



ROUTE A · PLANNING MANUFACTURE
Metal by hand

LEARNING INTENTION

Plan and make my EarBuddy from 1 mm aluminium sheet using hand tools and a pillar drill.

SUCCESS CRITERIA · I can...

- ☐ mark out sheet metal accurately
- ☐ cut, shape and drill aluminium safely
- ☐ finish the edges and surface to a high quality

Aluminium sheet · 1 mm

Type	Non-ferrous metal (contains no iron)
Properties	Lightweight, does not rust, easy to cut and bend
Cut with	Tin snips; junior hacksaw for slots
Finish	Emery cloth, then metal polish



Tools & equipment

 Steel rule measures in mm	 Scriber scratches a fine line	 Engineer's square marks lines at 90°	 Odd-leg callipers lines parallel to an edge	 Centre punch marks hole centres	 Straight tin snips straight cuts & outside curves
 Curved tin snips tight curves	 Junior hacksaw cuts slots	 Flat file edges & draw filing	 Half-round file inside curves	 Hand vice holds sheet for drilling	 Pillar drill drills holes

WORKSHOP SAFETY

- Wear **goggles** when cutting, filing and drilling.
- Cut edges and **burrs are razor sharp** — handle sheet carefully and file burrs off straight away.
- Pillar drill: guard down, hair tied back, tie and sleeves tucked in.
- **Clamp** the sheet in a hand vice — thin sheet can spin and cut you.
- Remove the chuck key before switching on. One person at the machine.
- **Never wear gloves** at the pillar drill — they can be pulled in.

CHECK YOUR UNDERSTANDING

1 Choose two safety rules from above. **Explain** why each one keeps you safe.

How to make it

1 Mark out

- Stick or hold your paper template on the aluminium and scribe round it.
- Use **odd-leg callipers** for lines parallel to an edge and an **engineer's square** for 90° lines.
- Mark each hole centre with two crossing lines, then tap a **centre punch** on the cross.



2 Cut

- Cut away the waste in small pieces with **tin snips**. Stay about 1 mm **outside** the line (on the waste side).
- Straight snips for straight lines and outside curves; **curved snips** for tight curves.
- For a slot: drill a hole at the end, then cut the sides with a junior hacksaw.



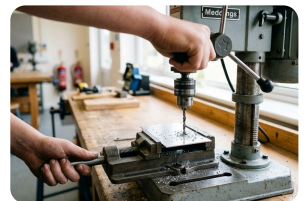
3 Shape

- Hold the sheet **low** in the vice. **Cross file** down to the line to remove metal quickly.
- Draw file** (file held sideways, pushed along the edge) for a smooth, straight finish.
- Use needle files in slots. Round every corner and **remove all burrs** from both sides.



4 Drill

- Check your centre-punch mark. Clamp the sheet in a **hand vice**, with scrap wood underneath.
- A **step drill** gives a clean, round hole in thin sheet.
- Drill slowly with light pressure. Remove the sharp burr round the hole afterwards.



5 Finish

- Rub the edges with **emery cloth** wrapped round a file: coarse first, then fine.
- Polish the surface with **metal polish** and a soft cloth for a bright shine.
- Or: rub in one direction with fine emery for a **brushed** look. Your teacher may **dip coat** it in plastic using the fluidiser.



Drilling with the work clamped



A step drill cuts clean holes in thin sheet



A fluidiser for plastic dip coating (teacher only)

COMMON MISTAKES

- Cutting right on the line — leave 1 mm to file off.
- Twisting the snips, which bends the sheet. Keep the blades upright.
- Drilling without a centre-punch mark — the drill wanders.
- Leaving burrs on — check edges with emery cloth, never by running a finger along them.

Extension

Want a 3D shape? Sheet aluminium can be bent in a vice using folding bars — ask your teacher.

My manufacturing plan

SEQUENCE OF OPERATIONS

2 Plan every step in order. Use page 2 to help. For each step, list the tools and a safety point.

#	What I will do	Tools & equipment	Safety
1			
2			
3			
4			
5			
6			
7			
8			
9			

CUTTING LIST

3 What size of material do you need? Add 5 mm to each side of your design.

Part	Material	L	W	T	Qty
Main body	Aluminium sheet			1 mm	1

L = length · W = width · T = thickness, all in mm

MY FINISH

4 Which finish will you use and why?

QUALITY TARGETS

Professionals work to a **tolerance** — how far a size is allowed to be from the drawing. Check your work against these targets as you go.

Outline within ± 1 mm of the template	± 1 mm
All edges smooth, no burrs	no burrs
Corners rounded to at least R3	$\geq R3$
Holes in the right place	± 0.5 mm
Surface polished, no deep scratches	shine

Making log & evaluation

MAKING LOG

5 At the end of each workshop lesson, record your progress.

Lesson	What I did	A problem & how I solved it	Next lesson I will...
9			
10			
11			

MY EARBUDDY

Sketch or stick a photo of your finished EarBuddy.

FINISHED PRODUCT

LESSON 12 · EVALUATION

6 Test your EarBuddy against your specification.

Specification point	Met?	Evidence
	☐ ☐	
	☐ ☐	
	☐ ☐	
	☐ ☐	
	☐ ☐	

Tick first box = met, second box = not met.

REFLECT

What went well in the workshop?

IMPROVE

If you made it again, what would you change and why?

Teacher check: quality targets met ☐ all ☐ most ☐ some

Signed _____