

# BASIC METALWORK THEORY BOOKLET



NAME \_\_\_\_\_

YEAR \_\_\_\_\_

## BOOKLET ASSESSMENT RUBRIC

Below is the rubric you will be marked on for the completion of this booklet. Try to show as much understanding and detail as possible within your answers.

GRADE	MARKS	ASSESSMENT CRITERIA	YOUR MARK
A	75 – 100	<ul style="list-style-type: none"><li>You have completed all activities within this booklet in great detail and have demonstrated you understand the theory of metalwork well.</li></ul>	
B	65 – 74	<ul style="list-style-type: none"><li>You have completed most activities within this booklet in some detail and have demonstrated you understand many of the elements of the theory of metalwork.</li></ul>	
C	50 – 64	<ul style="list-style-type: none"><li>You have completed some activities within this booklet and have demonstrated you understand some aspects of the theory of metalwork.</li></ul>	
D	35 – 49	<ul style="list-style-type: none"><li>You have completed few activities within this booklet and have demonstrated limited understanding of metalwork theory.</li></ul>	
E	0 - 34	<ul style="list-style-type: none"><li>You have completed little of this booklet and demonstrated little knowledge of Metalwork.</li></ul>	

### Wasting processes

Whenever we remove material it creates waste, this makes any material which creates waste a 'wasting process'. Below are some metalwork tools which are used during the wasting process, explain how we use each tool safely and also the function of the tool.

TOOL NAME	PICTURE	FUNCTION OF THE TOOL	HOW WE USE EACH TOOL SAFELY
HACKSAW			
TIN SNIPS			
BENCH SHEARS			
GRINDER			
JUNIOR HACKSAW			
FILE			

### Categorising Metals

Metal is a versatile group of materials and have played an important role in the history of civilisation. There are four groups of metals; Ferrous, Non-ferrous, Pure and Alloys, it is important that you are aware of these and are able to categorise metals into these groups.

Below write a short description of each group of metals, make sure you also include examples.

Ferrous: \_\_\_\_\_

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Non-Ferrous: \_\_\_\_\_

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Pure: \_\_\_\_\_

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Alloys: \_\_\_\_\_

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Below is a list of different metals from each of the four groups, you need to colour each block a different colour according to which the metal belongs to:

Ferrous – Red

Non-ferrous – Blue

Pure – Yellow

Alloy – Green

Aluminium

Iron

High carbon  
Steel

Wrought Iron

Lead

Titanium

Brass

Bronze

Zinc

Magnesium

Tool Steel

Nickel

Silver

Stainless Steel

Copper








Platinum

Gold

Tungsten

## Metalwork Tools

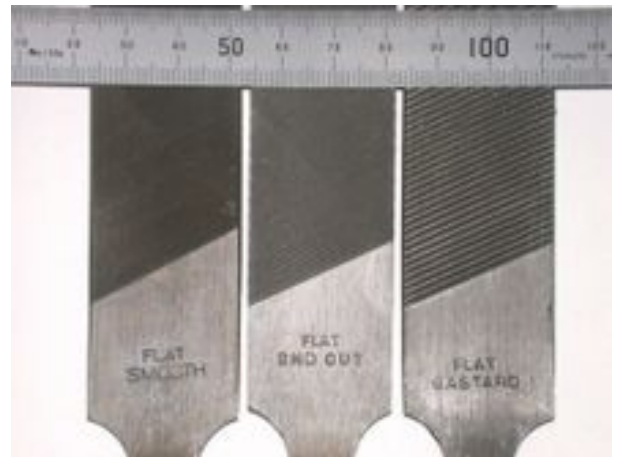
Below are some common metalwork tools, Complete the names and then explain their uses.

