AQA

GCSE
DESIGN AND TECHNOLOGY: RESISTANT MATERIALS TECHNOLOGY

Unit 1 Written Paper

June 2018

Preliminary Material

Instructions

- This Preliminary Material will be given to you on or after 1 March 2018.
- The context for the question in Section A of the paper is given below.
- Between 1 March and the examination date you will have the opportunity to research the context with the guidance of your teacher.
- **No Preliminary Material or any associated material may be taken into the examination room.**

Information

- The Preliminary Material is to be seen by teachers and candidates **only**, for use during preparation for the examination on Thursday 14 June 2018. It **cannot** be used by anyone else for any other purpose, other than as stated in the instructions issued, until after the examination date has passed. It must **not** be provided to third parties.

Context: Organising remote controls in the home.

Preliminary Material 2018

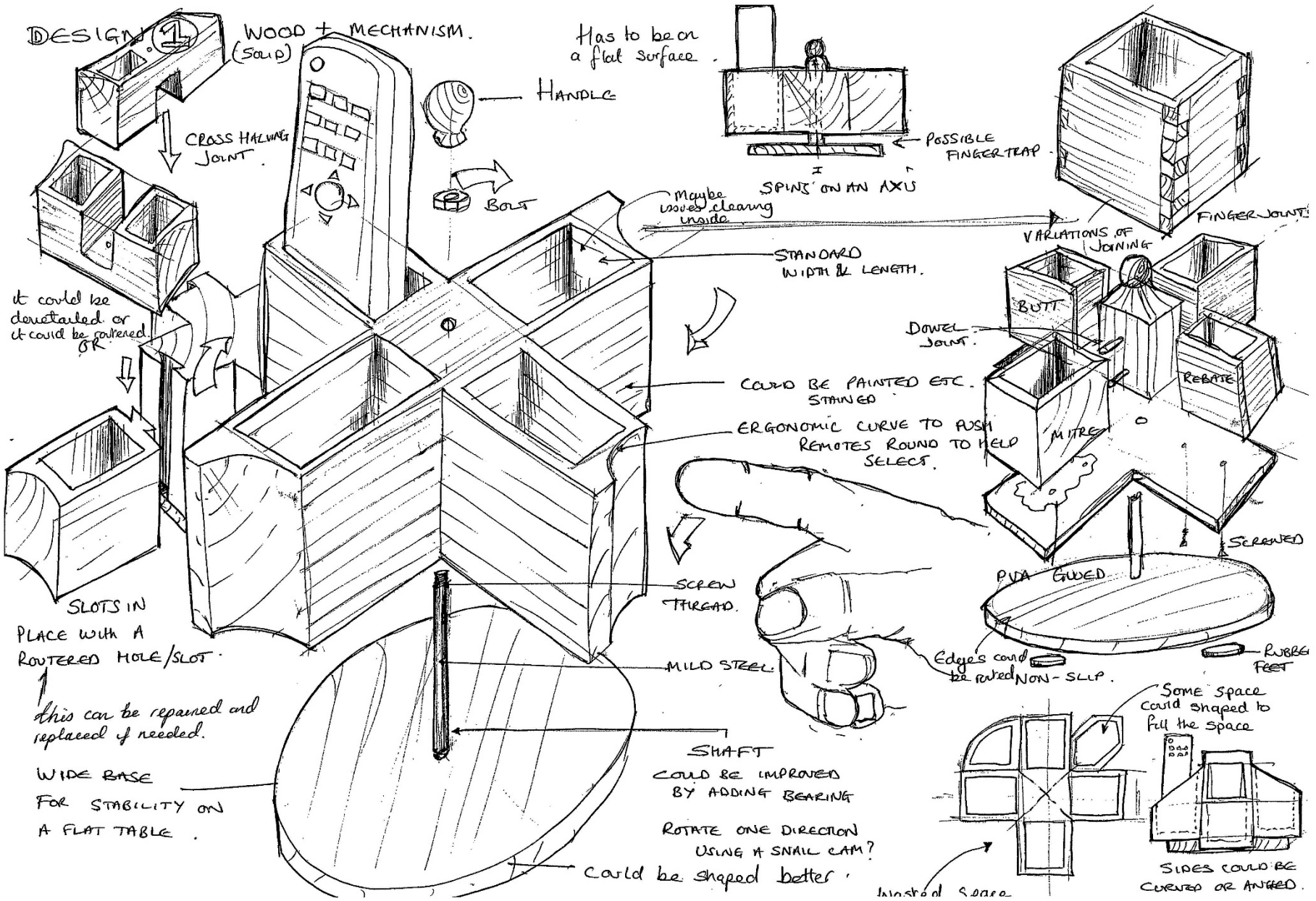
CONTEXT :- REMOTE CONTROL STORAGE

Keep it simple and explain:

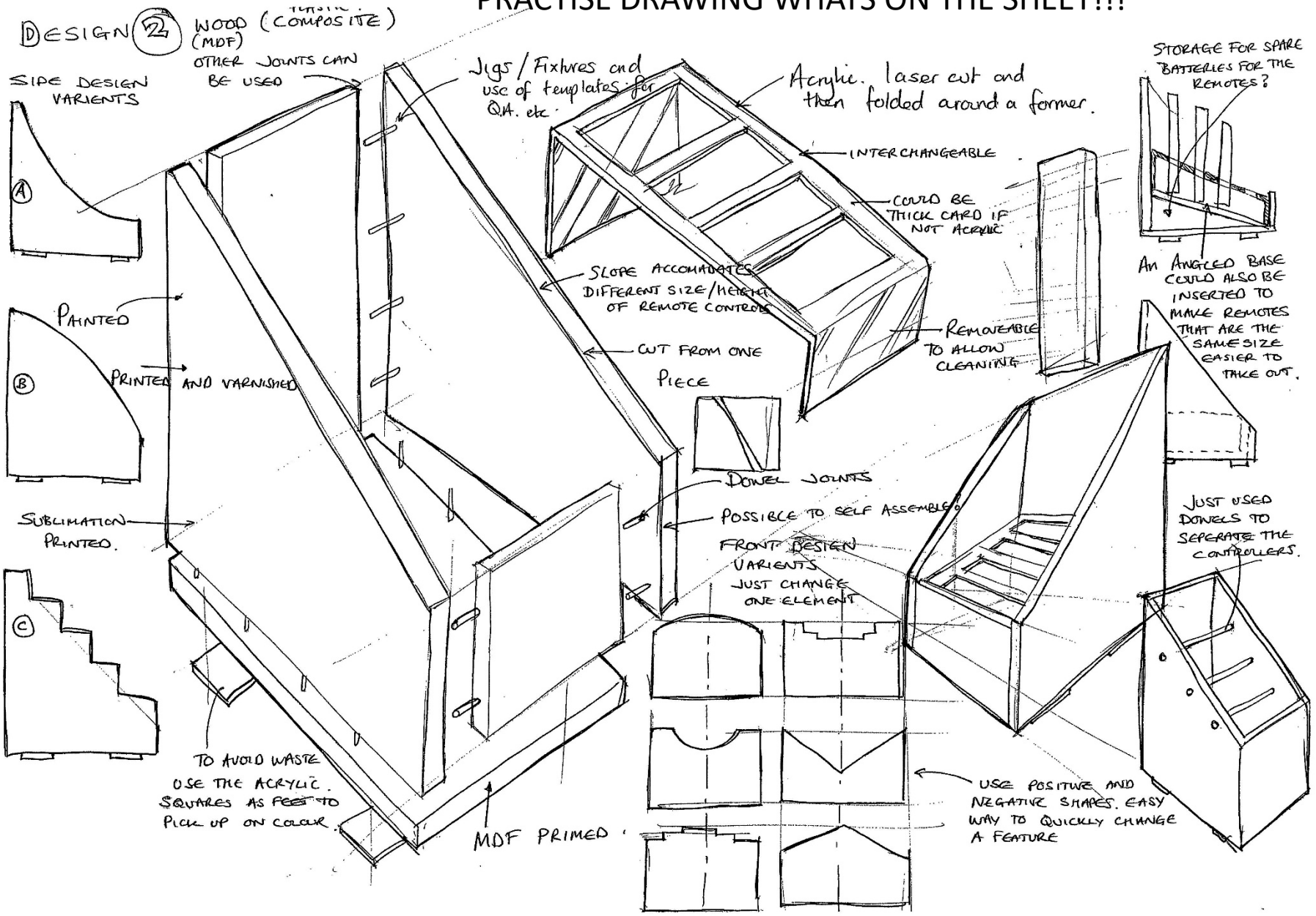
Materials

Construction techniques

PRACTISE DRAWING WHATS ON THE SHEET!!!



PRACTISE DRAWING WHATS ON THE SHEET!!!



