






Designing

Ergonomic	An ergonomic design is safer and more comfortable to use. Add softer or rounded edges to make your speaker more ergonomic to handle
Chamfer	You can add a chamfer to the edges of your speaker by filing or sanding an angle on each edge
Precision	You will need to be precise in measuring your template, to allow the sound to reverberate through the speaker
Upcycling	You will be upcycling hardwood for your speaker. The Iroco was once a science worktop!

Materials

Hardwood	Dense wood, taken from slow growing deciduous trees. These trees lose their broad leaves in winter.	
Softwood	Lighter, less dense wood taken from fast growing conifers. Conifers are ever-green trees that have needle-like leaves	
Iroco	A dark reddish brown hardwood. Often used for worktops and benches it has a close grain	
Pine	A yellow-coloured softwood. Pine has a clearly visible and attractive grain pattern	
Grain	The pattern of lines in wood. Grain is caused by slicing through the growth rings in trees	

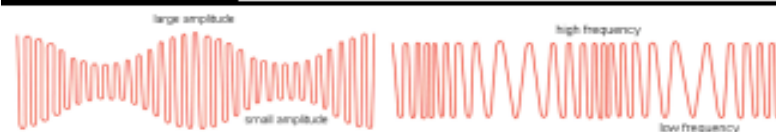
Manufacture

Wasting	Shaping by wasting is removing material by cutting, filing or drilling. The material removed is 'wasted'
Bespoke	A one-off product designed and made for a specific purpose or client. Often a bespoke product is 'made to measure'
Template	You will create a template that fits your own smartphone. Your template needs to make allowances for the speaker holes in your phone
Cone Drill	You will use a cone drill to make conical holes for your speaker. This will help the sound reverberate and project forward



Explore—STEM links

Amplitude	The height of a sound wave. The loudness of a sound signal depends on the height of the amplitude
Frequency	The number of sound waves per second is measured in Hertz (Hz). 1Hz is equal to one complete sound wave cycle per second
Pitch	The pitch of a sound signal is determined by the frequency or number of cycles per second. Higher pitch sounds have higher frequencies



Functionality

Acoustic	A non-electronic way of transmitting a sound. Any instrument that doesn't need to be plugged in is an acoustic instrument. Examples include brass (saxophone), guitar, cello or drums
Amplifier	A system that makes sound louder. Amplifiers are normally electronic, boosting a sound signal's amplitude.
INPUT	The sound signal going into the speaker
OUTPUT	The louder, amplified sound coming out



Critique

ACCESSFM	An acronym which designers use to evaluate products. Each letter stands for a different aspect for evaluation
	A = Aesthetics; how the product looks
	C = Cost; how much to make or buy
	C = Customer or client; who the product is for
	E = Environment; is the product harmful to the planet?
	S = Safety; is the product safe to use
	S = Size; is the product the right size
	F = Function; how does it work, how well does it work
	M = Materials; what is it made from, is it a good use of materials

Vocabulary used in materials—Hardwood Softwood safety goggles apron pillar drill cone drill adhesive template sanding sealer wood finishing vice

Health and Safety - Wear protective clothing. Tie long hair back. Listen to instructions. Use the correct technique. Stay calm and sensible at all times. Tidy up after you have finished. Use the correct equipment safely

Polymers Knowledge Organiser Resist ant Materials

Property	Definition	Found in
polymer	The umbrella term for synthetic materials engineered from a string of monomers.	plastics, paints, man-made fibres. DNA is an example of a natural polymer.
plastic	A synthetic polymer available in many different types, widely used in packaging, product cases, toys and the car industry.	universal applications from toys to artificial limbs
thermoplastic	A polymer material which can be deformed and reformed using heat processes.	acrylic, polystyrene, ABS, nylon
thermoset plastic	A polymer that, once set, cannot be changed using heating processes, thereby making it more resistant to heat and fire.	urea formaldehyde (UF) is one of the most common types and is used in electrical fittings such as plugs and sockets. Bakelite, now rarely used, was an early plastic used commonly in the UK.
memory plastic	Some thermoplastics can be deformed using heat and then reformed back to their original shape using heat again. The polymer chains return to their original state hence 'memory'.	high impact polystyrene (HIPS) can be reverted to its original state when vacuum forming
stiffness	A material that resists bending, remains rigid.	acrylic, UF, polystyrene
tough (durable/strong)	Able to withstand rough handling or treatment. Offers good weather resistance.	polystyrene, PVC, ABS
transparent	A polymer that is clear-offering the same visual properties as glass, but with the safety benefits of often being shatterproof.	acrylic safety glass, moulded shapes such as jet-plane canopies, cellophane product packaging
brittle	A material which, through its stiffness and other properties, has less toughness and therefore may snap or crack in some situations.	acrylic, UF, Bakelite