PICTURE	TOOLNAME	HOW IS THE TOOL USED?
	C _ _ _ _ _ P _ _ _ _ _	
	T _ _ S _ _ _ _ _	
	S _ _ _ _ R _ _ _ _	
	S _ _ _ _ _	
	B _ _ _ P _ _ _ H _ _ _ _ _	
	H _ _ _ _ _	
	J _ _ _ _ _ H _ _ _ _ _	

## Files and Filing

Files come in all shapes and sizes and vary in coarseness with the cut of the teeth on the file. The number of teeth per inch varies slightly according to the brand of file, but the following list represents a fair average:

Smooth Cut Approximately 62 teeth per 25mm (Fine)  
Second Cut Approximately 36 teeth per 25mm (Medium)  
Bastard Cut Approximately 26 teeth per 25mm (Coarse)



These are the different shapes of the files available in the workshop, match the descriptions with the correct file.

\_\_\_\_\_ also known as a half-moon file, excellent for inside curves and circles.



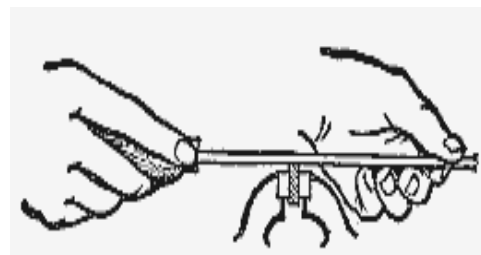
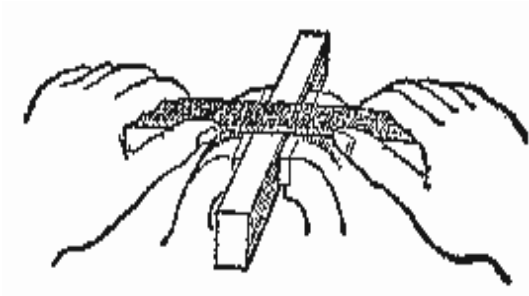
\_\_\_\_\_ also known as a triangle file. Good for tight corners and grooves.



\_\_\_\_\_ is excellent for finishing the end of a slot or for squaring a corner.

\_\_\_\_\_ is the most common in the workshop, used for general filing and metals. Best for achieving a flat edge or side.

Name the two different types of filing



\_\_\_\_\_

\_\_\_\_\_

### FINISHING STEEL

Describe the steps of finishing steel ensuring you use the words below:

**File**                      **Emery cloth**                      **Buffer**                      **Polish**                      **Wet and Dry**

**Vice**                      **Cross Filing**                      **Draw Filing**                      **Shiny**                      **Varnish**

STEP	EQUIPMENT	PROCESS
1		
2		
3		
4		
5		
6		
7		

## METAL PRODUCTS

Find ten different products from home which are made from metal. Try to select products which have different functions.

Product Description	Ferrous or Non-Ferrous	Probable Material and property
<i>Tin can</i>	<i>Ferrous</i>	<i>Steel coated with tin, so it doesn't rust</i>

Test the product with the magnet which you were given and fill in column 2.

If it is magnetic then it is a Ferrous metal (containing iron) and if it is not magnetic then it will be non-ferrous (not containing iron).

Use the internet to find the probable material.

Add this information to your table

The following websites will help you with this task:

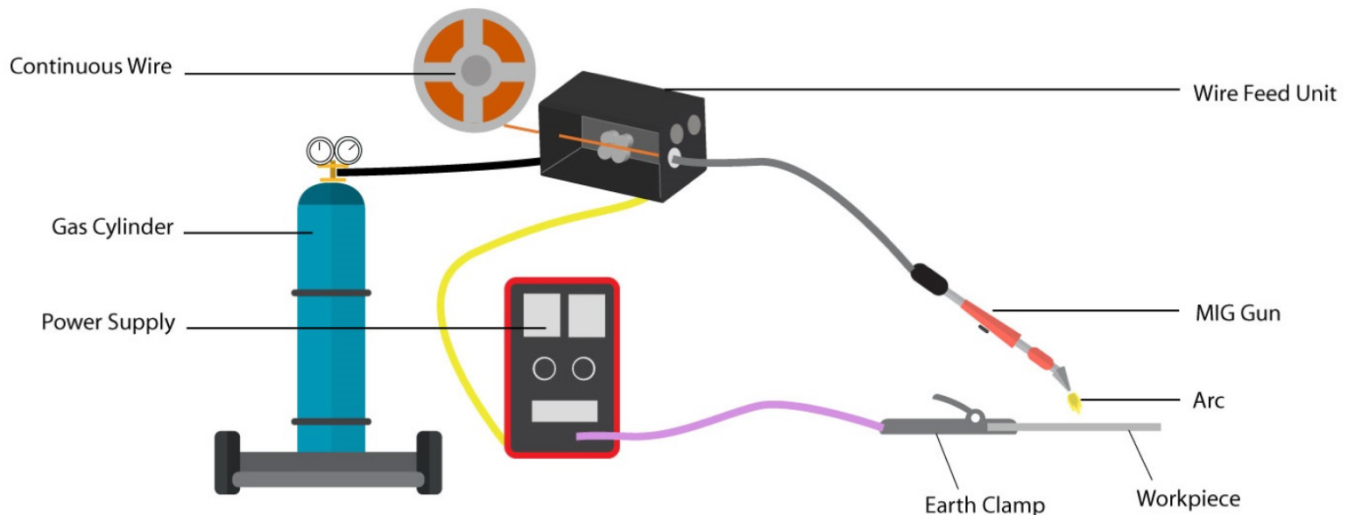
<http://www.technologystudent.com/designpro/metals1.htm>



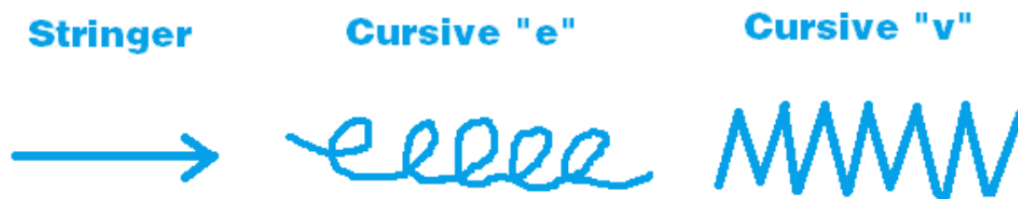
## MIG Welding

The MIG process is an arc welding process which joins metals together by heating them with an electric arc formed between a wire electrode and the workpiece. The wire electrode is fed through a MIG gun which is connected to a MIG welder and is consumed into the molten weld pool. A shielding gas is also released through the MIG gun to protect the arc and weld puddle from being contaminated by the atmosphere.

Below is an illustration of how your complete MIG setup will look.



There are different types of **bead** which can be created when mig welding but getting the speed of the handpiece correct is the key to a good weld.



A stringer bead is the most straightforward weld, where you simply push or pull the MIG gun across a joint in a straight line. These are usually thinner welds than weave beads but are fine for your average butt weld.

The cursive "e" weld is a popular weave bead. To perform this, weld straight across the joint but use small circles which are linked together to form e shapes. This gives a really cool scaled effect and can look very smooth.

Similar to the cursive "e", but this time you move the electrode side to side in a "v" shape which forms a zigzag shape. This is often used for overhead and vertical welds where you don't want the weld bead to drip down so you have to angle it upwards.

Which type of bead did you use on your product?



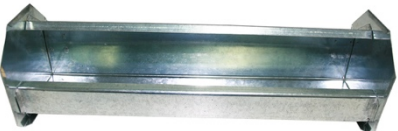



Why?

## Metal coatings

Rusting, Corrosion and Oxidation are processes which can happen to metals if they are not correctly protected from air and water. There are several ways of protecting metals and some of these are detailed below:

