Tools Worksheet - Metals

Engineer's square Junior Hack saw Hand file Layout blue Scriber Wet & dry Paper
Centre punch folding bar Vice Steel Rule Pillar Drill Dip coating machine

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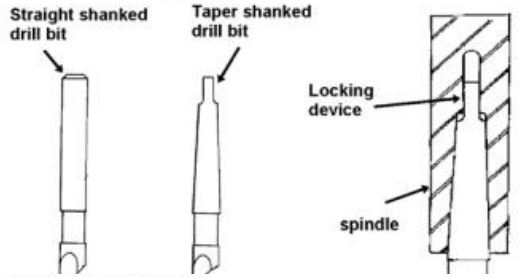
Using the correct tool names above, write in the correct name for each tool in the space provided and a brief explanation of what each tool is used for.

Distance Learning—KS3 Materials 1 (Y7)

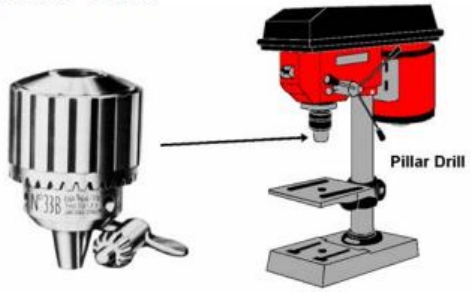
DRILLING METAL

Metals are drilled by **Jobber Drill Bits**, made from HSS.

The smaller diameter bits have a straight shank and are held in a **chuck**. The larger diameter bits have a tapered shank and are held directly in the pillar drill spindle. The thin part at the end locks into the spindle and cannot slip under pressure, like a straight shank could in a chuck.



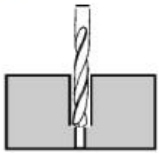
A 'Jacobs' Chuck



Note: For efficient cutting - Small diameter bits should turn at a fast speed. Large diameter bits should turn at a slow speed.

Pilot Holes

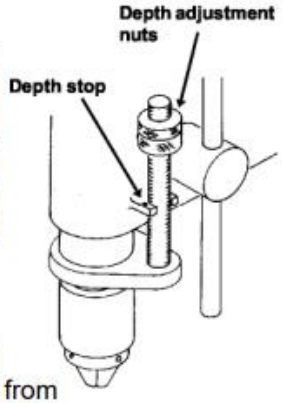
For holes in metal of 8mm diameter or larger, it is better to use a smaller drill bit first (4 or 5mm dia.). The smaller drill is less likely to wander off the centre punch mark. It also provides a hole that can guide (pilot) the larger drill.



A pilot hole guiding a larger drill bit

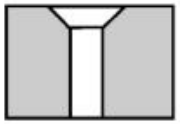
Depth stop

The depth stop on a pillar drill is useful for drilling holes to a given depth and for drilling a number of holes that have to be the same depth. The adjusting nuts hit the stop and cannot move down any further.



Countersink Bit

The bit is made from HSS. It is used to widen a previously drilled hole so that a countersunk screw head or rivet head can lie level with the surface.

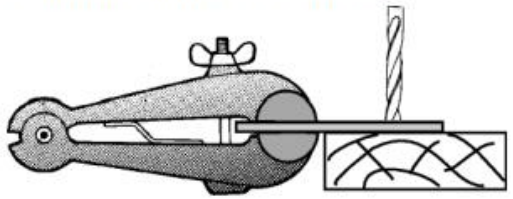


Cone Bit

Used for cutting and enlarging holes in thin sheet metal. This design does not catch in the metal and gives perfectly round holes.

Hand Vice

A hand vice should be used to safely hold thin metal (up to 3mm thick), while it is being drilled.



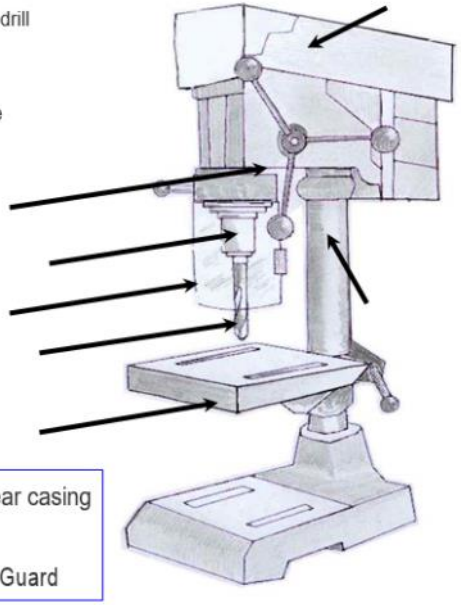
KEY WORDS Shank: Chuck: Pilot hole: Depth stop: Hand Vice: Cone bit:

1. What is the purpose of a chuck on a pillar drill?
2. What is the advantage of the taper shank design for larger diameter drill bits?
3. Explain what a pilot hole is used for.
4. You need to drill three holes that are 6mm diameter and 10mm deep. How can you be sure that they will be identical?
5. A jobber bit will cut a near triangular hole in thin sheet metal, instead of a round hole. How can you deal with this problem?
6. Illustrate a way of holding thin metal safely for drilling.

Worksheet 26c

1. Using drawings and notes, explain how to drill holes using the Pillar Drill.
Use extra paper if needed

2. Using the key words listed below, label the picture of the Pillar drill.



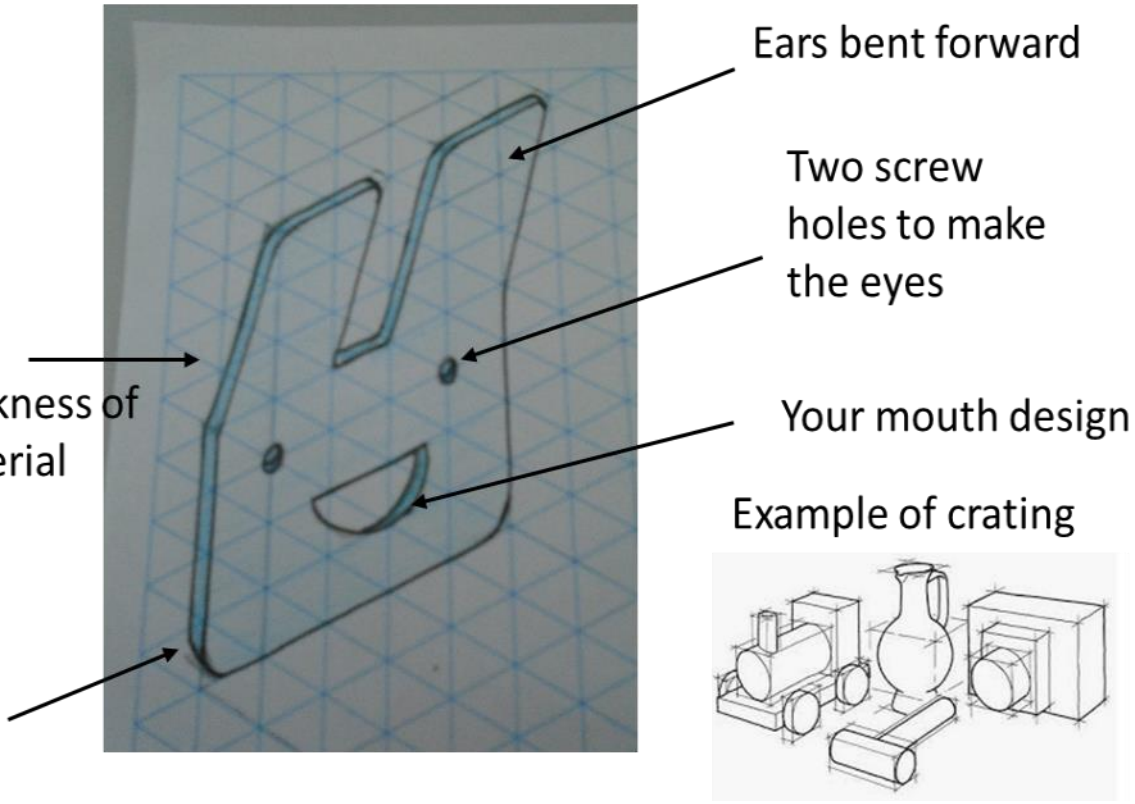
Pillar Pulley gear casing
Chuck Table
Drill bit Handle Guard

Use notes and sketches to describe the step by step process of plastic dip coating a coat hook in the school workshop.

Sketch and annotate an Isometric drawing of a possible coat hook design.