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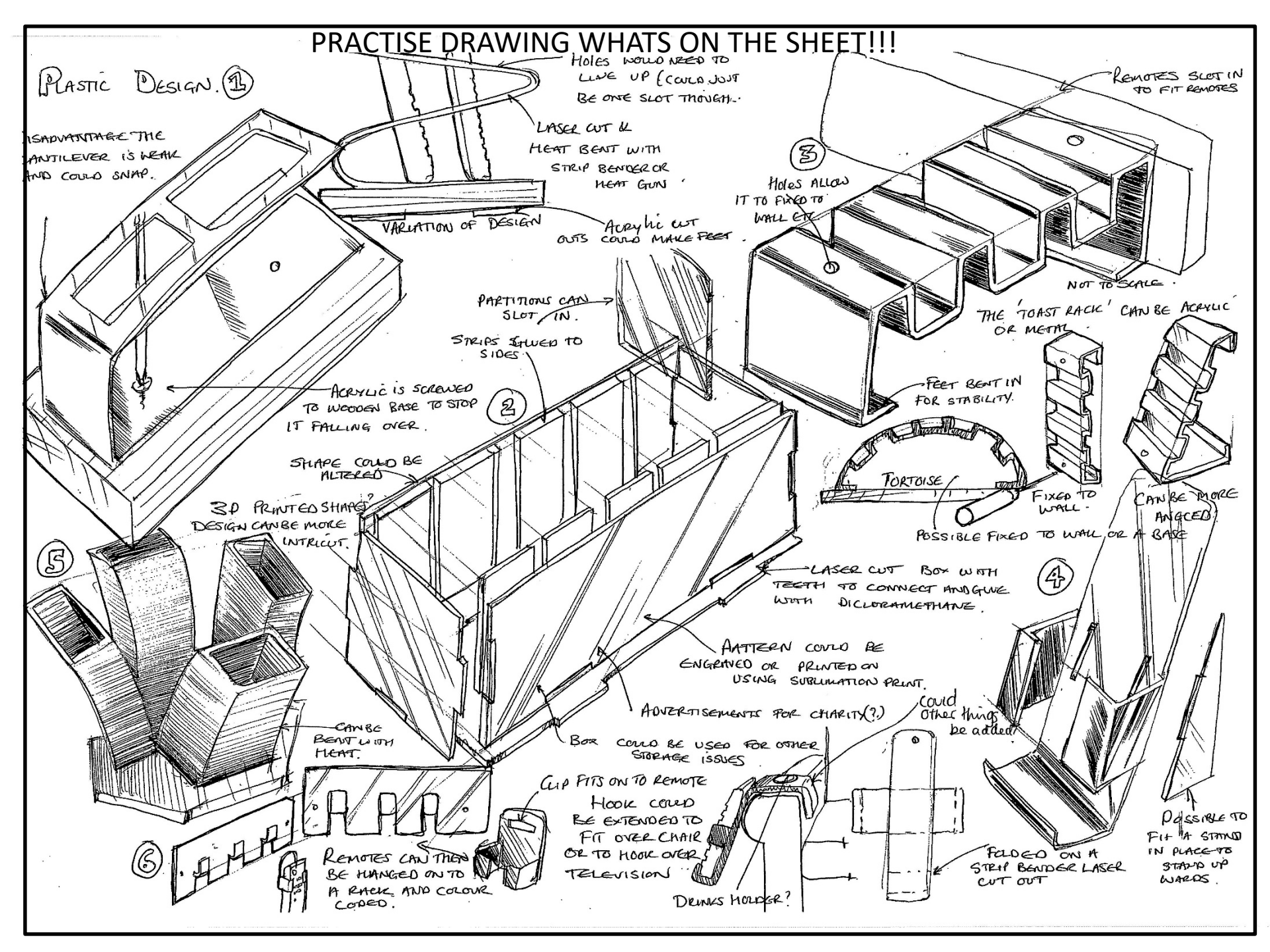

