Transition Pack GCSE

Design Technology - RM

Email work to: NRS@churchdownschool.com

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GCSE Design & Technology Preparation Task
Resistant Materials

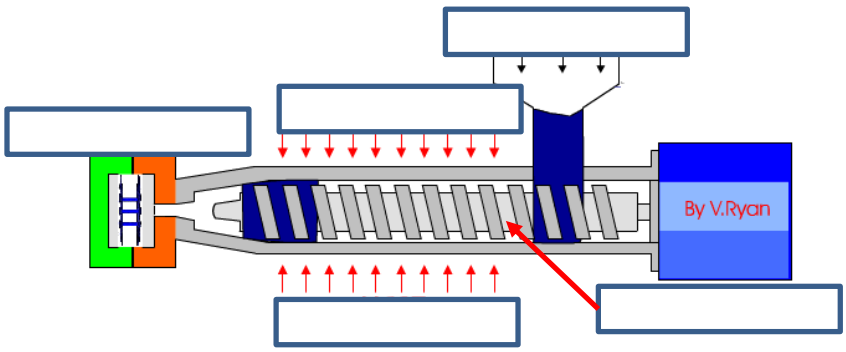
In order to prepare for starting your Design & Technology GCSE in September please complete the following tasks and submit the work during your first D&T lesson in September 2018. These tasks will help bridge the gap between your performance in Year 9 and the expected level in Year 10.

TASK 2 – Manufacturing Process

One of the most popular ways to produce products in **PLASTIC** is by **INJECTION MOULDING**

Research injection moulding (use the text book page that follows) and present a detailed description of how it works. You must include the following:

1. Write a step by step for the injection moulding process
2. Labelled diagram of the machinery used during the process
3. Name four products that are usually injection moulded



Injection moulding

This process is very versatile and can be used to make a range of simple or complex products (such as very complex 3D shapes). It is used to make toothbrush handles, laptop casings, computer mice, car interior consoles, buckets and chairs. The moulds can be highly complicated and include many moving parts dependent on the item to be made. The moulds are expensive to manufacture but, where small objects are to be made, they can normally produce more than one part at a time. Injection moulding is commonly used to form thermoforming polymers but, if needed, can also form thermosetting polymers. The process is:

1. Granules of polymer are fed into a hopper. A pigment is added at this stage if a specific colour is required.
2. The granules are fed forwards towards the mould using an Archimedes screw.
3. The heat chamber that surrounds the screw gradually melts the polymer as it moves towards the mould.
4. The screw moves away from the mould as the volume of molten polymer builds up next to the mould.
5. A hydraulic system rams the screw towards the mould, pushing the molten polymer into the mould.
6. The polymer cools quickly in the mould. The two halves of the mould are opened. The ejector pins push the formed object from the mould.
7. The two halves of the mould close and the process starts again.

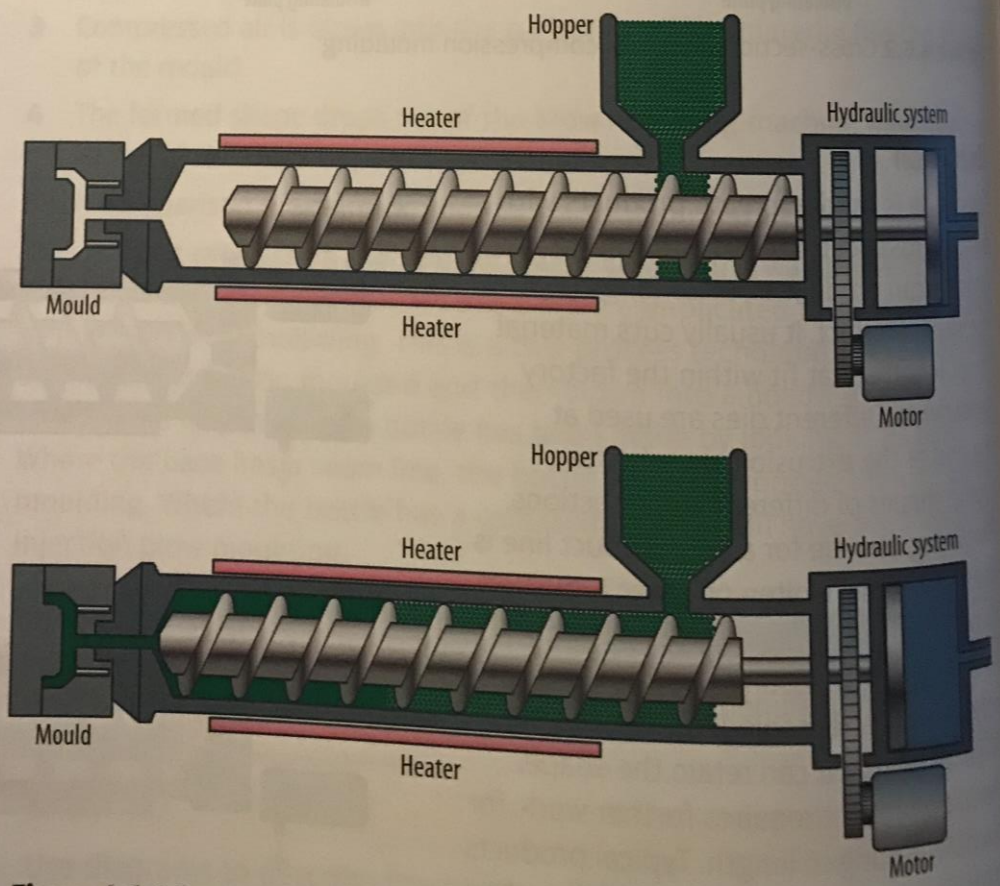
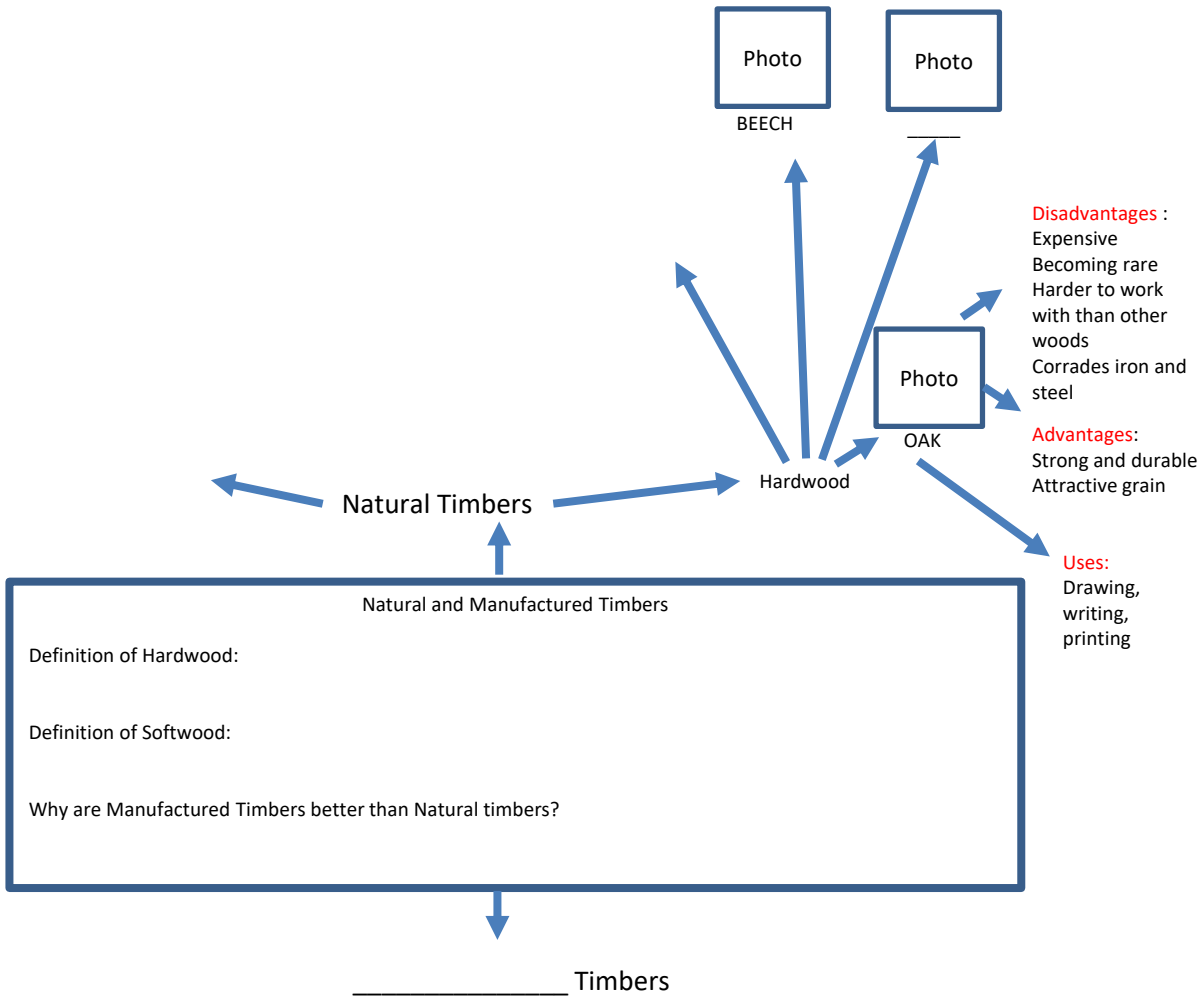


