Metals
Ferrous and Non - Ferrous

Icons key: **Flash activity. These activities are not editable.** **Accompanying worksheet.**

Teacher's notes included in the Notes Page. **Useful websites for further information.**

For more detailed instructions, see the ***Getting Started*** presentation.

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- Take a few minutes to think about the metals you already know about. Perhaps they are at home or in the room right now.
- What are they used for?

  –Steel
  –Aluminium
  –Brass
  –Copper
  –Iron
  –Stainless Steel
  –Bronze

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Metals

- Metals make up the largest class of chemical elements in the Periodic Table.
- Approximately three quarters of elements are metals. Most metals are silvery in colour, have a characteristic lustre, and are solid (rather than liquid or gaseous).
- Most metals are also malleable (can be shaped with a hammer), ductile (can be drawn into a wire), and good conductors of both heat and electricity.

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What you need to learn…

- Ferrous Metals
- Non-ferrous Metals
- Alloy Metals

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Where do they come from?

Metals are part of the Earth's crust in the form of metal ore. The process by which metal ore becomes metal is known as smelting. Iron is extracted from iron ore by burning it with carbon in a blast furnace at very high temperatures. This animation will guide you through the process in which iron ore becomes iron.

Press **start** to begin.

start

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Categories of metal

Metals can be broken down into two main categories: **ferrous** metals and **non-ferrous** metals.

Ferrous metals all have certain properties:

- they contain **iron**
- they will corrode unless protected
- they are attracted by magnets.

Non-ferrous metals also have certain unique properties:

- they do not contain iron
- they are not magnetic
- they are mostly **pure metals**.

How many different metals can you think of?

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Metalwork

What groups can metals be broken down into?
What are some of the properties that might affect how a metal is grouped?
Press the buttons to find out more about two categories of metals that are commonly used.

Press **start** to begin.

start

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Ferrous Metals

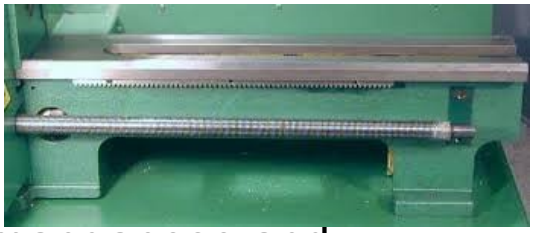
Cast Iron

Uses:

- Car piston rings
- Castings for domestic hot water boilers
- Drain cover grills
- Sliding ways for machine beds

Properties:

- Brittle, has a soft core beneath a hard skin.
- Strong in compression
- Snaps before it will bend
- Drilling – crumbles easy
- Fling – produces fine black powder



- 93% iron, 3% carbon, with traces of sulphur, silicon, manganese and phosphorus.
- Melting point 1200°C - 1400°C

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Ferrous Metals

Wrought Iron

Uses:

- Crane hooks
- Anchor chains
- Cores for electric motors and transformers

Properties:

- Soft, malleable and ductile
- Bends well, hot or cold.
- Dropping – gives a dull note when dropped
- 99% iron plus 1% of impurities such including carbon, sulphur, silicon, manganese and phosphorus
- Melting point 1600- 1700°C

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Non - Ferrous Metals

Copper

Uses:

- Electrical wiring
- Water pipes
- Boilers
- Roofing Pins
- Rivets

Properties:

- Extremely ductile and malleable either hot or cold
- Good conductor of heat and electricity
- Solders easily
- Water pipes can be bent cold
- Electrical cables can be bent cold
- 100% copper, copper is an element
- Melting point 1083°C

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Non - Ferrous Metals

Aluminium

Uses:

- Foil wrapping for food products
- Car body panels
- Aircraft parts – for its lightweight
- Cans
- Clips

Properties:

- Light in weight
- Malleable and ductile
- Takes an excellent polish
- Resistant to corrosion
- Machines easily
- Difficult to solder and weld
- Melting point 658°C
- 100% Aluminium – Aluminium is an element

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Non - Ferrous Metals

Zinc

Uses:

- Protective coating on mild steel (galvanising)
- Sheets are used for roofing
- Castings used in many industries
- Zinc often used with other metals to form alloys
- Zinc often forms protective layer on steel and iron

Properties:

- Sheet metal folds easily and can be soldered
- Castings are brittle and show clearly visible grains
- Resistant to atmospheric conditions
- Melting point 419°C
- 100% zinc – zinc is an element

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Non - Ferrous Metals

Tin

Uses:

- Protecting coating on steel plate (tinned)
- Used with other metals to form alloys
- Food cans
- Tin foil

Properties:

- Extremely ductile and malleable
- Does not oxidise
- Not used much on its own
- 100% tin – tin is an element
- Melting point - 231°C

Tinned steel –
Tin would melt if pure tin so the surface is tinned

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Non - Ferrous Metals

Lead

Uses:

- Water pipes
- Sheets for roofing and guttering
- Accumulator plates in car batteries

Properties:

- Sheet metal folds easily and can be soldered
- Castings are brittle and show clearly visible grains
- Resistant to atmospheric conditions
- Melting point 419°C

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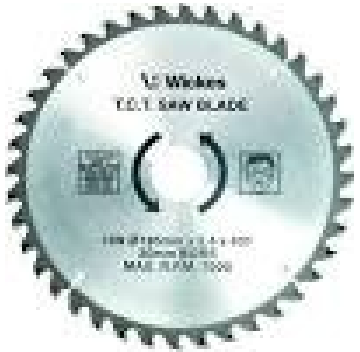
Non - Ferrous Metals

Tungsten



Uses:

- Cutting blades
- Abrasives
- Armour piercing round

Properties:

- A rare metal
- The free element is remarkable for its robustness,
- Highest melting point of all the elements
- Extremely hard material
- Melting point 2870°C

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QUESTIONS

1. Which metal would be most suitable for a church roof?
2. Which metal would be most suitable for domestic wiring in a new build?
3. Which common metal might you expect to find transporting the water throughout a house?
4. What are the properties of Aluminium?
5. Which metal would likely to be used for the tips of a circular saw blade and why?
6. Galvanising is typically the use of which metal to give a surface coat?
7. Give an example of a product/s that uses Cast Iron
8. Give an example of a product/s that uses Wrought Iron

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Homework

Research 3 types of Alloys:

- State the uses of that alloy and its properties

- http://www.youtube.com/watch?v=9LHDSB1n11k

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What you need to learn…

Alloys

- Low carbon steel — 0.15%-0.30% carbon
- Medium carbon steel — 0.30%-0.7% carbon
- High carbon steel — 0.7%-1.4% carbon
- Stainless steel
- High speed steel
- Duralumin
- Brass.

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Learning Objectives

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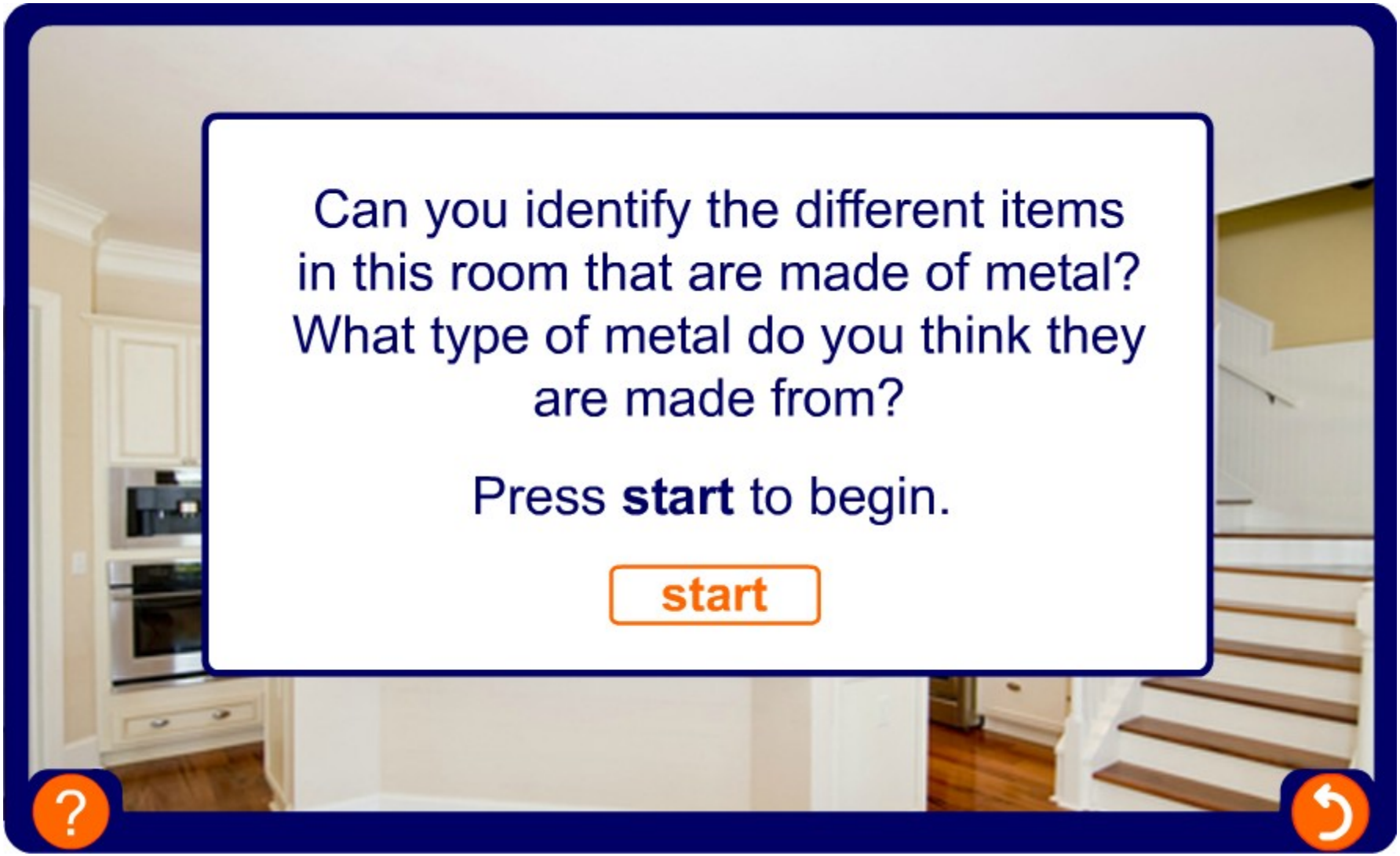
Heavy metal?