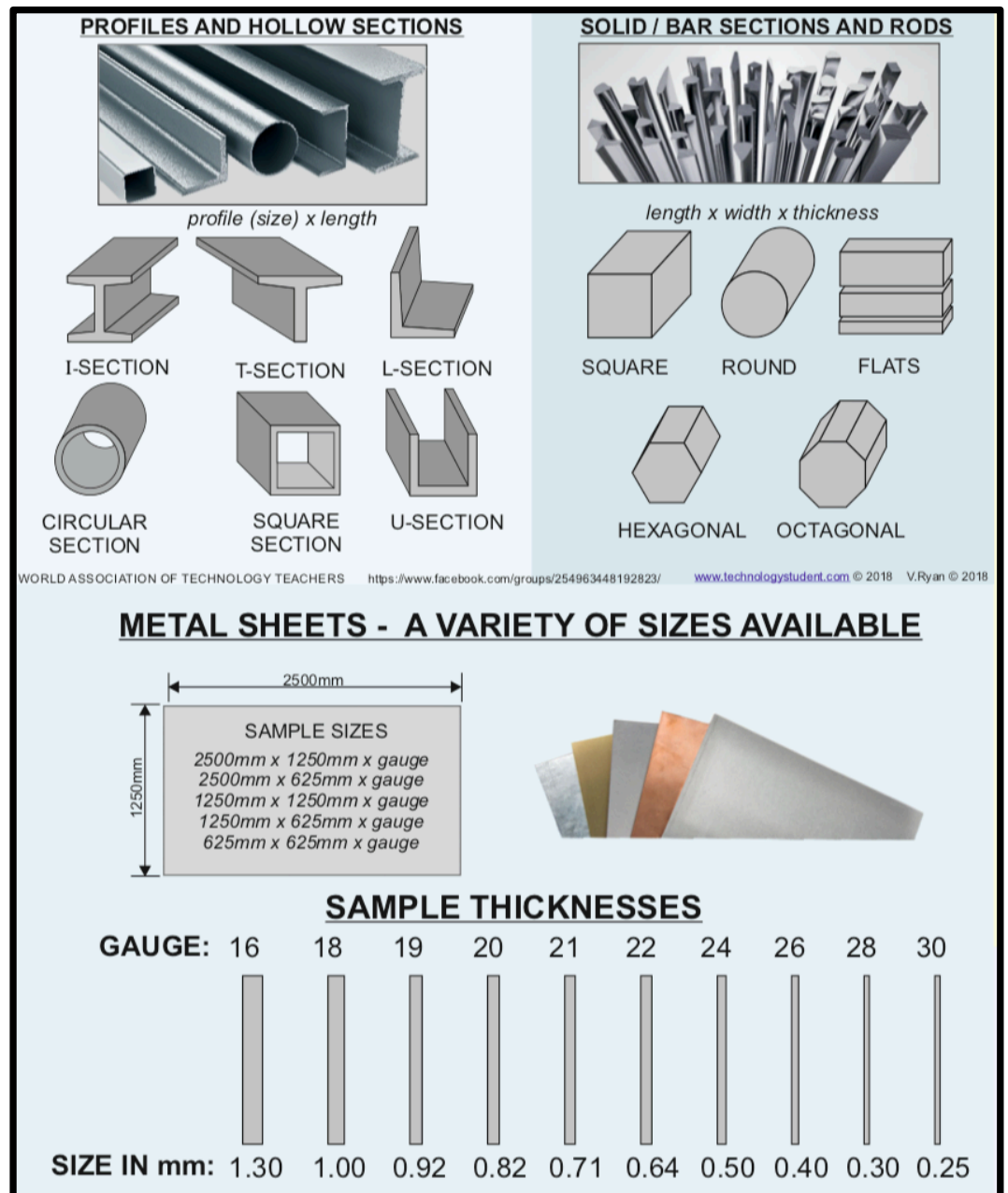
- **Anodising** involves coating a metal with a protective oxide layer. The oxide layer is impervious to air and water, thus protecting the underlying metal from further corrosion.
- **Electroplating** involves coating a metal, such as iron, with a less reactive metal, such as tin. The less reactive coating metal will corrode much slower, thus protecting the more reactive metal underneath. Electroplating is used in the manufacture of tin cans, which are actually steel with just a thin coating of tin.
- **Galvanising** involves coating a metal, such as iron, with a more reactive metal, such as zinc. The coating metal forms a protective barrier for the underlying metal.
- Coating metals with **plastic, paint, grease** and **oil** can also protect metals. These methods all involve unreactive substances forming physical barriers against corrosion of an underlying metal. They are generally more cost-effective than the methods described above.