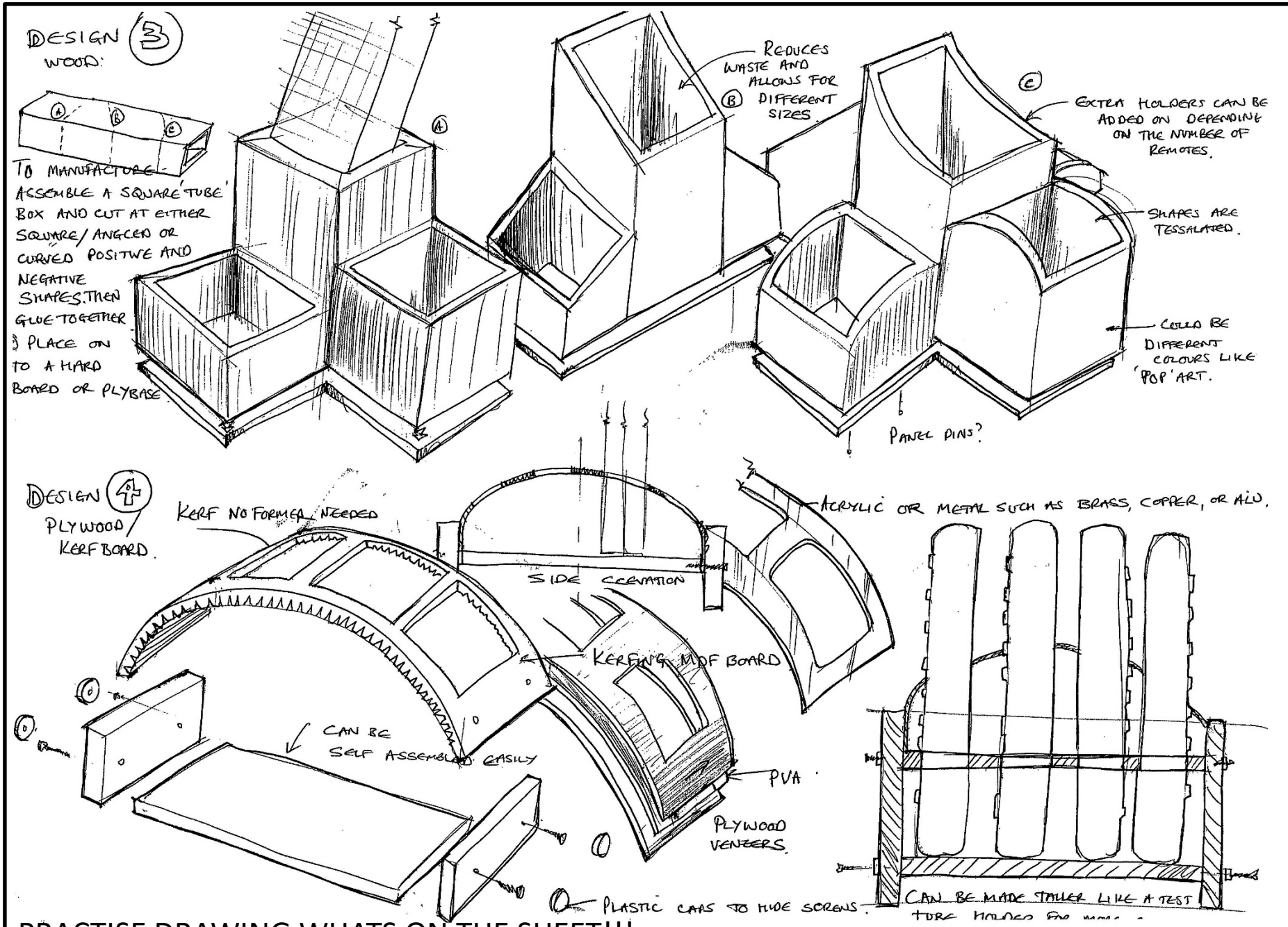

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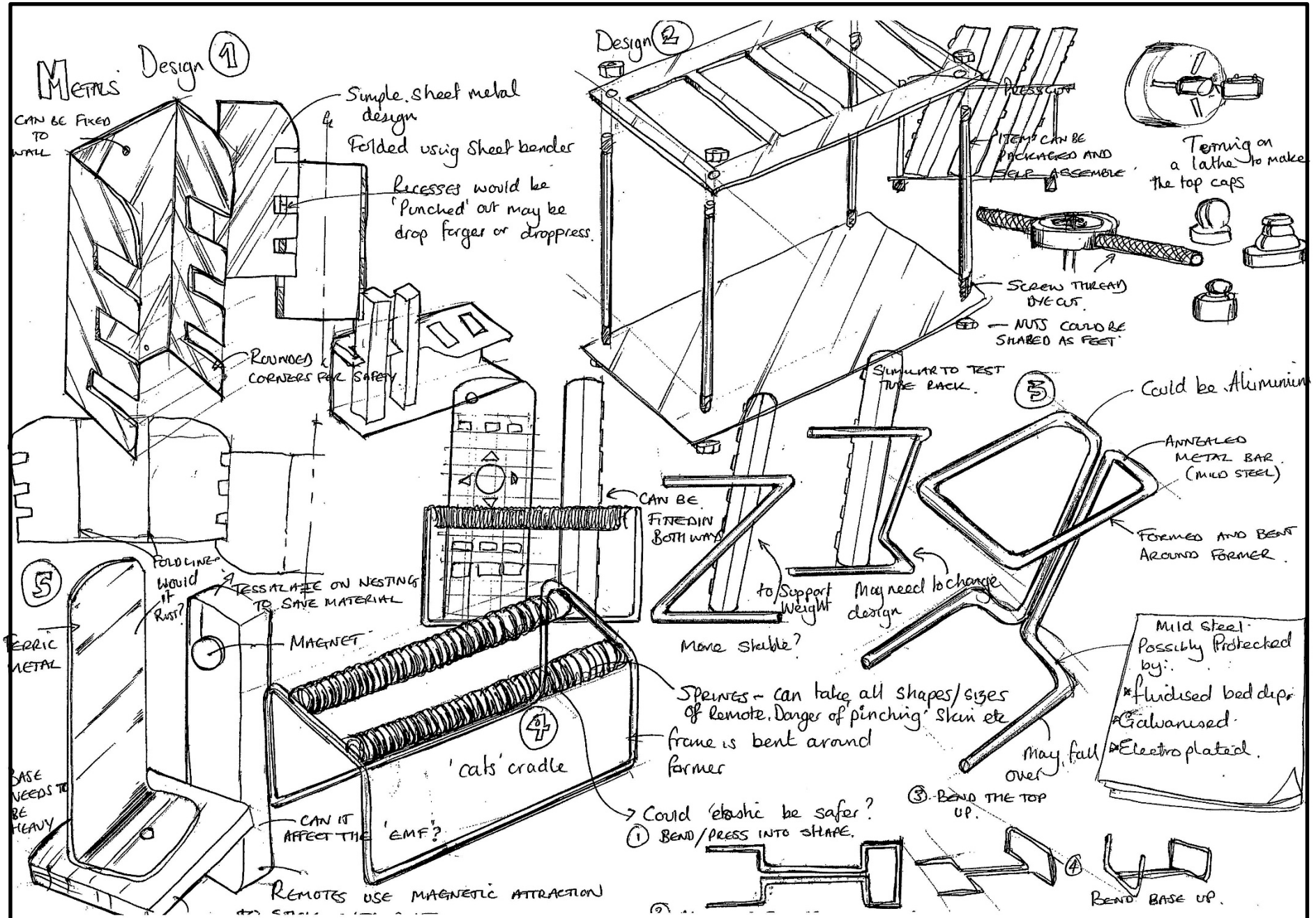
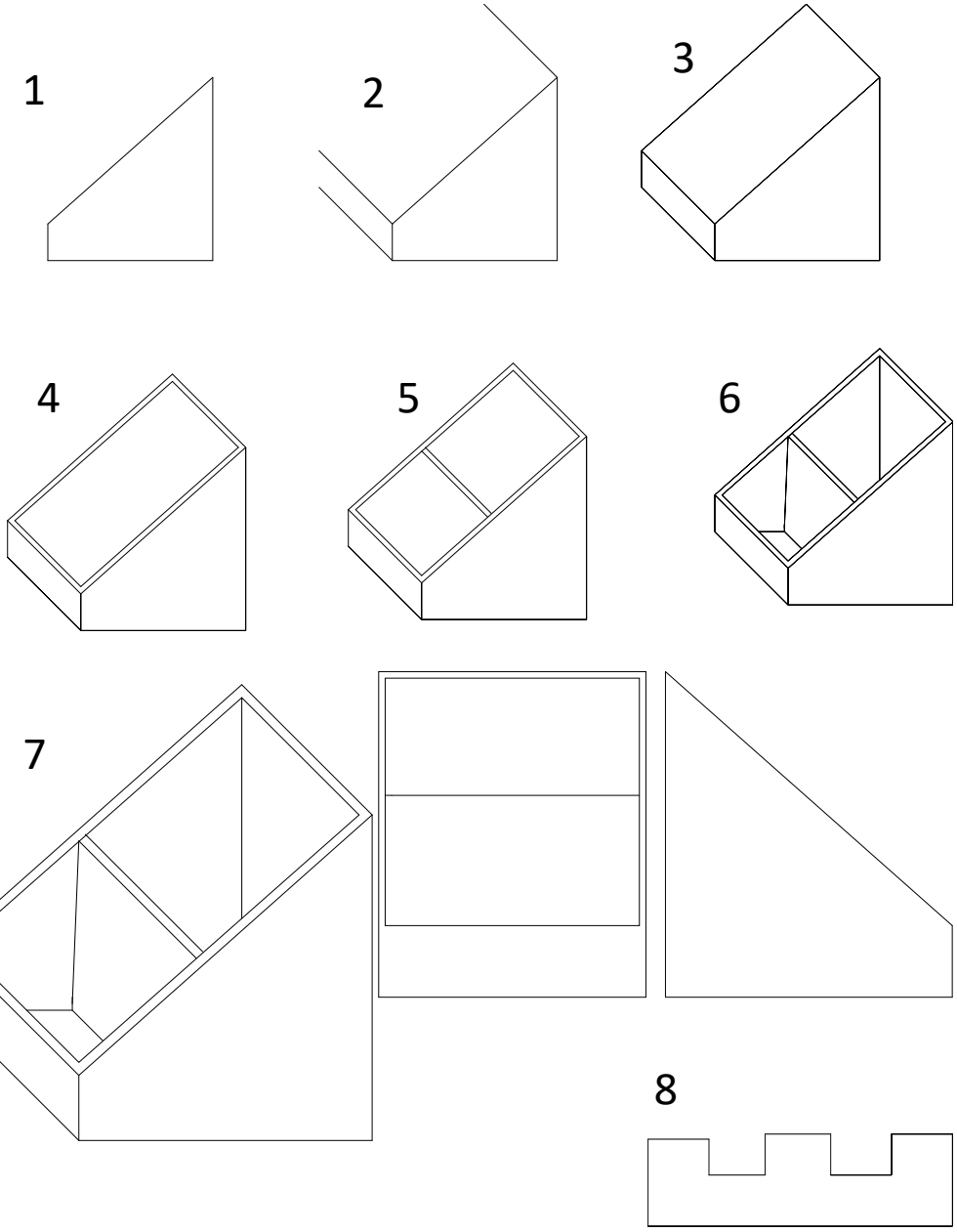


PRACTISE DRAWING WHATS ON THE SHEET!!!

PRACTICE DRAWING A BASIC HOLDER



1 Draw your profile of the side of the shape in 2d (flat)

2 Project your lines away from every corner. Keep them the same length and the same angle (ideally 45o)

3 Draw in the edges if the other sides.

4 Draw a square inside the op edge.

5 Draw a line across the square to partition the inside of the box.

6 Project the lines down to complete the drawing.

7 To fill the space draw the front view and side view next to it as these can often provide areas TO ADD DETAIL AND ANNOTOATE.

8 TRY EXPIRIMENTING WITH DIFFERENT SHAPES !

PRACTISE DRAWING WHATS ON THE SHEET!!!

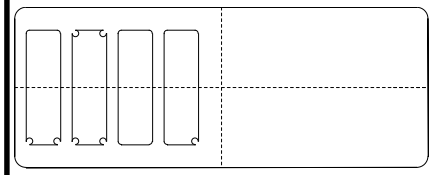
Assume that this product will need to be manufactured out of Card and covered with faux leather.

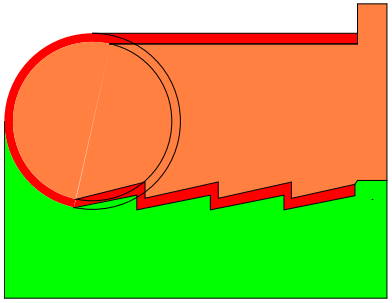
1) Name a suitable type of plastic and explain why you have selected that material (properties etc.).

2) What GSM of card have you chosen and why?

3) Looking carefully at this image how this product would be manufactured (e.g. Joined, cut out, formed and folded)

4) Give and advantage and disadvantage of this product.





Assume that this product will need to be manufactured out of plastic.

1) What type of plastic family is more suitable? Name a suitable type of plastic and explain why you have selected that material (properties etc.).

2) Using some of the images below explain (use sketches if necessary) how this product would be manufactured (eg cut out, formed and folded)

3) Give and advantage and disadvantage of this product.

Assume that this product will need to be manufactured out of Timber.

1) What type of wood family is more suitable? Name a suitable type of Wood and explain why you have selected that material (properties etc.).

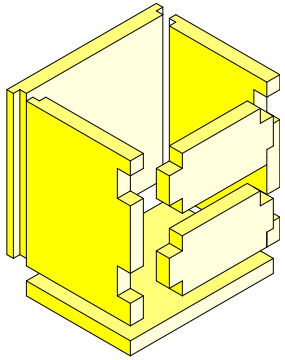
2) Using some of the images below explain (use sketches if necessary) how this product would be manufactured (eg cut out, joined and finished)

3) Give and advantage and disadvantage of this product.

Assume that this product will need to be manufactured out of Timber.

1) What type of wood family is more suitable? Name a suitable type of Wood and explain why you have selected that material (properties etc.).

2) Using some of the images below explain (use sketches if necessary) how this product would be manufactured (eg cut out, joined and finished)



3) Give and advantage and disadvantage of this product.

Assume that this product will need to be manufactured out of aluminium.

1) What type of metal family is more suitable? Explain why you have selected that material (properties etc.).

2) Using some of the images below explain (use sketches if necessary) how this product would be manufactured (eg cut out, formed and folded)

3) Give and advantage and disadvantage of this product.

Assume that this products prototype has been manufactured by using 3d printing.

1) What type of material suitable? explain why you have selected that material (properties etc.).

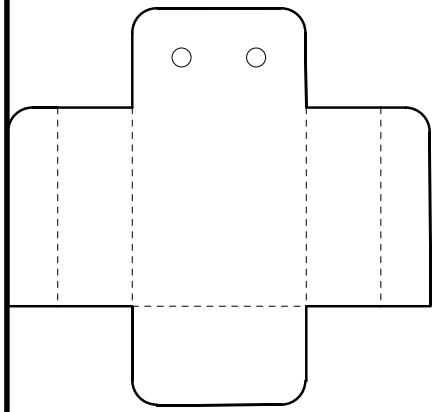
2) Using images explain (use sketches if necessary) how this product would be manufactured

3) Give 2 advantages and two disadvantages of manufacturing this product.

