are incredibly useful, for example saving lives, and others are causing environmental harm, such as polluting the oceans
How numbers are used to identify polymers and what they tell us about how the polymer can be recycled

I'd hoping you'll remember some of these

To join in with the lesson bring:

Grated chocolate (any), Plate over a pan of just boiled water (adult supervision for the hot water), 3 teaspoons, knob of butter/marg/ oil, Glass of water.

Before the lesson!!!

Have a look around the house for plastic items with numbers in triangles on them. Can you find numbers 2 and 4? How about 1, 3, 5, 6 or 7?!
Bring them if so!

Complete this table when I ask you during the lesson

Substance	Properties (What's it like?)
Chocolate	
Water	
Marg	
Chocolate + Marg	
Chocolate + Water	
Burned chocolate	

Suggested properties to choose from (you might think of more!).

Solid or liquid at room temperature?

Transparent? (You can see through it)

Opaque? (You can't see through it)

Colour?

Sticky/dry at room temperature?

Snaps easily? (*Brittle*)

Shiny or not?

Toxic or non-toxic?

GCSE questions!

1) Polystyrene is a man-made substance. Fill in the gaps to complete the sentence. Choose from the words below.

**carbohydrates plastics monomers
polymers recycled reused**

“Small molecules called _____ join together to form _____”

2) Some plastics are not biodegradable. Give two reasons why this is a problem.

Summary question!

1. Complete the paragraph, using some of the words below.

Polymers have very _____ molecules.

The properties of polymers depend on what _____ they are made from,

and how they are made. Low density poly(ethene) and _____

poly(ethene) are examples of polymers

that are made with the same _____

but have difference properties.



Theatre of Science Materials 3: Metals!

Today we'll be hearing about:

The general properties of metals
What the definition of an alloy is
Examples of some alloys and why they are useful

I'm hoping you'll remember these

How metals are precious for lots of different reasons
The value of metal can change over time
Metals can be mixed to make them more useful

I'd hoping you'll remember some of these

To join in with the lesson bring:
Some foil, paper, scissors, glue, candle, means of lighting the candle, **ADULT SUPERVISION FOR CANDLE** (we're holding paper above it!!), glass of water. Fork or spoon, tin can, 2p coin if you've got one.



THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5/£6/£10 a month! It's the only way this can be my job xx

What makes some metals so valuable?

They're rare

They don't corrode - break down - easily

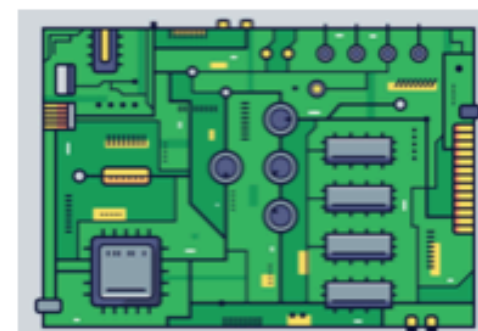
Electricity passes through them easily

They don't react with other substances

They're very reflective

They are hard to make pure

They're beautiful



An *alloy* is...

a mixture of two or more elements, where at least one of the elements is a metal.

Which of these is NOT an alloy?

A metal and two non-metals mixed together

Three metals mixed together

Two metals mixed together

A liquid made of two metals

A solid made of two non-metals

1. Match the alloy to its use

Bronze

(Copper with a bit of zinc and tin)
Can change shape easily, doesn't corrode, and kills germs!

Duralumin

(Aluminium and copper)
Light (not dense), but strong.

Brass

(Copper and zinc)
Electricity flows through it easily, strong.

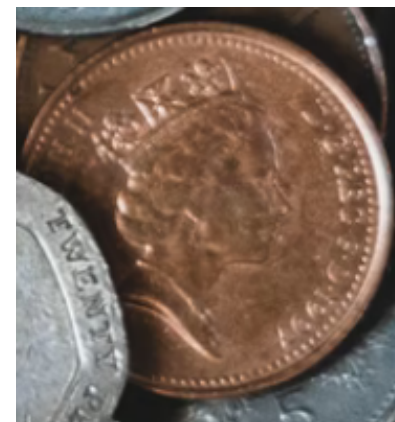
Stainless Steel

(Iron with chromium and things)
Very strong, doesn't rust, not damaged by acids.