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Examples of metals

Ferrous metals contain iron. Most ferrous metals need alloying with other metals to make them useful. Mild steel is a relatively weak material. To make it more useful and to change its properties, we introduce carbon which makes the steel harder and more useful for everyday life. Press the images to find out more.

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Examples of metals

Non-ferrous metals do not contain iron. Aluminium, brass, copper and titanium are all non-ferrous metals. Press the objects below to find out more.

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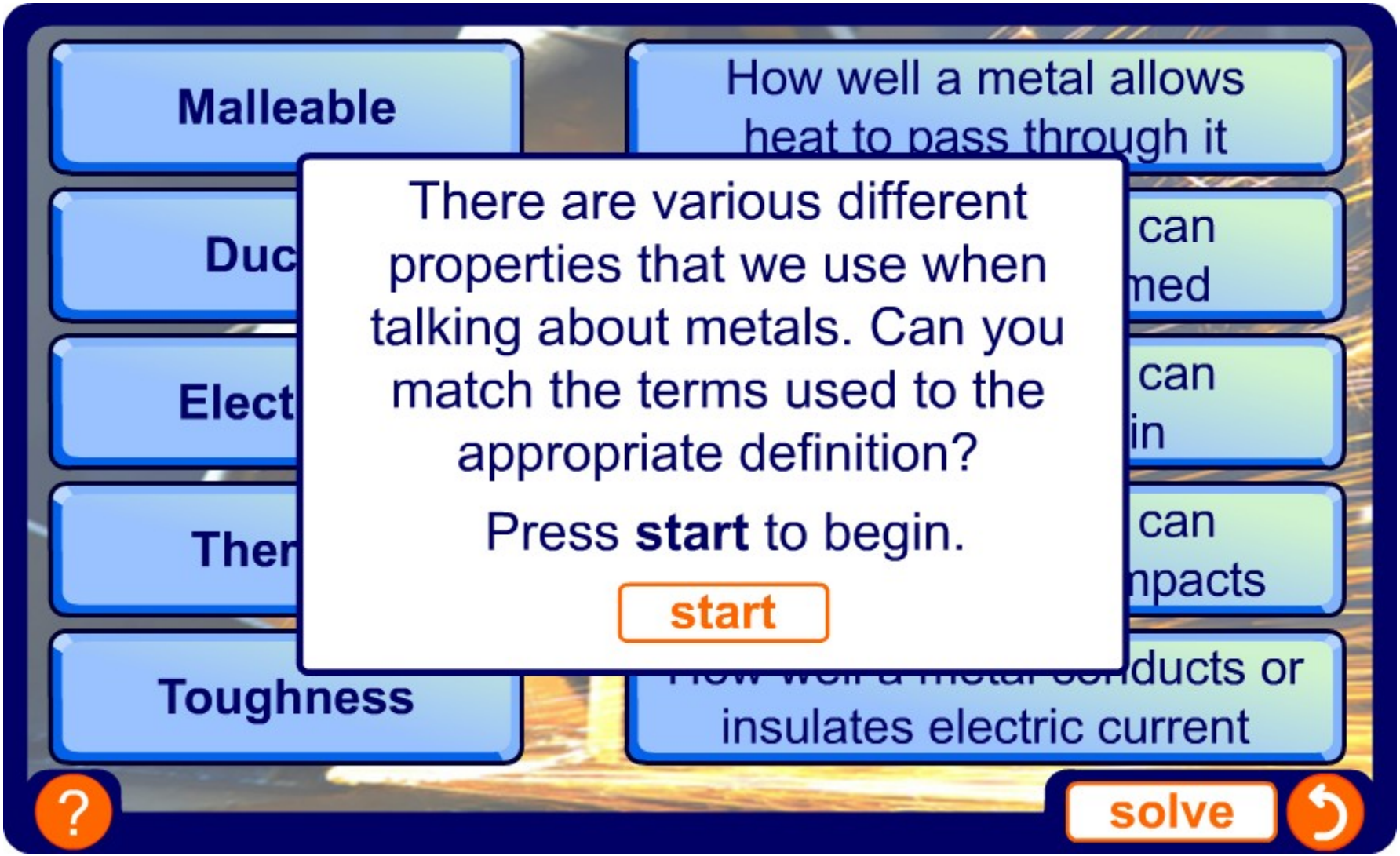
Properties of metals



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