Figure 4.6.4 Cross-sectional view of the injection moulding process

Task 2: Timbers Graphic Organiser

Using pages 52-55 from the text book complete the graphic organiser below to help you form links between products their properties and their uses

The first material has been completed for you. Complete the rest in the same way.



Key Terms:	Physical Characteristics of Timber:
Hardwood:	Knots:
Grain:	Density:
Softwood:	Colour:
Evergreen:	
Veneer:	

Timber is wood that has come from tree trunks and been dried and cut into planks. Timber has been used as a building material for thousands of years to make homes, furniture and tools. Timber is still used a lot as trees grow naturally, their wood is easy to work with and it is relatively strong and lightweight.

Natural timbers: hardwoods

A **hardwood** comes from a broad-leaved tree whose seeds are enclosed in a fruit, such as an acorn. Hardwood trees grow quite slowly, often taking more than 100 years to be big enough to use for timber. This means hardwoods are rarely planted and they are increasingly rare and expensive.

Apply it

Make a list of wooden things you have used. Discuss why you think wood is a good material to make things from.

Key terms

Hardwood: comes from a tree with broad leaves.

Grain: fibres run the length of a tree trunk, which give it its strength and make the distinctive patterns you see on timber.

Type	Description	Advantages	Disadvantages	Common uses
Oak		• Strong and durable • Has an attractive grain when well finished	• Expensive • Becoming rarer • Harder to work with than some woods • Corrodes iron and steel	• Used a lot for building houses and boats in the past • Now used for high-end furniture and wine and whisky barrels
Mahogany		• Has a very attractive finish • Quite easy to work	• Expensive • Environmental problems with sourcing from tropical forests • Oils in the wood can give some people a skin rash or breathing problems	• High-quality furniture, jewellery boxes, windows
Beech		• A tough wood • Does not crack or splinter easily • Hard	• Expensive • Not very resistant to moisture • Not suitable for exterior use	• Toys, cooking implements, solid and laminated furniture
Balsa		• Very lightweight • Easy to cut	• Much too soft and weak for most products	• Model making, primary school projects, surf board cores • Used for rafts in ancient times

Table 1.12.1 Properties of hardwoods

Natural timbers: softwoods

A **softwood** comes from a tree with needle-like leaves and seeds in a cone. Most softwood trees are **evergreen**, meaning they have leaves all year. Softwood trees grow quite quickly, and can be used for timber after about 30 years. This means they can be grown commercially, which is why softwood timber is a lot cheaper than hardwood timber.

Key terms

Softwood: a tree with needle-like leaves and seeds in a cone.
Evergreen: a tree that keeps its leaves all year round.

Type	Description	Advantages	Disadvantages	Common uses
Pine		• Very durable • Easy to work • Quite cheap as it grows quickly enough to be forested • Reasonably strong, lightweight and easy to work with	• Can warp, crack and splinter more than some other woods	• House construction, for roof joists and floorboards • Furniture, doors, interior woodwork
Cedar		• Natural oils make it resistant to water and fungal growth	• More expensive than pine and not as strong	• Outdoor furniture, fences, sheds, boats

Table 1.12.2 Properties of softwoods

Manufactured timbers

Natural timber is a useful material, but because of the size of a tree trunk, it is only available in fairly narrow planks. If you want a large, thin sheet of wooden material, you need a manufactured board. Manufactured boards use timber to make a board that has different properties to plain timber.

Key term

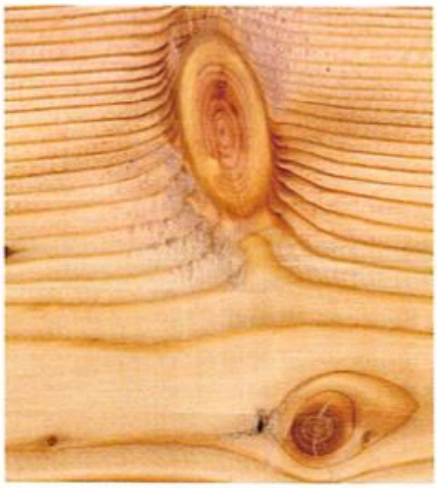
Veneer: a thin slice of wood, about 1 mm thick. Used as a decorative surface and to make plywood.

Type	Description	Advantages	Disadvantages	Common uses
Plywood	• A tree trunk is sliced into thin layers called **veneer** • These layers are glued together with the grain lines going in alternate directions	• Flat and structurally strong • Surface looks like wood • Resistant to warping, cracking and twisting	• Quite expensive • Edges can look rather rough • Susceptible to water damage if wrong grade is used	• Building and furniture panels that need some strength
Medium density fibreboard (MDF)	• Wood dust and fibres are mixed with a glue and pressed into flat sheets under extreme heat and pressure	• Cheap (made from waste wood) • Smooth ungrained surface is good for painting or staining • Easy to machine	• Does not look good, so needs coating • Weak compared to real wood or plywood • Tools blunt quickly due to the glue	• Cheap flat-pack furniture, wall panels, display cabinets, storage units

Table 1.12.3 Properties of manufactured woods

The physical characteristics of timber

Because of the way trees grow, all timbers have a similar set of physical characteristics.