Assume that this product will need to be manufactured out of plastic.

1) What type of plastic family is more suitable? Name a suitable type of plastic and explain why you have selected that material (properties etc.).

2) Using some of the images below explain (use sketches if necessary) how this product would be manufactured (eg cut out, formed and folded)



3) Give and advantage and disadvantage of this product.

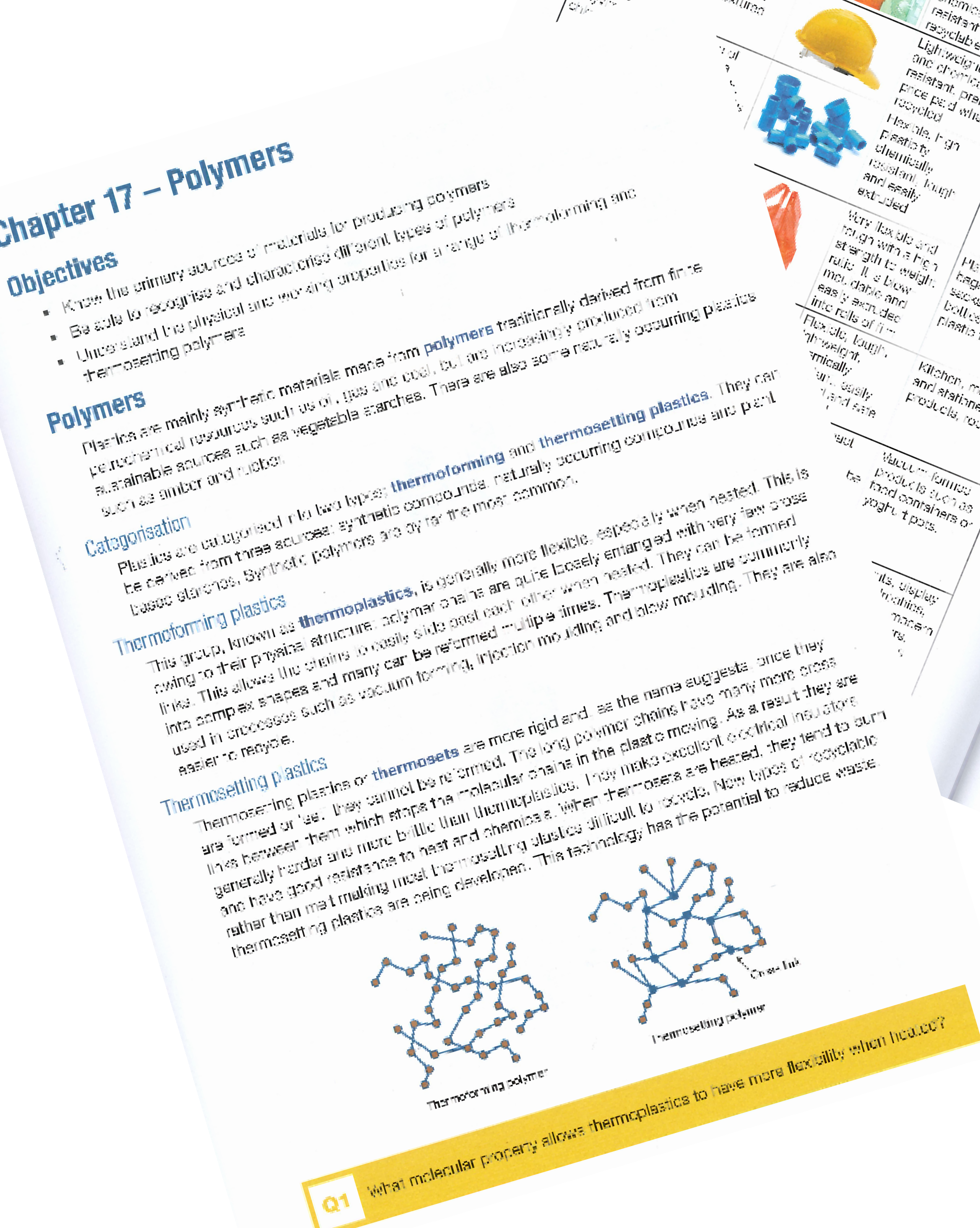
DUAL CODING – A WAY TO REVISE AND RETAIN (bilingual processing)

Recall/recognition is enhanced by presenting information in both visual and verbal form. Paviavo 1986

The objects were presented as words, pictures, or word-picture pairs. The response times were slowest for word-word pairs, intermediate for the picture-word pairs, and fastest for the picture-picture pairs.

Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe

V A K



Chapter 17 – Polymers

Objectives

- Know the primary sources of materials for producing polymers
- Be able to recognise and characterise different types of polymers
- Understand the physical and working properties for a range of thermoforming and thermosetting polymers

Polymers

Plastics are mainly synthetic materials made from **polymers** traditionally derived from finite petrochemical resources such as oil, gas and coal, but are increasingly produced from sustainable sources such as vegetable starches. There are also some naturally occurring plastics such as amber and rubber.

Categorisation

Plastics are categorised into two types: **thermoforming** and **thermosetting plastics**. They can be derived from three sources: synthetic compounds, naturally occurring compounds and plant based starches. Synthetic polymers are by far the most common.

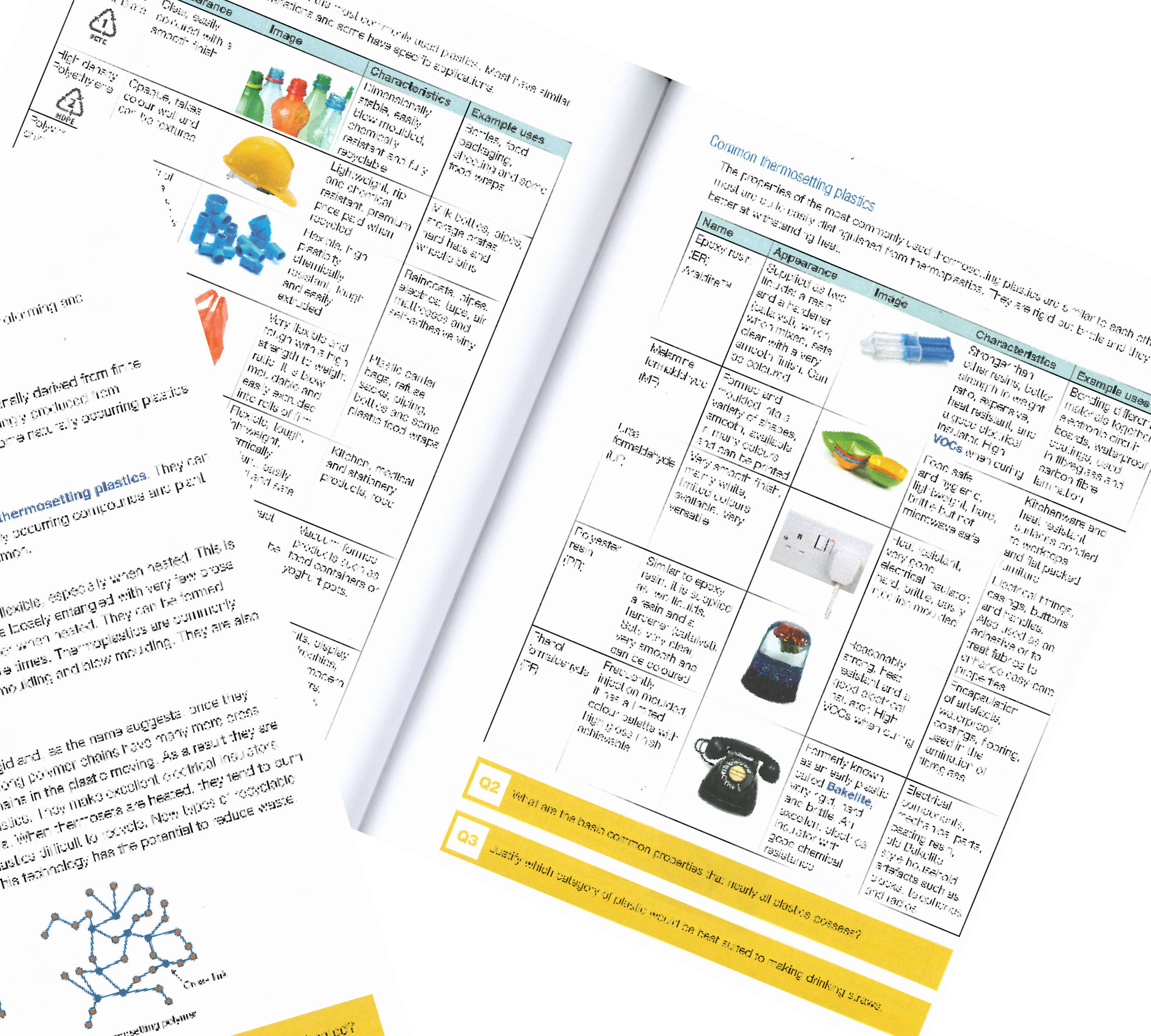
Thermoforming plastics

This group, known as **thermoplastics**, is generally more flexible, especially when heated. This is owing to their physical structure; polymer chains are quite loosely entangled with very few cross links. This allows the chains to easily slide past each other when heated. Thermoplastics can be formed into complex shapes and many can be reformed multiple times. Thermoplastics are commonly used in processes such as vacuum forming, injection moulding and blow moulding. They are also easier to recycle.