Complete the table below to identify which products use which coating method:

PRODUCT	COATING USED	WHY WAS THIS COATING CHOSEN?
		
		
		
		
		
		

## Sections of Metal

Metals come in lots of stock sizes and sections. This means that these are already shaped and cut to this size. Below are details of some of the common stock sizes and sections.



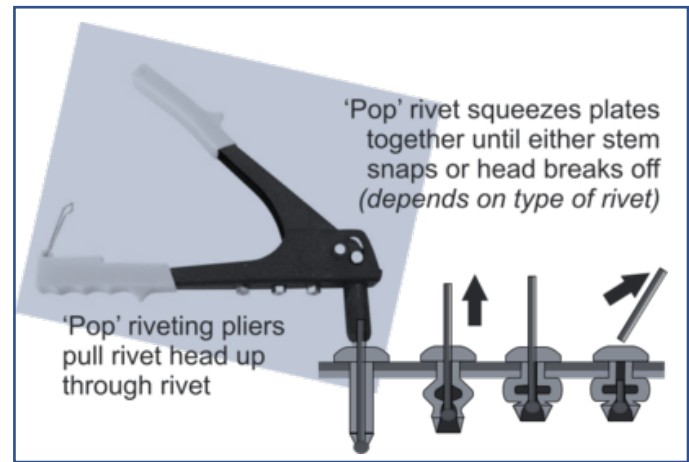
- What do you think are the reasons for having stock sizes and sections?
- Why do you think metals are made into different shaped sections?
- Which sections do you think would be the strongest?
- Which sections do you think would be the weakest?

## Riveting

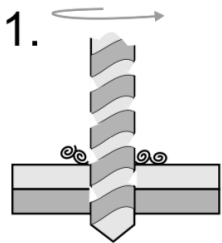
Pop riveting is a technique that is used to join thin pieces of metal and it can also be used to join plastic sheet.

The rivet has two parts; the pin and the rivet. The pop rivet pliers are used to pull the pin through the rivet and as this happens the rivet is deformed slightly so that it joins the metal or plastic pieces.

This technique is used where the metal or plastic is thin and where the joint does not have to be very strong. It is ideal for joining aluminium or even thin sheet plastic.



Explain the process below:

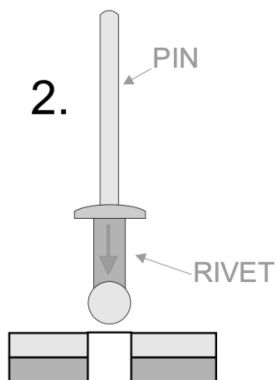


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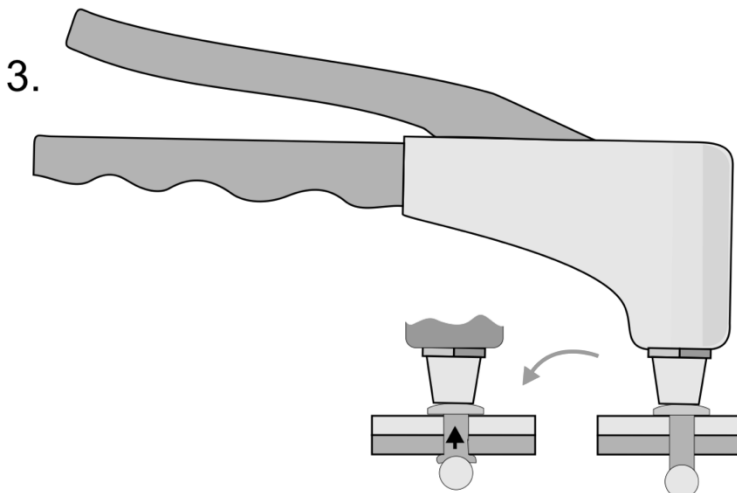