Knots in timber

Knots

A knot in timber appears where a branch grew out of the tree: the grain swirls around and the wood can be harder, so a knot can make that part of the timber harder to cut with saws and chisels. Knots also fall out, leaving a hole, so it is good to use timber that is free from them. However, knots can also make timber visually appealing, but if timber is to be painted, knots should be treated with knotting (shellac dissolved in methylated spirits) to prevent resin in the knot from staining the painted surface.

Colour

Different woods have different colours, from the pale colours of pine to the rich, dark reddish browns of mahogany. But trees are living organisms and their colours will vary from tree to tree and within the tree itself. This means that when buying timber it's important to remember that colour may vary from plank to plank.

Grain structure and density

Timbers are split into hardwoods and softwoods. Hardwoods have two types of long vessels, known as fibres and pores, which run the length of the tree. Softwoods have one main cell called tracheids. Both have annual rings, produced as growth is added under the bark each year. These give timber its grain. Slow growth and narrow annual rings is sometimes called close grained. Birch and holly do not have clear growth rings but they can be seen by staining. Parana pine has almost no discernible growth rings and its small cells give it a very fine texture, whereas pitch pine and western red cedar have clear growth rings. In some hardwoods such as utile or iroko, the vessels spiral through the tree, giving an attractive interlocking grain, which is difficult to work with as it tears whichever way you plane it.

Open grain refers to hardwoods where the vessels are quite large and show at the surface (also called coarse grained). Birch and holly are close grained timbers with small vessels similar in size, hence fine grained. All hardwoods are somewhere between open and close grain. For example, red oak is very open, birch is close.

When applying finishes to grain, softwoods generally require sanding first. With most hardwoods, grain filler is needed before painting or polishing, otherwise the vessels will show through. Even very dense hardwoods like rosewood need grain filler.

Density varies from timber to timber; balsa wood has a density of 60 kg per cubic metre, while oak has a density of 750 kg.

Key terms

Grain: fibres run the length of a tree trunk, which give it its strength and make the distinctive patterns you see on timber.

Density: weight in grams per cubic centimetre or kilograms per cubic metre. Density is the compactness of a substance or material. Wood is often said to have a high strength to weight ratio because of its low density and good structural strength.

Single Point Perspective

You can use **perspective techniques** in your design ideas and presentation.

Perspective drawings use a number of points according to the view you wish to represent. They are used to show your client how your final product will **look in reality.**

Perspective drawings

It has **one** vanishing point and is mostly used for **interiors.**

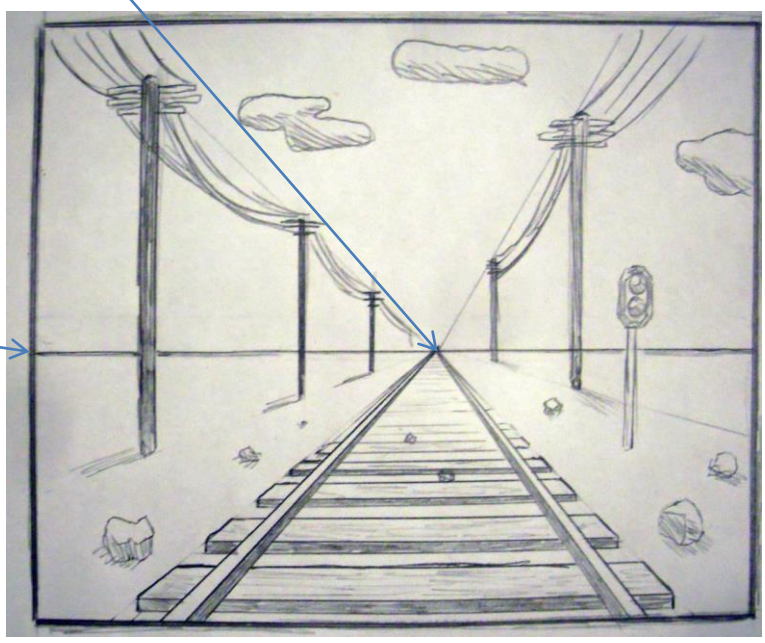
It can be used as a **quick sketching method.**

Perspective drawing is based on the fact that **all** lines appear to converge and meet at a **vanishing point.** This usually sits on a **horizon** or **horizon line;** otherwise known as your '**eye line.'**

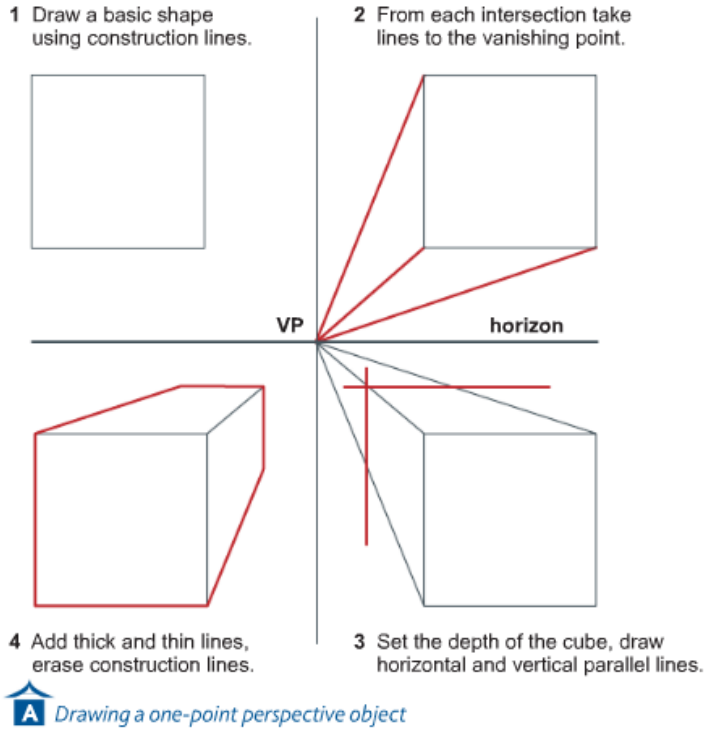
One point perspective

VANISHING POINT

HORIZON LINE



One point perspective – Step by Step



A *Drawing a one-point perspective object*

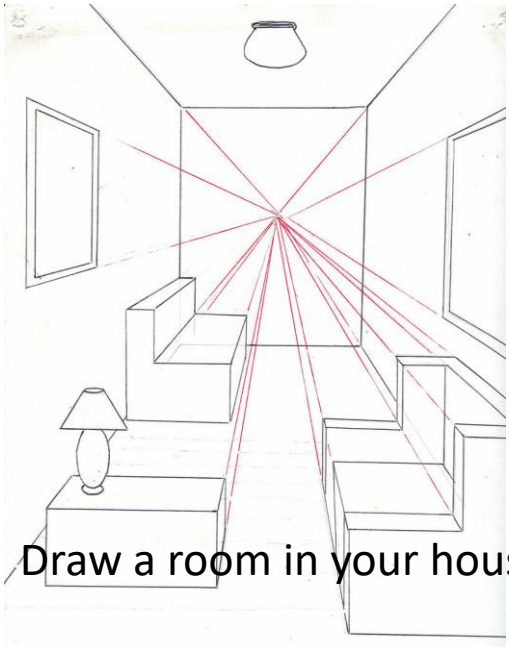
Use these instructions to help you complete the activity **below**

This may also help you complete the next activity

TASK: Using the step by step draw some rectangle shapes

Use this You Tube link to help (also watch also Single Point Perspective videos you tube recommends: https://www.youtube.com/watch?v=bjhkxFDvD78

TASK 3: Single Point Perspective 1



TASK: Draw a room in your house in Single Point Perspective

Use this You Tube link to help (also watch also Single Point Perspective videos you tube recommends:
http://www.youtube.com/watch?feature=player_detailpage&v=7ZYBWA-ifEs
https://www.youtube.com/watch?v=qOojGBEsWQw

TASK 4: Single Point Perspective 2: A room in your house

TASK 5 – Modern and Smart Materials

Using the text book pages about Modern and Smart materials complete a brainstorm that you can revise from for some recall questions at the start of year 10

The first modern material has been completed for you. Complete the rest in the same way.