Thermosetting plastics

Thermosetting plastics or **thermosets** are more rigid and, as the name suggests, once they are formed or 'set', they cannot be reformed. The long polymer chains have many more cross links between them which stops the molecular chains in the plastic moving. As a result they are generally harder and more brittle than thermoplastics. They make excellent electrical insulators and have good resistance to heat and chemicals. When thermosets are heated, they tend to burn rather than melt making most thermosetting plastics difficult to recycle. New types of recyclable thermosetting plastics are being developed. This technology has the potential to reduce waste.

Q1 What molecular property allows thermoplastics to have more flexibility when heated?



Common thermosetting plastics

The properties of the most commonly used thermosetting plastics are similar to each other; most are easily distinguished from thermoplastics. They are rigid but brittle and they better at withstanding heat.

Name	Appearance	Image	Characteristics	Example uses
Epoxy resin (ER) Araldite™	Supplied as two liquids: a resin and a hardener (catalyst), which when mixed, sets clear with a very smooth finish. Can be coloured		Stronger than other resins, better strength to weight ratio, expensive, heat resistant, and a good electrical insulator. High VOCs when curing	Bonding different materials together, electronic circuit boards, waterproof coatings, used in fibreglass and carbon fibre lamination
Melamine formaldehyde (MF)	Formed and moulded into a variety of shapes, smooth, available in many colours and can be printed		Food safe and hygienic, hard, lightweight, brittle but not microwave safe	Kitchenware and heat resistant surfaces bonded to worktops and flat packed furniture
Urea formaldehyde (UF)	Very smooth finish, mainly white, limited colours available, very versatile		Heat resistant, very good electrical insulator, hard, brittle, easy to injection mould	Electrical fittings, casings, buttons and handles. Also used as an adhesive or to treat fabrics to enhance easy care properties
Polyester resin (PR)	Similar to epoxy resin, it is supplied as two liquids, a resin and a hardener (catalyst). Sets very clear, very smooth and can be coloured		Reasonably strong, heat resistant and a good electrical insulator. High VOCs when curing	Encapsulation of artefacts, waterproof coatings, flooring, used in the lamination of fibreglass
Phenol formaldehyde (PF)	Frequently injection moulded. It has a limited colour palette with high gloss finish achievable		Formerly known as an early plastic called **Bakelite**, very rigid, hard and brittle. An excellent electrical insulator with good chemical resistance	Electrical components, machine parts, casting resin, old Bakelite style household artefacts such as telephones and radios

Q2 What are the basic common properties that nearly all plastics possess?

Q3 Justify which category of plastic would be best suited to making drinking straws.

INFORMATION FROM A TEXT BOOK
IS CONDENSED TO ………

Plastics

There are two happy families of plastics — thermoplastics and thermosetting plastics. They've got different properties, so don't go mixing them up — some of them are well 'ard.

Thermoplastics are Recyclable and Bendy

1) Thermoplastics don't resist heat well — they're easily formed into different shapes by heating, melting and moulding.
2) Because thermoplastics can be melted, they are recyclable.
3) Examples of thermoplastics are acrylic, ABS, polystyrene, HIPS (high impact polystyrene) and polyethylene (polythene).

Thermosetting Plastics are Non-Recyclable and Rigid

1) When thermosetting plastics are heated they undergo a chemical change and become hard and rigid. So once you've heated and moulded them to make a product they can't be melted and reshaped again.
2) This means that thermosetting plastics are non-recyclable.
3) They resist heat and fire so are used for electrical fittings and pan handles.
4) Examples of thermosetting plastics are melamine-formaldehyde, polyester resin, epoxy resin and urea-formaldehyde.

EXAM TIP

Don't just write 'plastic' if you're asked to suggest a suitable material — give a specific example, e.g. acrylic.

urea-formaldehyde

melamine-formaldehyde

So, which type of plastic you use depends on what you want to do with it.

1) For example, thermosetting plastics are often used where there is heat or electricity involved, or when something needs to be really hard.
2) Different types of thermoplastics have different properties — polypropylene will bend without breaking and is used for plastic chairs so they're comfy when you lean back.

Thermoplastics and thermosetting plastics can be bought in many different forms — from powders, granules, pellets and liquids (for processing into finished products), through to films, sheets, rods, tubes and extruded mouldings (complex shapes).

Plastics Don't Need Surface Finishes

1) Plastics don't need protective surface finishes because they're very resistant to corrosion and decay.
2) But for a nice appearance, you can use wet and dry paper (silicon carbide paper) to remove scratches from the plastic, and follow that up with a mild abrasive polish or anti-static cream.
3) Or, you could use a buffing machine.

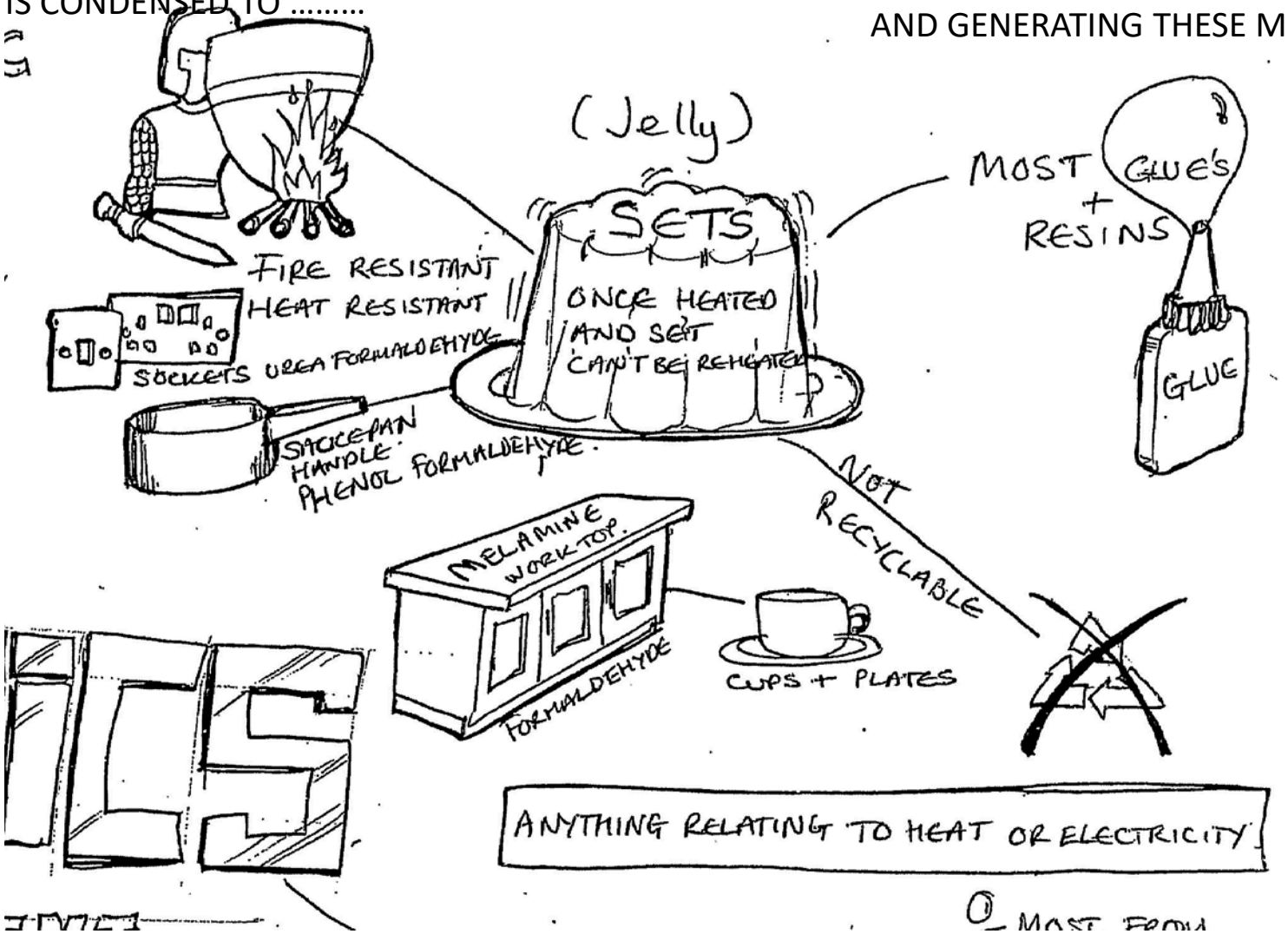
Wet and dry paper — sounds like someone's a bit confused...

So, there are two types of plastic that you need to know about — thermoplastics and thermosetting plastics. Small difference in name, but a pretty big difference in their properties. Best get it learnd...