Plug pins



2p coins



Knives and forks



Aeroplane parts



2. *Cast iron* is an alloy used for making large frying pans. What do you think cast iron would have to be like to make it good at this job?!

GCSE questions!

1) What is an alloy? (2)

2) Name one alloy, and explain why it is useful, giving an example (3)

Alloy: _____

Use: _____

Summary questions!

1) Explain in a few words why aluminium used be very expensive but is now very cheap.

2) Copper lets electricity flow through it but isn't very strong. Explain why it is mixed with zinc for use in plugs.



Theatre of Science Materials 4: Textiles!

Today we'll hear about:

The definition of 'textile'

The names of some popular textiles and where they come from.

I'm hoping you'll remember these

The advantages and disadvantages of various textiles.

Tests to help identify textiles!

I'd hoping you'll remember some of these

To join in bring:

A tea towel, a normal towel, a paper towel (or whatever you use to dry kitchen spills!), toilet roll, glass of water, four small cups. ALSO an item of clothing that is quite static-y (ie wool or manmade fibre).

1. Draw a line to match the fabrics to where they come from

Linen

Nylon

Wool


Polyester

Silk

Cotton

Acrylic

Long particles are made from oil, then spun

The fluff attached to a plant's seeds 

It's a protein made from a caterpillar's spit

An animal's coat

From the stalk of a plant 

Long particles are made from oil, then spun

Long particles are made from oil, then spun

2. Fabric can be put into 2 categories; guess what they are!

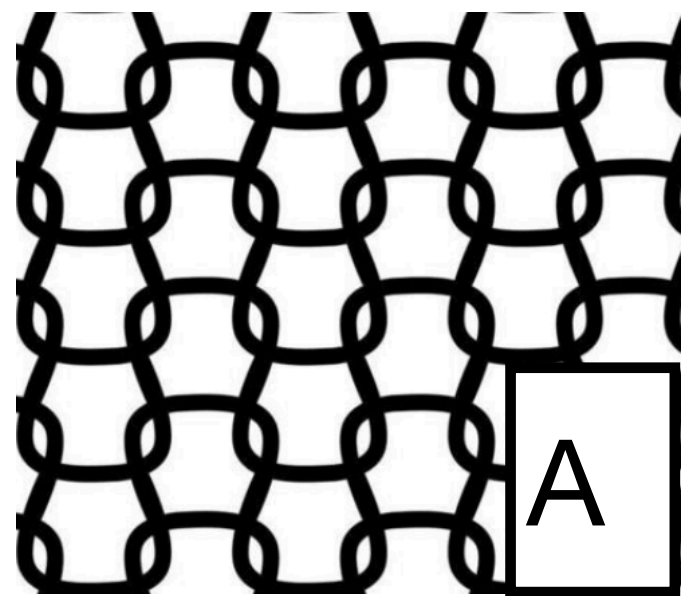
3. Wool is warm, but itchy. Look at the label on an item of your clothing. Why you think that material was chosen? Can you think of any disadvantages?

GCSE questions!

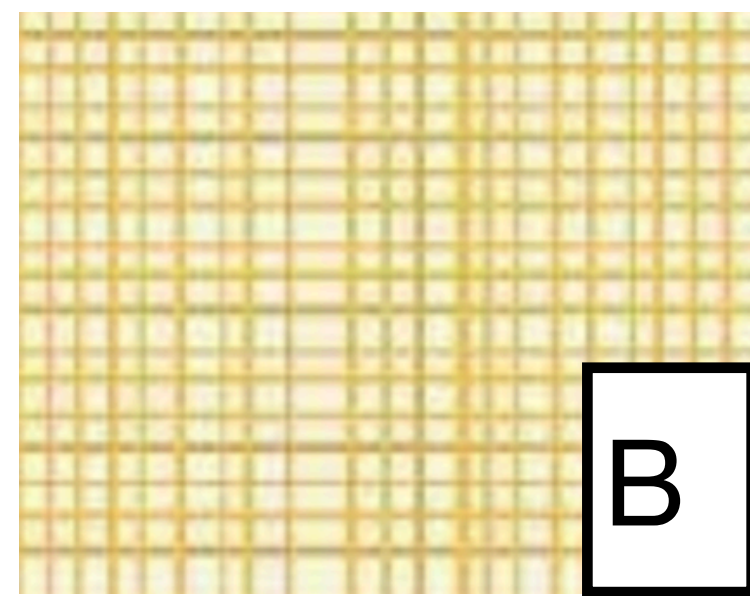
1) Which of the following is not biodegradable?