Modern and Smart Materials

Definition:

Shape Memory Alloys

Description:
Can have their shape changed stretched or crumpled and will return to the original shape when heated

Advantages:
Extends product life
Reduces size
Less complex

Disadvantages:
Expensive
Can wear out

Examples:

Glasses

Dental braces

Exam style question: This is an 'explain' question. You must give a reason for your answer - do not just give an advantage without an explanation.

Explain one use of Conductive Inks…

Links for the text book page:

https://churchdownschool-my.sharepoint.com/:b:/p/nrs/EZQJq-XVVEpKl1wH9Ttd9DYBWDSddaqs_ZwA2v7KsfRt2A?e=MEemsu

1.4 Smart and composite materials, and technical textiles

Learning objectives

By the end of this section, you should know the characteristics, applications, advantages and disadvantages of:

- modern and smart materials
- composites
- technical textiles.

Modern and smart materials

Modern materials do not occur naturally, but are existing materials that have been altered to improve their properties.

Smart materials are existing or modern materials with physical properties that can be varied by an external input such as temperature, light, moisture, force or electrical current. They sense and respond to conditions in their environment and some can return to their original state when the conditions change.

Table 1.4.1 gives some examples.

Material	Description	Applications	Advantages	Disadvantages
Shape-memory alloys (SMAs)	• Can be plastically deformed (have their shape changed, stretched or crumpled) and will return to their original shape when heated or a current is applied • Examples include nickel-titanium (nitinol), gold-cadmium and iron-nickel-cobalt-titanium	• Glasses frames • Greenhouse window openers • Medical stents • Tweezers and hooks • Orthodontic wires	• Lengthen life of product • Reduced overall size, less complexity	• Expensive • Continuous use can cause metal fatigue
Nanomaterials	• Made of tiny components less than 100 nanometres (nm; a millionth of a millimetre) in at least one direction • May be particles, nanowires, nanotubes or thin films and surface coatings	• Fire-retardant materials • Sunscreen • Tennis rackets • Motorcycle helmets • Car bumpers	• Larger relative surface area can improve their strength, elasticity, magnetic, electrical, thermal conductivity and absorbent properties • Can combine properties, e.g. lightweight but robust and scratch-resistant	• Unusual physical and chemical properties – may need specialist risk assessment relating to health and the environment
Photochromic glass	• Darkens when exposed to light and reverses in the dark • Tiny particles of silver halide are added to glass; these react with ultraviolet light, causing a chemical reaction that changes the glass's colour	• Sunglasses • Plane cockpit windows	• Adapts easily to changing conditions • Can undergo thousands of cycles without performance change	• May be slow to react • User cannot control reaction

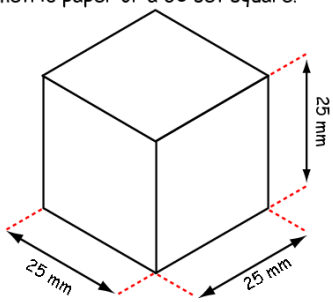
Table 1.4.1 Examples of modern and smart materials *Cont...*

Material	Description	Applications	Advantages	Disadvantages
Reactive glass	• Uses electrochromatic technology to change from transparent to opaque by applying voltage while allowing light to pass through from both sides	• Welding masks and goggles • Windows	• Retains heat, so reduces energy bills • Instant privacy without permanent blocking of light	• Expensive • Requires electricity source
Piezoelectric materials	• Generate a small electric charge when compressed (sensors) • Can work in reverse, generating movement when an electric charge is applied (actuators)	• Generating energy • **Sensors**: burglar alarms, keyless car entry, seat belt sensors, keypads, microphones • **Actuators**: for precise position control, e.g. digital cameras, fast-acting valves and nozzles	• Sustainable • Low maintenance • Compact size especially useful in micro-electronics • In actuators, high response speed and can create a large force	• Wear out • Has temperature, load and voltage limitations
Temperature-responsive polymers, e.g. poly N-isopropylacrylamide (PNIPAM)	• Can change physical properties with a change in temperature, so they are useful in many scientific applications	• Can deliver drugs, cells or proteins to patients in a controlled way when mixed with liquid polymer • When injected into a patient, a gel deposit forms; the drug is released in a controlled way when the temperature is increased • Can be used as sensors and gel activators	• Useful in biomedical applications	• Still being researched so wider application may take time
Conductive inks	• Contain pigments that allow small currents to flow through even when dry • Made with silver, carbon, graphite or other precious metal-coated base material • Used in a pen on any suitable material	• Drawing working circuits on polyester, polycarbonates and paper • Improvising or repairing circuits on printed circuit boards • Printing RFID tags for tickets etc.	• Easy to use • Lighter and more economical than traditional circuit boards • Low waste • Ink can be folded, so you can draw a circuit, fold the paper and unfold it to find the circuit still works	• Silver is expensive • Difficult to get circuits right

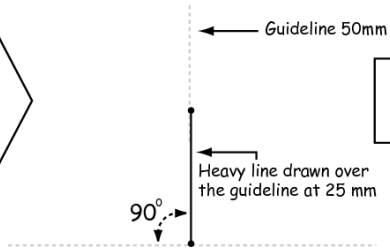
Table 1.4.1 Examples of modern and smart materials

Use the step by step below to draw a simple cube

You will now learn how to draw a '3D cube' to scale in isometric view. You will need isometric paper or a 60° set square!

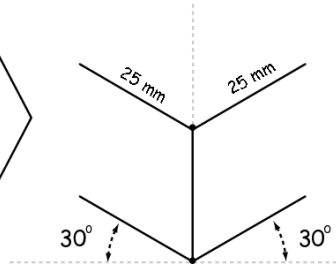


Now draw a light baseline at 90° then draw a light height line also at 90° and 50mm high. Now draw a heavy line over the light line at 25mm and at 90°.



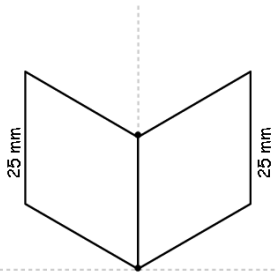
Step 1

From the two ends of your centre line draw four parallel lines at 25mm out at 30°. Note: Use the 30° line on your set square!



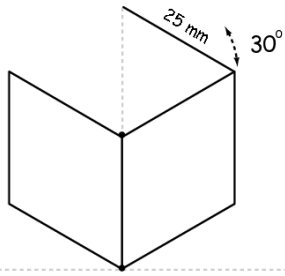
Step 2

Now add the two sides of your cube at 90° and at 25mm high like below.