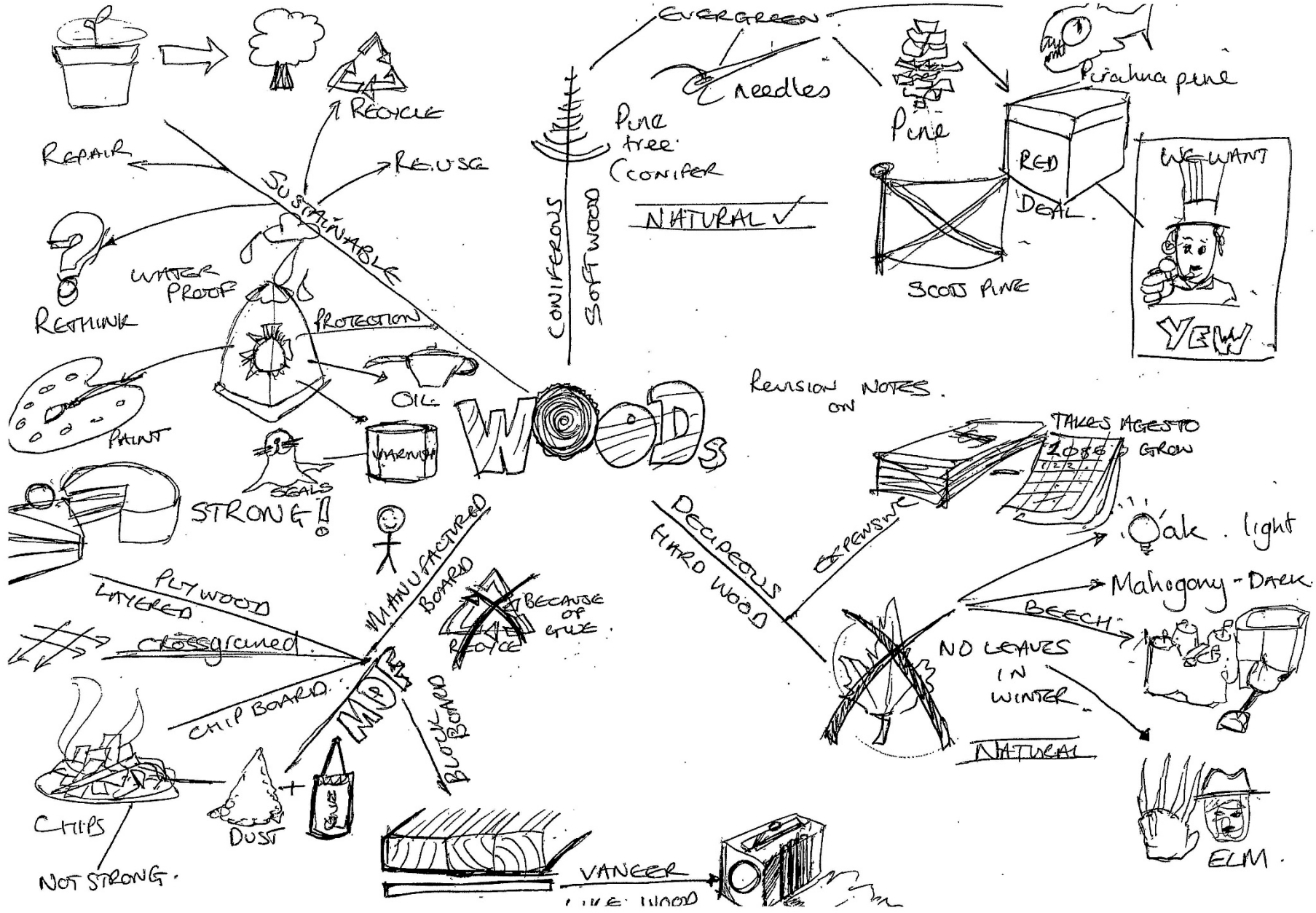
INFORMATION FROM A REVISION GUIDE IS CONDENSED TO ……

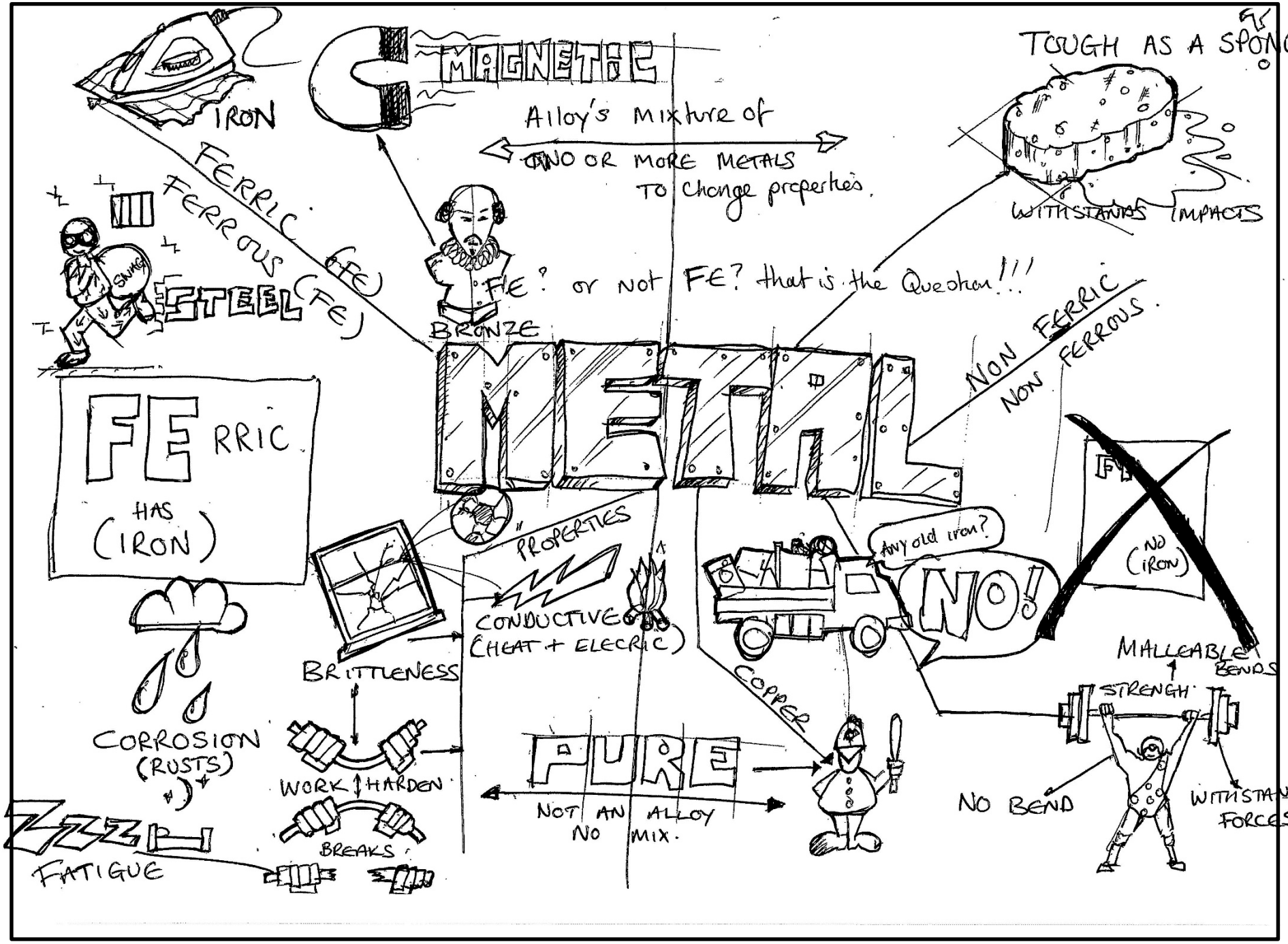
INFORMATION FROM A REVISION GUIDE IS CONDENSED TO ……