- a) Cotton
- b) Silk
- c) Acrylic
- d) Wool

2) What kind of fabrics are A and B?
Choose from the words below.



A



B

Bonded

Knitted

Felted

Woven

Summary questions!

1) What two main categories are fabrics divided into?

Give at least one example of each.

2) What are two differences and two similarities between silk and cotton?



THANKS FOR SUPPORTING ME ON KO-FI! I'll send you rainbow glasses, sticker and a magazine for supporting my lessons with £5/£6/£10 a month! It's the only way this can be my job xx



Theatre of Science Materials 5: Reduce, Reuse, Recycle!

I'll send you rainbow glasses, sticker and a magazine for supporting my lessons! It's the only way this can be my job xx

Today we'll hear about:

The definitions of 'reduce' 'reuse' and 'recycle'.
What helpful and unhelpful reusing looks like.
What questions we need to ask to assess whether an action is 'good for the environment'.

Why some materials are recycled and some aren't
Why it's important to 'reduce, reuse and recycle'.

To join in bring:
Some scrap paper (nothing glossy or too colourful), two large bowls, glass of water, sieve, OLD tea towel, baking tray, rolling pin.

Why should we reduce, reuse, recycle?! Think about...

Landfill



Making stuff



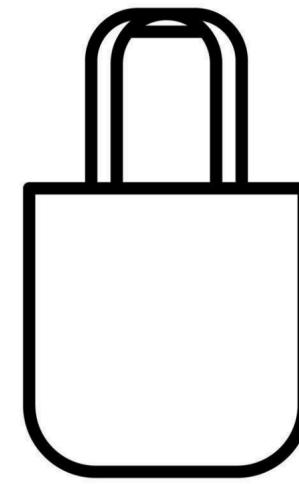
Mining



1. Label these boxes 'reuse' 'reduce' or 'recycle'. Or more than one!



Using cloth nappies instead of disposables



Making plastic bottles into tote bags

Buying a foil-wrapped chocolate bar instead of a Kinder Egg



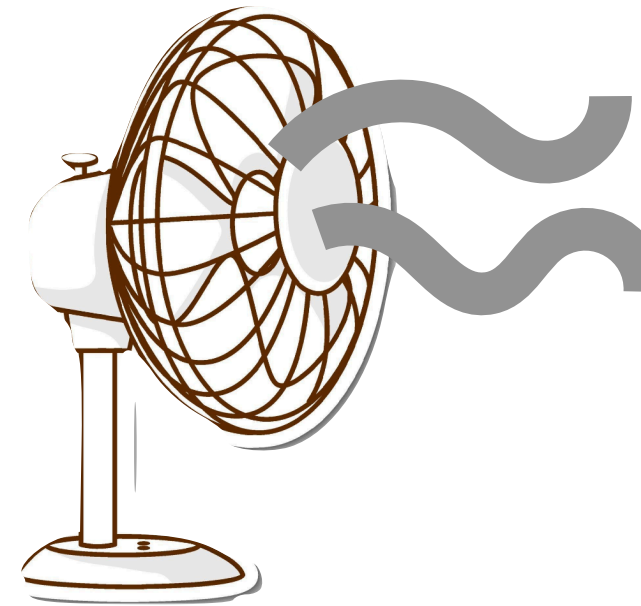
Buying clothes from a charity shop instead of new



Filling an old jar with rice at a refill shop instead of buying rice in a plastic bag



Filling a water bottle at a tap instead of buying a plastic bottle



Making a cat toy by tying plastic bag to a fan

An aluminium can being turned into a new can



2. Rank them from 1-8 where 1 works very well to help the planet and 8 not at all.

3. For the ones you're unsure about for (2), write down what questions you'd need to ask to help

4. Any here you think are good ideas but your house doesn't do them? Why not?

GCSE questions!

1) Fossil fuels must be burned to purify copper when it comes out of the ground. Why is recycling copper better than mining it? (3)

2) Which word describes waste materials being made into different products?

Reduce Reuse Recycle Refuse Dispose

Summary questions!

1) Match the word to the description

Reduce

Using a product to make something else with all or part of it

Reuse

Cutting down on the amount of energy or material used

Recycle

Reprocessing a material and making something else

2) Give an example of each.

3) Which of the following can't be easily recycled?

Wet paper Aluminium McDonald's straws