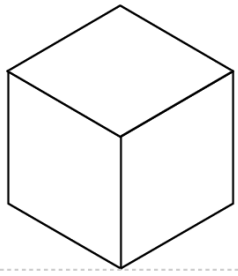
Step 3

From the top right hand corner draw a heavy line to the top of your 50mm light guideline at 30°.



Step 4

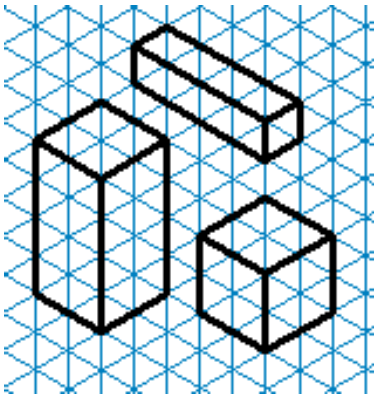
Now join your final line at 30° to close your cube. You have now finished, well done!



Step 5

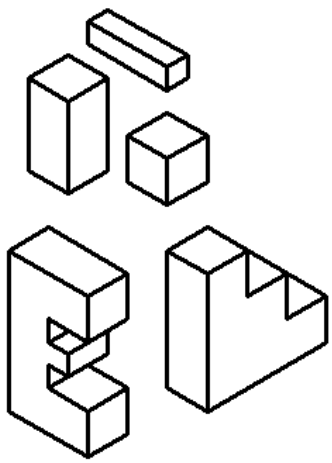
Task 6: Isometric basic cube

TASK: Sketching in 3D using Isometric



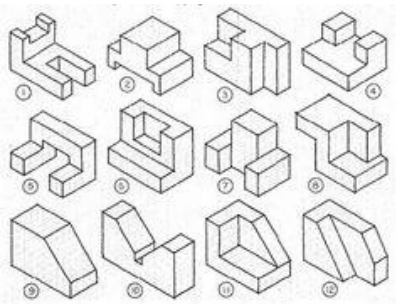
EASY

Use isometric paper to draw different rectangle and square shapes in 3D
TIP: Follow the lines.



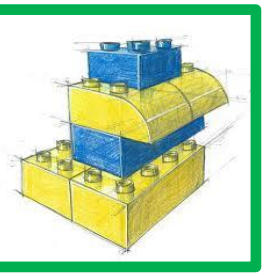
Achievable by all

Use plain paper to draw rectangles, letters and step shapes



Challenge Task

Draw more complex shapes



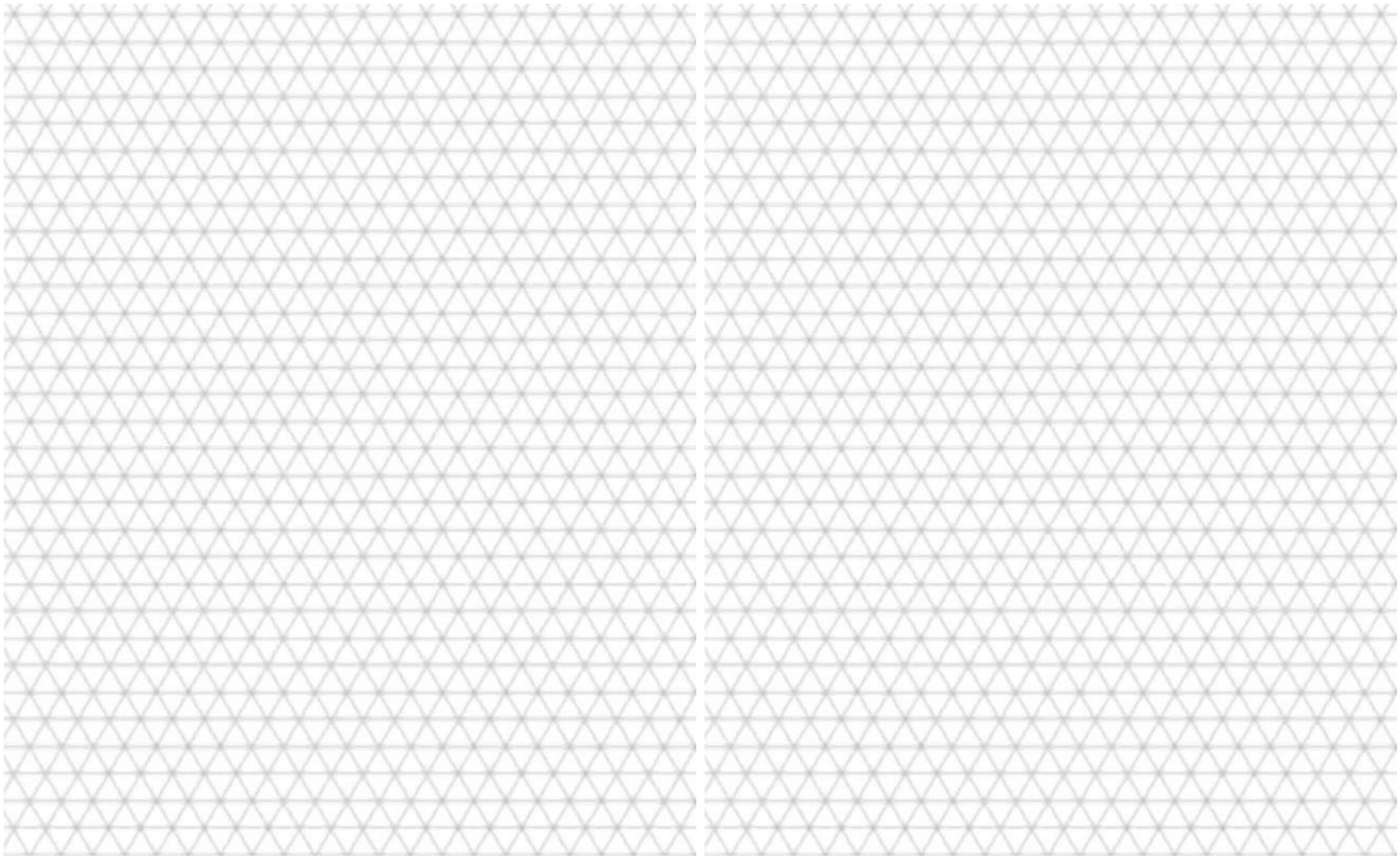
Challenge Task

Render all shapes to show light and shadow

SUCCESS CRITERIA

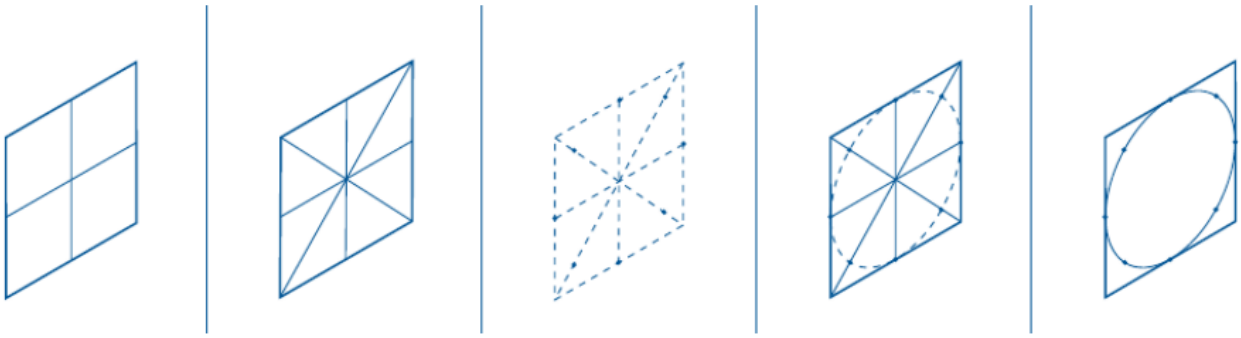
1. **Use Construction and Positive Lines**
2. **Accurate lines using a ruler**
3. **Draw on the grid lines.**
4. **Front and Back edges to be parallel**
5. **Colour shading included to show light and dark surfaces**