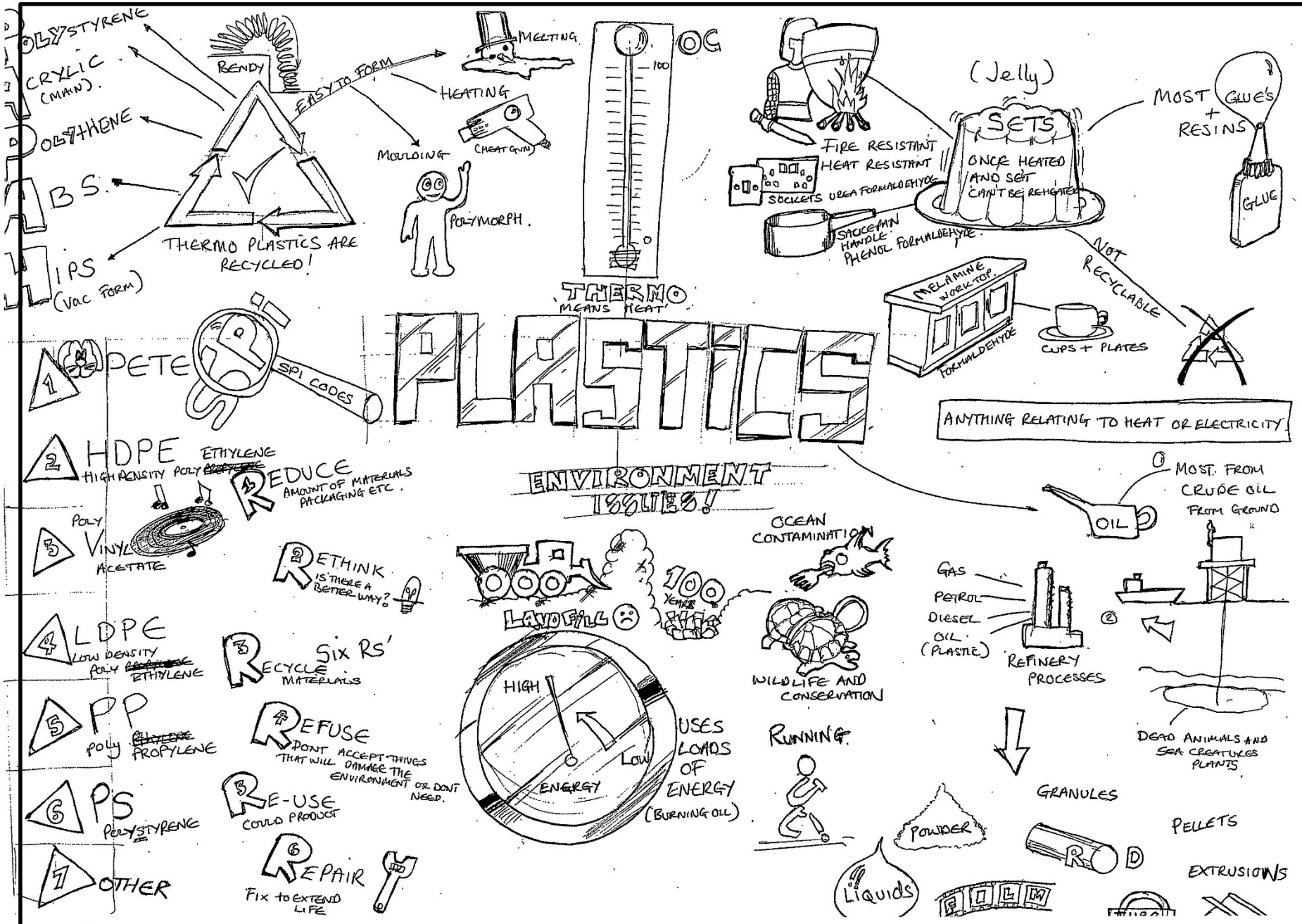
IDEALLY STUDENTS SHOULD BE GOING THROUGH THE TEXT AS THEY READ IT AND GENERATING THESE MIND MAPS

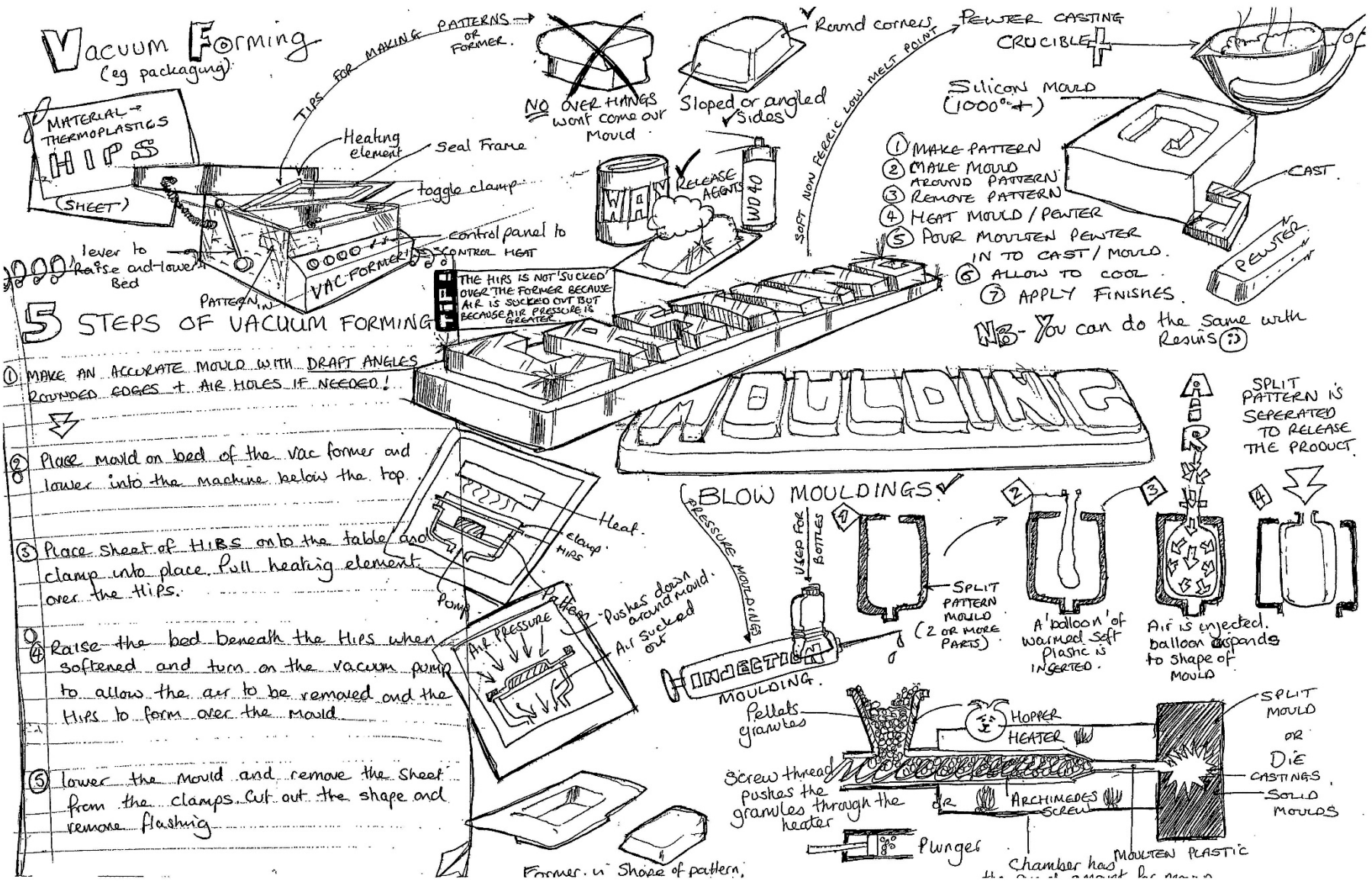


REALITY THEY STRUGGLE TO DO IT, OFEN MISS OUT INFO AND TAKE TOO LONG. SO THE MINUM THEY HAVE TO DO TO SHOW THEY HAVE READ IT AND HELP RECALL IT IS ADD COLOUR!