What you must do

1. Clean your steel product
2. Heat your steel product to a temperature that will melt the polymer powder or Plastisol
3. Plastic coat your steel product using either:
    1. a fluidised bed of polymer powder
    2. a tank of Plastisol
4. Reheat your product to ensure that the polymer has melted throughout its thickness
5. Prepare a Risk Assessment of the hazards involved with plastic coating
6. Evaluate the final product, e.g.:
    1. how well the plastic coating has covered your steel product, checking for pin holes, unevenness, unmelted polymer.
    2. discover what others think about your product.
7. Work safely and complete the assignment on time.



Example of crating

https://www.design-and-technology-education.com/Dip_coated_product.html

Do Now activity – Match the statements with the descriptions.

HARDNESS	When a plastic bends and returns to its original shape.
PLASTICITY	Ability to withstand dents and scratching
OPTICAL	The way a plastic allows light to pass through it.
ELASTICITY	How much a plastic can bend without breaking.

Polymers have become increasingly popular since their usage of consumer products back in the 1950s. As they are versatile and can be coloured, shaped, moulded; as well as being affordable they are used widely in all day to day products.

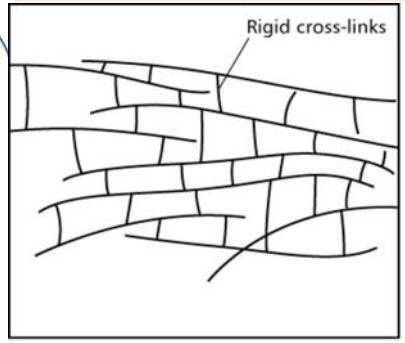
Most polymers are manufactured using crude oil which is non-renewable. This means it is not sustainable. The increase of use means that chemical engineers are looking for alternatives.

Polymers are split into two categories:

- Thermoforming
- Thermosetting

Thermosetting

Name	Properties	Principal uses
Epoxy resin	Good electrical insulator, hard, brittle unless reinforced, resists chemicals well	Casting and encapsulation, adhesives, bonding of other materials
Melamine formaldehyde	Stiff, hard, strong, resists some chemicals and stains	Laminates for work surfaces, electrical insulation, tableware
Polyester resin	Stiff, hard, brittle unless laminated, good electrical insulator, resists chemicals well	Casting and encapsulation, bonding of other materials
Urea formaldehyde	Stiff, hard, strong, brittle, good electrical insulator	Electrical fittings, handles and control knobs, adhesives
Phenol Formaldehyde	Hard, heat & chemical resistant, Good electrical insulator, limited colours available.	Electrical fittings, saucepan handles, bowling bowls.



Thermosets

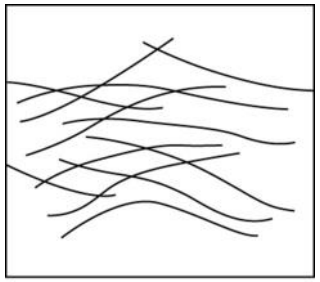
Long chain molecules held together by rigid cross links.

These links prevent the plastic being reshaped through the application of heat.

Write a paragraph discussing the differences between the three types of plastics from the table above.

Distance Learning—KS3 Materials 2 (Y8)

Why is this kettle is made from polymers? Write down your response.



What are polymers?

Polymers have become increasingly popular since their usage of consumer products back in the 1950s. As they are versatile and can be coloured, shaped, moulded; as well as being affordable they are used widely in all day to day products.

Most polymers are manufactured using crude oil which is non-renewable. This means it is not sustainable. The increase of use means that chemical engineers are looking for alternatives.

Polymers are split into two categories:

- Thermoforming
- Thermosetting

thermoforming

Long chain molecules held together by strong electrostatic forces called (van der Waals bonds).

These bonds can be released by applying heat allowing the material to be reshaped.

Name	Properties	Principal uses
Polyamide (Nylon)	Creamy colour, tough, fairly hard, resists wear, self-lubricating, good resistance to chemicals	Bearings, gear wheels, casings for power tools, hinges for small cupboards, curtain rail fittings and clothing
Polymethyl methacrylate (Acrylic)	Stiff, hard but scratches easily, durable, brittle in small sections, good electrical insulator, machines and polishes well	Signs, covers of storage boxes, aircraft canopies and windows, covers for car lights, wash basins and baths
Polypropylene	Light, hard but scratches easily, tough, good resistance to chemicals, resists work fatigue	Medical equipment, containers with built-in hinges, 'plastic' seats, string, rope, kitchen equipment
Polystyrene	Light, hard, stiff, transparent, brittle, with good water resistance	Toys, especially model kits, packaging, 'plastic' boxes and containers
Low density polythene (LDPE)	Tough, good resistance to chemicals, flexible, fairly soft, good electrical insulator	Packaging, especially bottles, toys, packaging film and bags
High density polythene (HDPE)	Hard, stiff, able to be sterilised	Plastic bottles, tubing, household equipment