Use the easy, achievable and challenge tasks from the previous page draw some shapes in isometric (these links will help: https://www.youtube.com/watch?v=LY5OqKhEP9k
& http://www.youtube.com/watch?v=ZBuhGaGPYfQ)

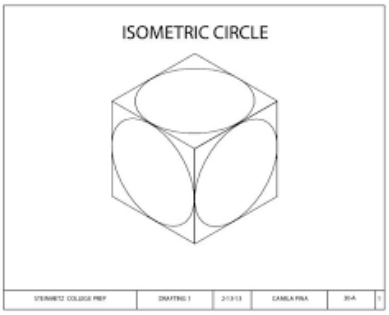


TASK 7: Isometric shapes

TASK: Sketching CIRCLES in 3D using Isometric

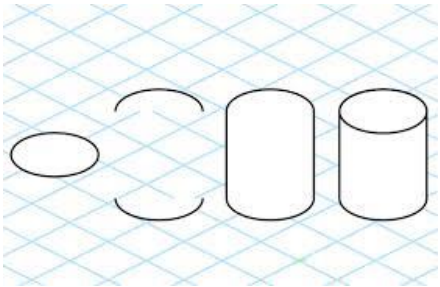


Use these links to see it being done: https://www.youtube.com/watch?v=AiGCMxWyRos & https://www.youtube.com/watch?v=Hg16J_4tmPk