Thermoplastics	Thermosetting Plastics
<p>Acrylic: A hard, tough thermoplastic available in sheet form and as granules for moulding. In its clear form, it makes a safe alternative to glass. Stiff, hard, durable, self-finishing, scratches easily.</p> <p>Used in bicycle reflectors, car lights, safety glass, clothing.</p> <p>Polyethylene Terephthalate (PET): One of the most common day-to-day thermoplastic polymers, widely used in food packaging and (in fibre form) clothing. Chemical-resistant, hard, stiff, strong.</p> <p>Used in drinks bottles, food packaging, cosmetic packaging.</p> <p>High Impact Polystyrene (HIPS): Inexpensive and widely used in many products as it is easily moulded. Suitable for food packaging. Flammable and not widely recycled. Expanded polystyrene is used in product packaging. High-impact, easy to shape, lightweight.</p> <p>Used in low strength structural applications, vacuum formed packages and casings.</p> <p>Polyvinyl Chloride (PVC): Good chemical and weather resistance, stiff, hard, tough, good insulator.</p> <p>Used in construction-window frames, drain pipes, guttering. Widely used in the fashion industry in the flexible form of PVC.</p> <p>Polypropylene (PP): Lightweight, hard, impact resistant, chemical resistant. Waxy finish.</p> <p>Used in medical equipment, syringes, chair shells, kitchenware, crates.</p>	<p>Silicone: Heat-resistant and rubber-like, this thermoset plastic is available in liquid form in many products. It is waterproof and mouldable. It is also heatproof and non-stick.</p> <p>Used in food preparation, cake moulds, medicine, prosthetic body parts, baby toys.</p> <p>Epoxy Resin (ER): High strength, good chemical and wear resistance, resists heat to 250°C.</p> <p>Used in castings, adhesive, laminating paper, printed circuit boards.</p> <p>Melamine Formaldehyde (MF): Stiff, hard, scratch resistant, brittle and dulls easily.</p> <p>Used in decorative laminates for work surfaces and flooring, tableware, electrical insulation.</p> <p>Phenol Formaldehyde (PF): Retains properties at low temperature, heat-resistant, easy to shape by casting.</p> <p>Used in Bakelite products, coatings, adhesives, laboratory tops.</p>



Metals Knowledge Organiser

Resistant Materials

ferrous: Metals that contain iron. Besides iron itself, all ferrous metals are alloys.

iron: Heavy and strong, iron is most commonly found nowadays in various alloys. Historically, iron was the key material which enabled the industrial revolution to thrive in the UK. Machines, bridges and weapons could all be cast in iron, allowing mass-production.

Used in heavy kitchen skillets, radiators and fireplaces in older houses.

The Iron Bridge
(opened 1781) in Shropshire was the first bridge to use cast-iron structurally.



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ferrous alloys

mild steel: General purpose metal for general engineering. Good strength and cold-forging properties. Corrodes quickly without protection. Can be welded and braised.

Used in structural components, general workshop projects.

high speed steel: Very hard, resistant to frictional heat.
Used in lathe cutting tools, drills, milling cutters.

high carbon steel: Very hard, difficult to cut, easily joined by carbon treatment.
Used in hand tools, hammers, screwdrivers, chisels.

stainless steel: Hard, tough, resists wear, corrosion resistant, difficult to cut.
Used in dishes, sinks, teapots, cutlery.

non-ferrous: Metals that do not contain iron.

aluminium: High strength to weight ratio, light, soft, difficult to join.
Used in kitchen utensils, packaging, cans, foils, window frames.

copper: Bright and decorative colour when polished. Corrosion resistant. Soft and easy to work by hand. Good heat and electrical conductor.

gold: Soft, malleable, ductile, often alloyed to give more strength, doesn't corrode or tarnish.
Used in jewellery, electronics, hi-fi equipment, dentistry.

tin: Soft, corrosion-resistant pure metal. Silver-coloured and bright when polished. Can be worked by hand. Used to plate other metals.

non-ferrous alloys

brass: Corrosion resistant, casts well, work-hardens, polishes well.
Used in castings, boat fittings, ornaments.

bronze: Corrosion resistant, casts well, work-hardens, polishes well.
Used in castings, boat fittings, ornaments, statues.

pewter: Soft alloy of tin, copper, lead or silver. Low melt temperature makes it ideal for casting projects.
Used in sand-casting, old-fashioned tableware.

solder: Soft alloy, usually made from copper and tin. An added substance, called flux, allows the solder to flow over other metals when heated.
Used in jewellery manufacture, electronics.

Properties of Metals

Property	Definition	Found in
brittle	Hard, but easily broken or cracked.	cast-iron, steel with high carbon content.
conductor	Metal which allows heat or electricity to flow through it easily.	copper, gold, brass.
corrode	To become damaged by chemical reaction (normally water).	ferrous metals in the form of rust, some alloys become powdery.
corrosion-resistant	A metal which resists damage by chemical reaction.	copper, gold, bronze.
ductile	Can be deformed without losing toughness.	lead, copper, gold.
hard	Not easily bent or broken.	steel, iron, brass.
lightweight	A metal which has a good strength-to-weight ratio.	aluminium, duralumin.
malleable	Can be deformed by beating, bending or pressing into shape.	lead, copper, gold, silver, tin
soft	Metals with comparatively low melting temperatures. Easily scratched and malleable.	lead, copper, gold, tin.
tensile strength	A material with good tensile strength resists breaking under tension.	steel, iron, aluminium.
tough/durable/strong	Able to withstand rough handling or treatment.	iron, stainless steel.