Symbol	Polymer type	Examples	Recyclable?
1 PETE	**PET** Polyethylene Terepthalate		Recycling points are located throughout the UK
2 HDPE		Milk bottles Juice bottles Washing up liquid Bath & shower bottles	Recycling points are located throughout the UK
	PVC Polyvinyl Chloride	Usually in bottle form however not that common these days	Some Recycling points in the UK

Use internet research to complete the table above.
Write a paragraph discussing the differences between the three types of plastics from the table above.

Tools Worksheet - Polymers

Jeweller's bench pin Coping saw Acrylic cement Scroll saw Piercing saw Try Square Wet & Dry Paper
Vice Steel Rule Disc Sander Pillar Drill Needle file

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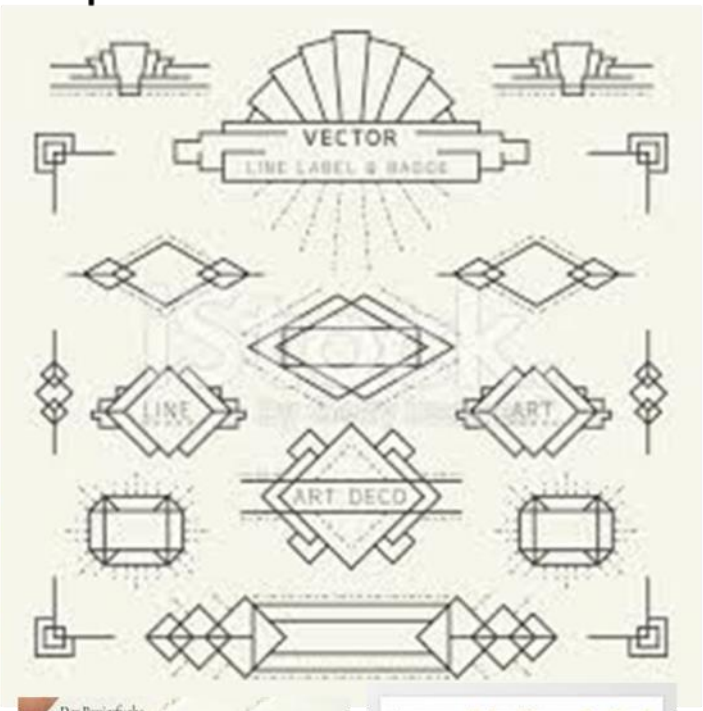
Using the correct tool names above, write in the correct name for each tool in the space provided and a brief explanation of what each tool is used for.

Success Criteria

1 - Create 6 ideas for an Art deco inspired Keyring, pendant or brooch.
2 - The design must fit into a presentation box that is 60mmx60mm
3 - Design using coloured geometric shapes.
4 - Each design will have one shape of each colour (red, blue & yellow).
5 - Your shapes will overlap to allow a strong bond.
6 - Use ACCESS FM to annotate your ideas.
7 - Write a conclusion explaining which idea you have chosen to make and why?

Inspiration mood board – Art Deco



Key terms
Proportion
Aesthetics
limiting factor

MODELLING IDEAS

Models are made to test ideas. Often only the part of the product that needs to be tested is modelled, e.g. If a simple box is to be lifted by a handle, only the handle shape needs to be modelled to test it for size and comfort.

Model vs Prototype

A **prototype** is what you make at the end of the project, using the correct sizes, materials, joints and finishes and it should fully work.

A **model** is often made to the wrong size, with the wrong materials and doesn't always need to work.