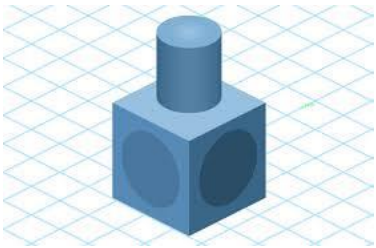
EASY

Use isometric paper to draw circles on all three sides of a cube



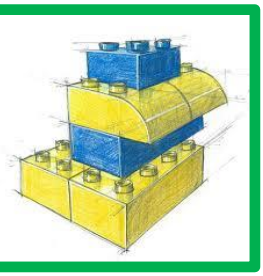
Achievable by all

Use isometric paper to draw some cylinders



Challenge Task

Draw more complex shapes



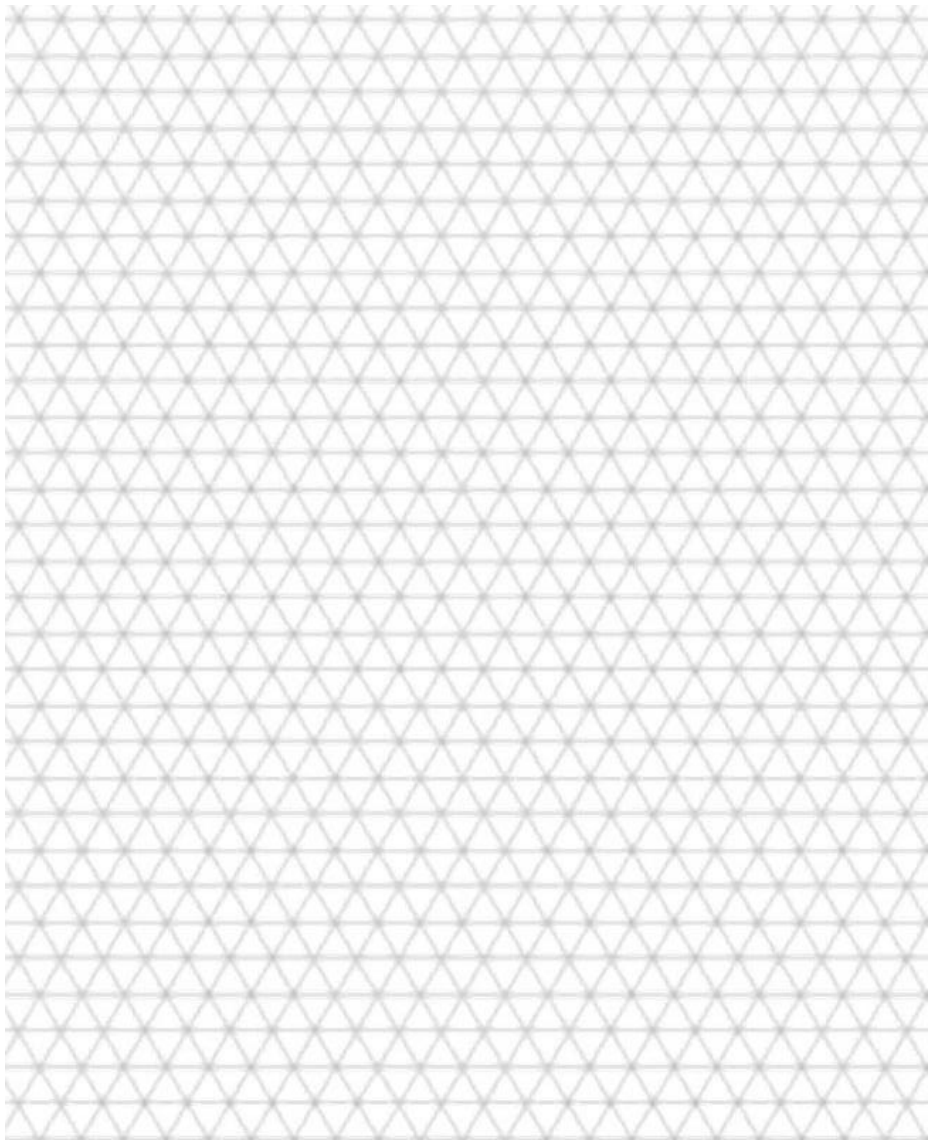
Challenge Task

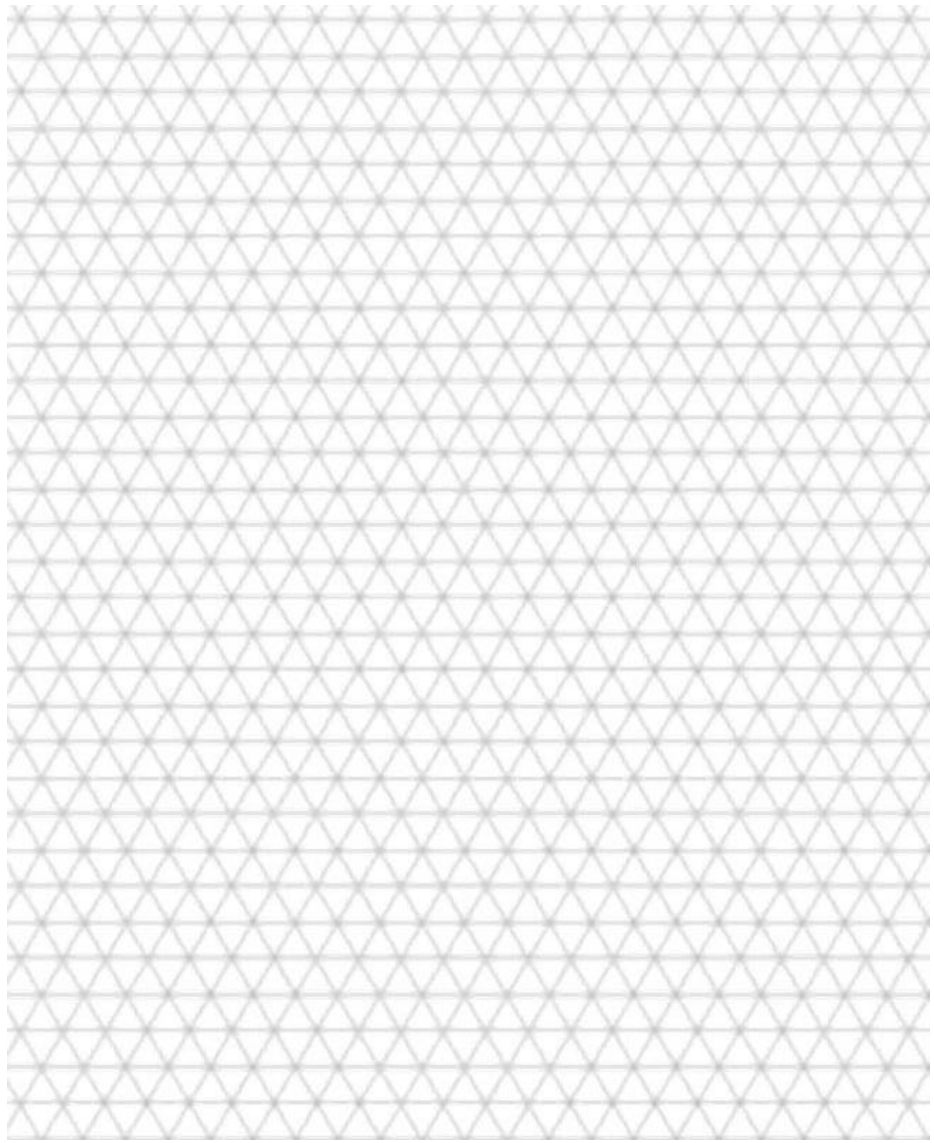
Render all shapes to show light and shadow

SUCCESS CRITERIA

1. **Use Construction and Positive Lines**
2. **Accurate lines using a ruler**
3. **Draw on the grid lines.**
4. **Front and Back edges to be parallel**
5. **Colour shading included to show light and dark surfaces**

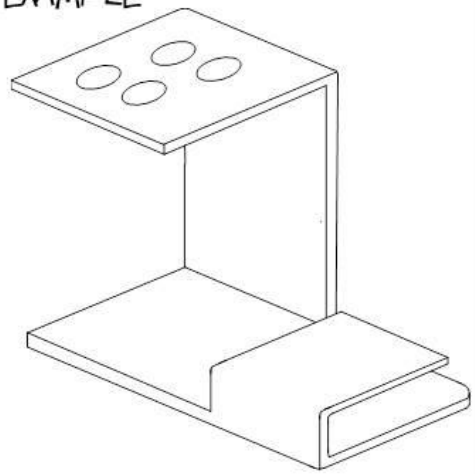
Use the easy, achievable and challenge tasks from the previous page draw some CIRCLE shapes in isometric (these links will help: https://www.youtube.com/watch?v=Hg16J_4tmPk & https://www.youtube.com/watch?v=AiGCMxWyRos





TASK 8: Isometric shapes

EXAMPLE



NAME:.....

KS4 ISOMETRIC DRAWING – DESK TIDY

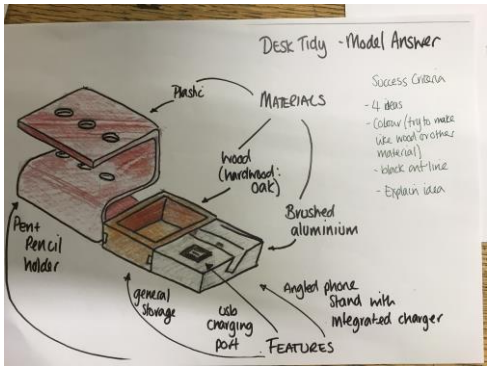
DRAW WITH RULER AND PENCIL HOW YOU THINK YOUR DESK TIDY WILL LOOK WHEN CONSTRUCTED

COLOUR. AND LABEL YOUR DRAWING

TASK 9: Isometric drawing task

Develop the desk tidy:

Draw your own version of a desk tidy (don't just copy this example!)



NAME:.....

KS4 ISOMETRIC DRAWING – DESK TIDY

DRAW WITH RULER AND PENCIL HOW YOU THINK YOUR DESK TIDY WILL LOOK WHEN CONSTRUCTED

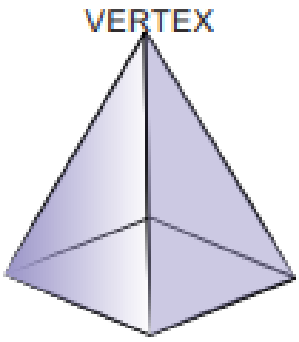
COLOUR. AND LABEL YOUR DRAWING

TASK 10 – Isometric Development Task

TASK 11: Maths – Faded example

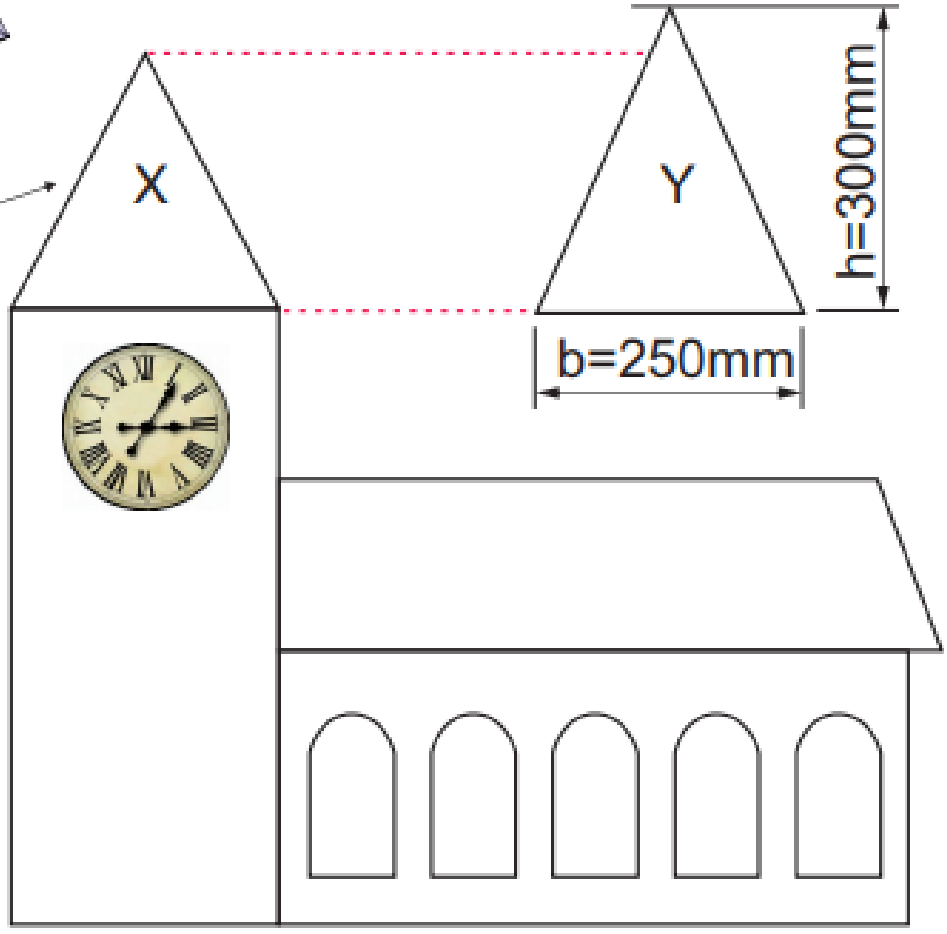
Steps	Worked Example	Partial Example	Q1	Q2
Question: Circle and Highlight	The table shows the number of plastic bags given away in England. Calculate the percentage reduction in bags given away Give your answer to the nearest whole number Year: 2014 — Number of Bags (billions): 7.6 Year: 2015 — Number of Bags (billions): 5.4	The table shows the increase in the amount of waste going to landfill in the last 2 decades. Calculate the percentage increase to one decimal place Year: 2000's — Waste in Tonnes (billions): 3265 Year: 2010's — Waste in Tonnes (billions): 4391	Calculate the increase in screen size from the iphone5 to the iphone 11 pro max as a percentage to 2 decimal places Model: 5 — Screen area (mm2): 36.65 Model: 11 pro — Screen area (mm2): 76.7	Calculate the percentage decrease in Ash trees due to Ash Dieback since 2007 Number of trees: 14611 — year: 2007 Number of trees: 6822 — year: 2017
Write out data and change units (if needed)	Find difference 7.6-5.4=2.2	Find difference 4391-3265=1126	Find difference 76.7-36.65=	
Write out equation	Percentage = Difference/total*100 2.2/7.6*100	Percentage= Difference/total*100		
Solve	Answer = 28.94			
Convert to correct format	Nearest whole number 29			