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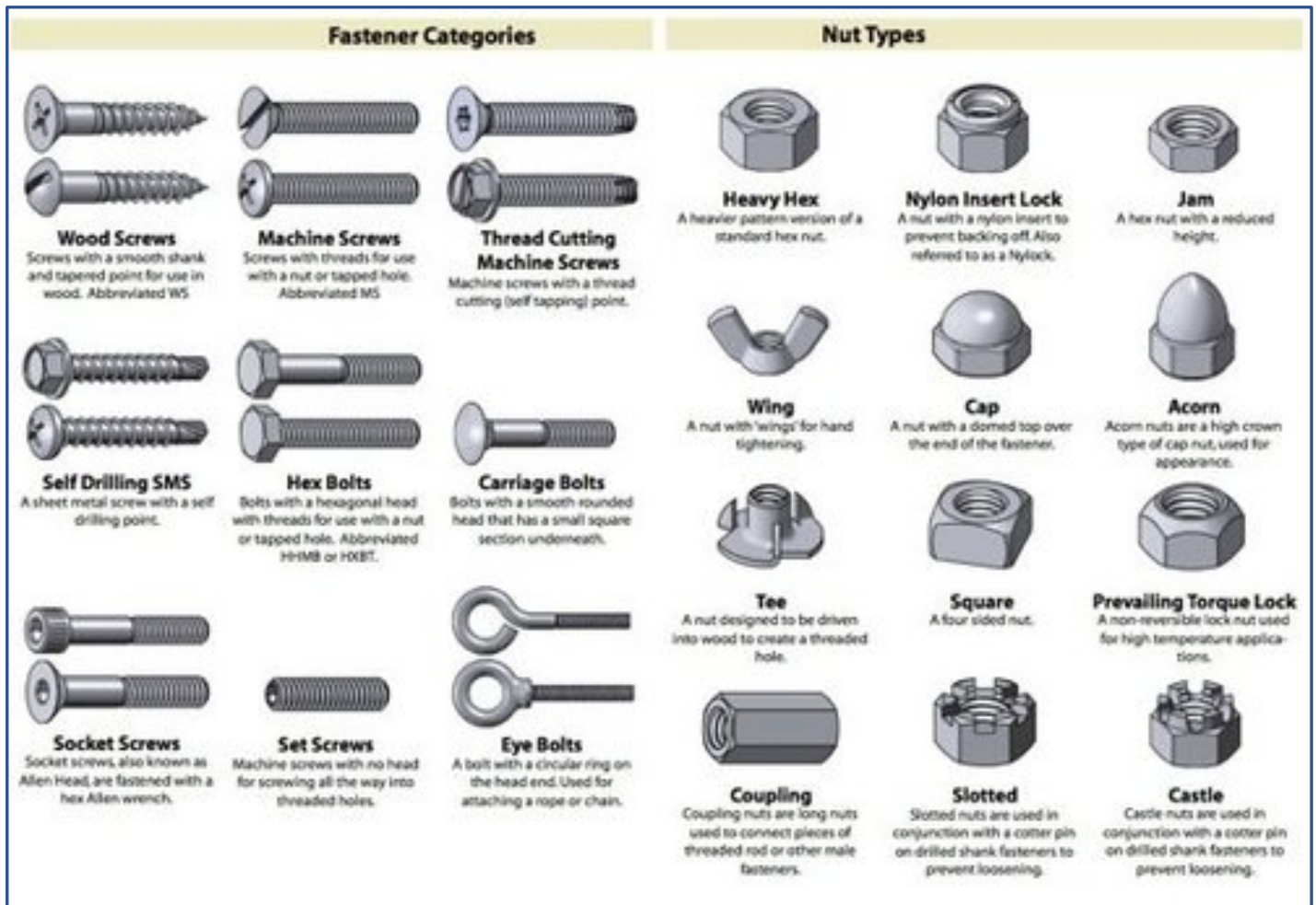
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## Types of Fasteners

Materials can be joined together using various fasteners such as screws and bolts. Different fasteners are used for different jobs and situations. Below is a selection of the types of fasteners which could be used.



Give examples of where the following types of fasteners could be used:

FASTENERS	POSSIBLE USES
Eye bolts	
Wood screws	
Carriage bolts	
Self-drilling SMS	
Coupling	