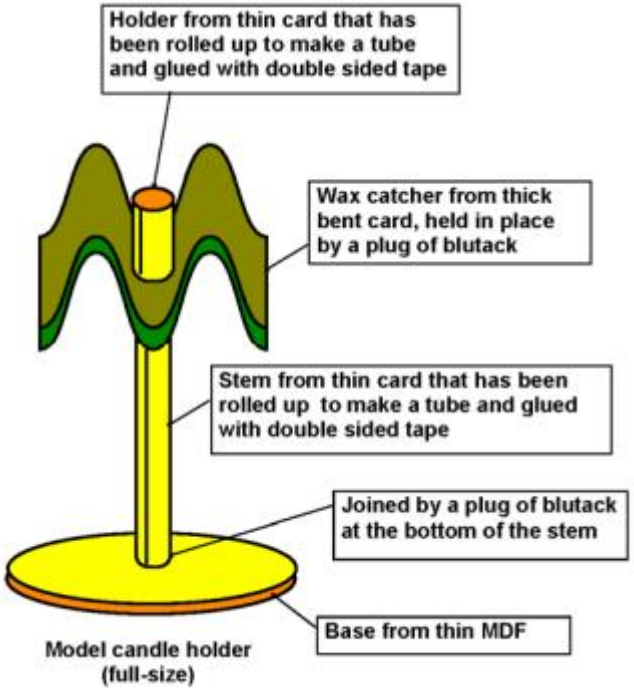
Scale

Models are often made smaller or larger than the product they represent. This is known as a **scale model** and is often referred to as half scale, if it is half the size of the product, or maybe 1/5th scale if every dimension is 1/5th of the full-size product, etc.

Testing

It is important that you are clear about what you want to test before you make a model. Models can be used to test:

- Dimensions
- Proportions
- Colour scheme
- Mechanical system (e.g. folding legs on a picnic table)
- Feature positions (e.g. buttons on a mobile phone)
- Shape
- Attractiveness
- Stability



Model candle holder (full-size)

Models should be quick to make and made from cheap materials.

Useful Model Making Materials

- Paper
- Card
- Cardboard
- MDF
- Plywood
- Balsa wood
- Rigid foam
- Polymorph plastic
- Wire
- Welding rod
- Matchsticks (without heads)
- Lollipop sticks
- Clear plastic sheet
- Drinking straws
- Clay

Joining methods should also be quick and simple.

- Glue gun adhesive
- Double sided adhesive tape
- Split pins
- Blutack
- PVA adhesive
- Velcro
- Pritt-stick

Computer modeling

In industry, computer modelling can be done using costly graphics programs. Ideas can be drawn in 3D and then rendered with colour, highlighting and shadow to make it look as realistic as possible. The drawing can then be rotated so that it can be viewed from any angle.

A computer rendered drawing of a drinks can

Computer programs can also model how a system works. For example, a car design engineer can draw a suspension system and then use the computer to animate it so that the parts can be seen moving together. The engineer can also put in what the forces are likely to be, to check that the parts of the system are strong enough for the job.

A At home, search for suitable model making materials, e.g. corrugated card from an old box, and then make a scale model of one of the products you find at home, e.g. washing machine, TV, video recorder, computer tower, table, wardrobe, etc.

Distance Learning—KS3 Materials 3(Y9)

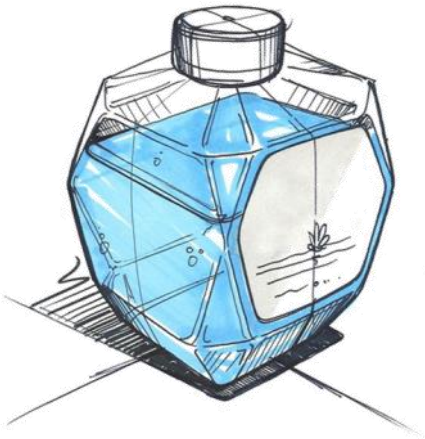
Brief

Gucci are looking for a new bottle to present their new range of perfumes/ aftershaves in. They have not yet selected the fragrance type and instead want the designer to select a fragrance type as well as design the appropriate bottle to go with this. They would like a prototype only of the shape and this must be able to fit into a package that measures 120x80x80mm.

Gucci would like the design to be suitable for all gender types. It must be suitable for teenagers and the bottle shape must be original and unusual whilst remaining ergonomic.

1) Highlight key points in the brief and explain:

- What it is telling you
- What you need to know or find out because of it
- How you will use it when considering a solution.



2) Complete 6 quick sketched ideas
This is a quick draw task 1min per sketch.
No more than 3 shapes per idea.
3)Add rendering and annotation to 2 of your ideas.
4) Create a star diagram and ACCESS FM to assess the success of your designs . Use a different colour for each design
5)Complete a refined drawing of your design.
This can be completed by hand or using the sketchbook App on the Ipad.
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