TO HELP YOU ANSWER THIS QUESTION Follow the link below.
http://www.technologystudent.com/pdf14/maths5.pdf (page 8)



27. Below is a model a typical village church.
The roof of the tower is a square pyramid.

A. What is the area of one side of the square pyramid?

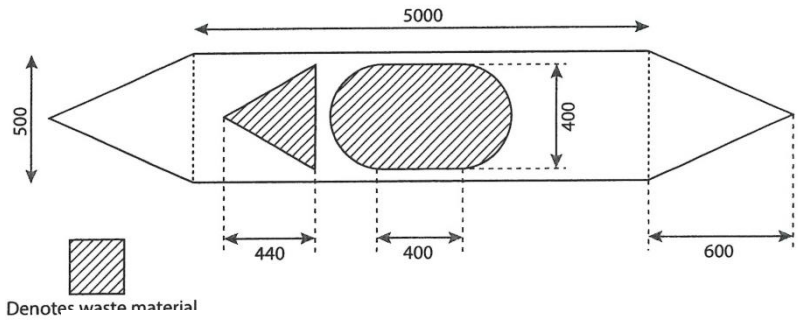


AREA = 1/2 X BASE X HEIGHT
6 marks

B. The labels X and Y represent the same part, one side of the square pyramid. Why does Y appear taller than X ? ***2 marks***

TASK 13 – Maths – practice exam question

(c) Figure 18 shows the plan view of the kayak.



AI Calculate how much polyethylene is wasted from the whole piece, in cm2.

Give your answer to 2 decimal places.

Area of a circle = $\pi \times r^2$

Area of a triangle = ½ × base × height

Use $\pi = 3.142$

TASK 14 – Extended Answer – practice exam question

Figure 16 shows a pine roof truss for a house.

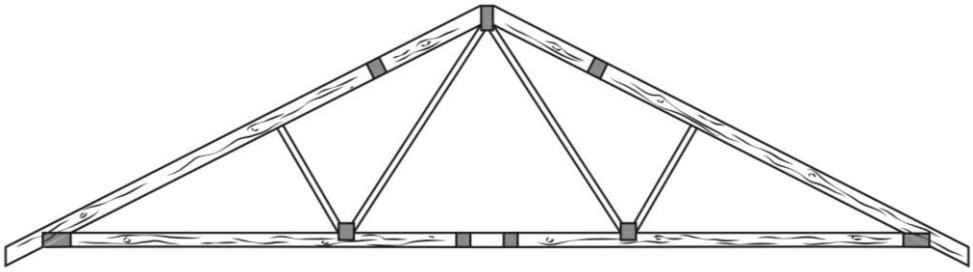


Figure 16

The roof trusses are manufactured in Europe and transported worldwide.

Figure 17 shows a table with information about the roof truss.

Scale of production	Mass
Material	Pine
Material source	Alpine forests
Size	6 m long 3 m high
Surface finish	Fireproof coating

Figure 17

Analyse the information in Figure 17.

Evaluate the roof trusses with reference to their social footprint including:

- trend forecasting
- impact of logging on communities
- ease and difficulty of recycling and disposal.

(9)

Read these pages from the textbook about SOCIAL FOOTPRINT & ECOLOGICAL FOOTPRINT:
https://churchdownschool-my.sharepoint.com/:b:/p/nrs/EVuUSaSWcjFAiRGibcbypr4BqWnggsYRN7rfL8trJCi-3Q?e=GOUzo4

Social footprint and Ecological Footprint are slightly different but have the same idea of saving the planet behind them.

ANSWER the question that is above on the next page in **300 words** or more

TASK 14 – Extended Answer– practice exam question

The roof trusses are manufactured in Europe and transported worldwide.

Figure 17 shows a table with information about the roof truss.

Scale of production	Mass
Material	Pine
Material source	Alpine forests
Size	6 m long 3 m high
Surface finish	Fireproof coating

Figure 17

Table of information

Write about each of these points (that are in the reading) and relate them to the information in the table

Analyse the information in Figure 17.

Evaluate the roof trusses with reference to their social footprint including:

- trend forecasting
- impact of logging on communities
- ease and difficulty of recycling and disposal.

Points to include

300+ WORDS

TASK 14 Continued – practice exam question

TASK 14 – Design Technology Reading list

If you have any thoughts about becoming an engineer, or you want to get an apprenticeship then you should start looking at these web sites:

How Stuff Works:
https://www.youtube.com/user/HowStuffWorks

Story of Stuff Project (clue is in the title!):
https://www.youtube.com/user/storyofstuffproject

Design Technology TV on You Tube:
https://www.youtube.com/channel/UCrEUBLZSlhI-8Dxx2pBfZRw

How to be a champion:
https://www.youtube.com/watch?v=px9CzSZsa0Y

Science (Spoiler! – DT uses science all the time!)
https://www.youtube.com/playlist?list=PLAaFUKkgClHDUxumPsnlfJDjINFVw7XEC

DT site – This is the site that teachers use for a lot of our resources
http://www.technologystudent.com

Another DT site:
http://www.mr-dt.com/default.htm

Yet another DT site (useful at GCSE for research)
http://wiki.dtonline.org/index.php/Main_Page

BBC Bite size – great for revision (this link takes you to GCSE and our exam board – Edexcel)
https://www.bbc.co.uk/bitesize/examspecs/zb6h92p