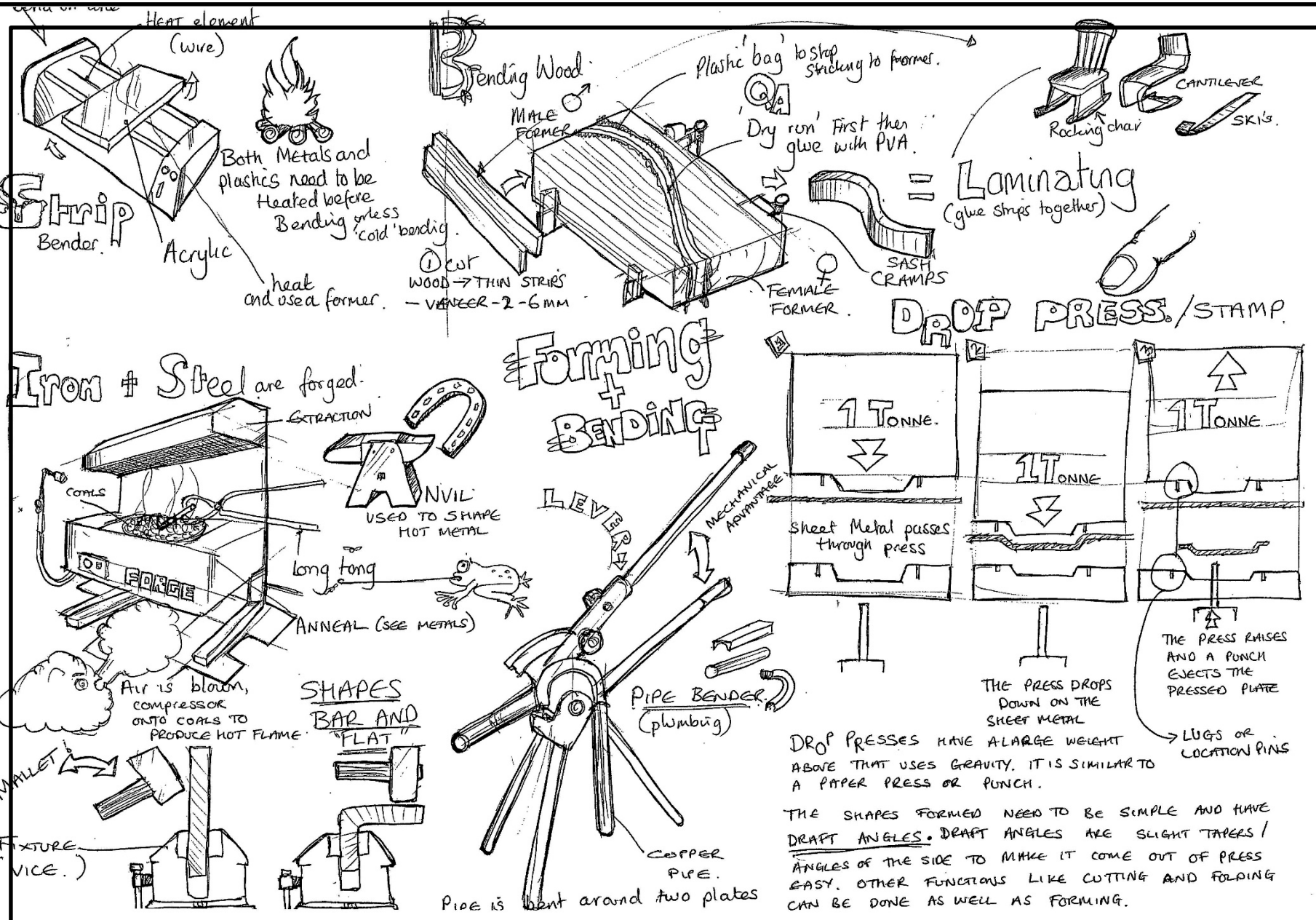

WOODS
REVISION NOTES ON
EVERGREEN
NEEDLES
PINE TREE
CONIFER
CONIFEROUS
SOFTWOOD
NATURAL ✓
PINE
PIRAHNA PINE
RED DEAL
SCOTS PINE
WE WANT
YEW
SUSTAINABLE
RECYCLE
REUSE
REPAIR
RETHINK
WATER PROOF
PROTECTION
OIL
VARNISH
PAINT
SEALS
STRONG!!
MANUFACTURED BOARD
PLYWOOD
LAYERED
CROSSGRAINED
CHIP BOARD
MDF
BLOCK BOARD
BECAUSE OF GLUE
GLUE
CHIPS
DUST
NOT STRONG.
VANEER
LIKE WOOD
DECIDEOUS
HARD WOOD
EXPENSIVE
TAKES AGES TO GROW
2000
OAK. LIGHT
MAHOGONY - DARK
BEECH
NO LEAVES IN WINTER.
NATURAL
ELM.

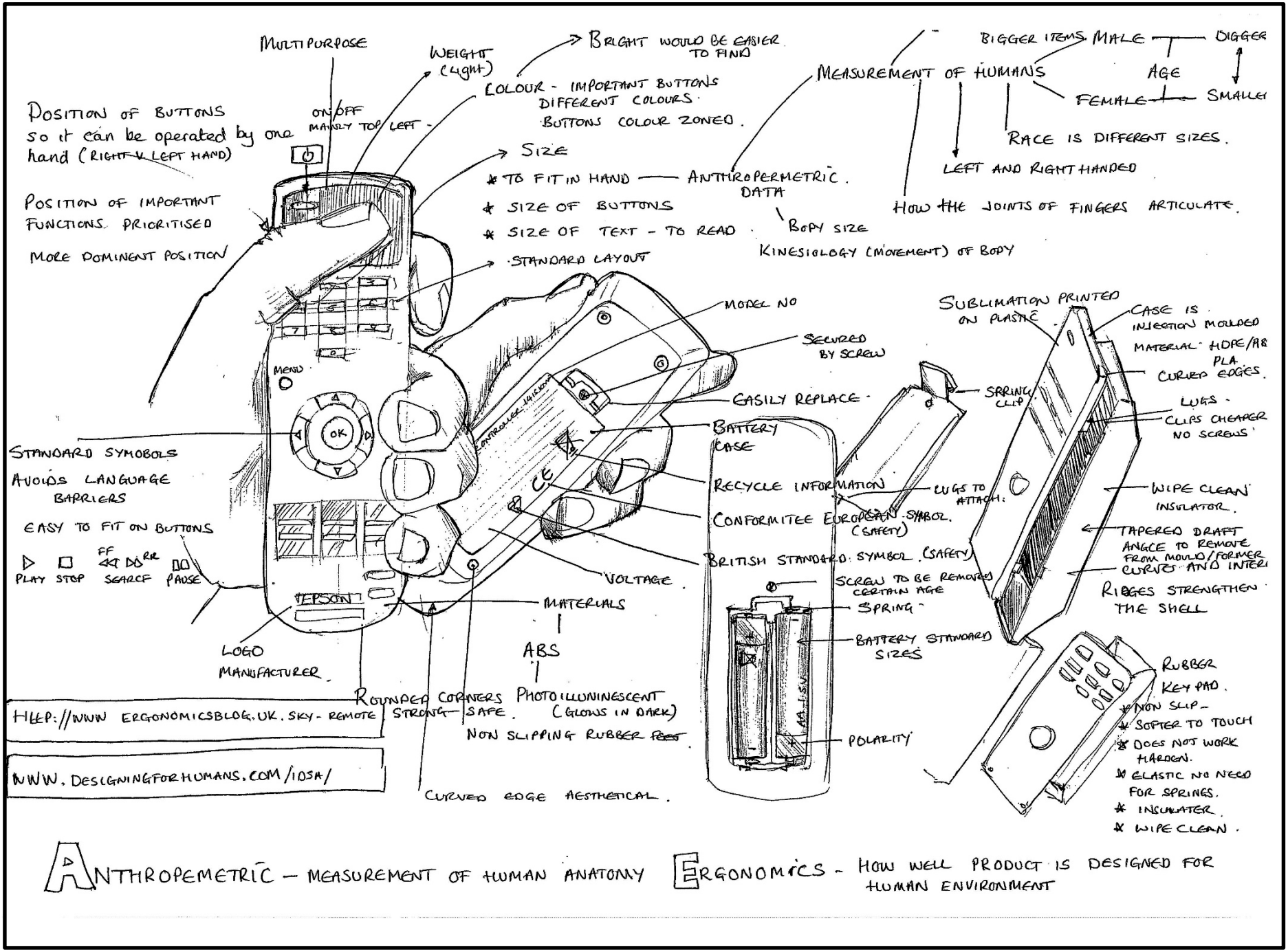

IRON
MAGNETIC
Alloy's Mixture of
TWO OR MORE METALS
TO change properties.
TOUGH AS A SPONG
WITHSTANDS IMPACTS
FERRIC (FE)
FERROUS (FE)
STEEL (FE)
FE? or NOT FE? that is the Queation!!!
BRONZE
METAL
NON FERRIC
NON FERROUS
FERRIC
HAS (IRON)
PROPERTIES
CONDUCTIVE (HEAT + ELECRIC)
Any old iron?
NO!
NO (IRON)
CORROSION (RUSTS)
BRITTLENESS
WORK HARDEN
BREAKS
FATIGUE
COPPER
PURE
NOT AN ALLOY
NO MIX.
MALLEABLE
BENDS
STRENGH
NO BEND
WITHSTAN
FORCES


POLYSTYRENE
CRYLIC (MAIN).
POLYTHENE
BS.
IPS (VAC FORM)
BENDY
EASY TO FORM
MELTING
HEATING
CHEAT GUN
MOULDING
POLYMORPH.
THERMO PLASTICS ARE RECYCLED!
OC
100
0
THERMO MEANS 'HEAT'
PLASTICS
(Jelly)
SETS
ONCE HEATED AND SET CAN'T BE REHEATED
FIRE RESISTANT
HEAT RESISTANT
SOCKETS USE A FORMALDEHYDE
STOKEMAN HANDLE PHENOL FORMALDEHYDE
MOST GLUES + RESINS
GLUE
NOT RECYCLABLE
MELAMINE WORKTOP
FORMALDEHYDE
CUPS + PLATES
ANYTHING RELATING TO HEAT OR ELECTRICITY
1 PETE
SPI CODES
2 HDPE
HIGH DENSITY POLY ETHYLENE
3 POLY VINYL ACETATE
4 LDPE
LOW DENSITY POLY ETHYLENE
5 PP
POLY PROPYLENE
6 PS
POLYSTYRENE
7 OTHER
REDUCE
AMOUNT OF MATERIALS PACKAGING ETC.
RETHINK
IS THERE A BETTER WAY?
RECYCLE
SIX RS'
REFUSE
DONT ACCEPT THINGS THAT WILL DAMAGE THE ENVIRONMENT OR DONT NEED.
RE-USE
COULD PRODUCT
REPAIR
FIX TO EXTEND LIFE
ENVIRONMENT ISSUES!
LANDFILL
100 YEARS
HIGH
LOW
ENERGY
USES LOADS OF ENERGY (BURNING OIL)
OCEAN CONTAMINATION
WILDLIFE AND CONSERVATION
OIL
MOST FROM CRUDE OIL FROM GROUND
GAS
PETROL
DIESEL
OIL (PLASTIC)
REFINERY PROCESSES
DEAD ANIMALS AND SEA CREATURES PLANTS
RUNNING
GRANULES
POWDER
PELLETS
LIQUIDS
FILM
EXTRUSIONS



Look out for the you tube clips (5 mins max) which explains these sheets)


Heat element (wire)
Strip Bender.
Acrylic
Both Metals and plastics need to be Heated before Bending unless 'cold' bending.
heat and use a former.
Bending Wood
MALE FORMER
Plastic bag to stop sticking to formers.
Dry run' first then glue with PVA.
FEMALE FORMER.
SASH CRAMPS
① cut WOOD → THIN STRIPS — VENEER - 2 - 6 mm
Rocking chair
CANTILEVER
SKI's.
= Laminating (glue strips together)
DROP PRESS. / STAMP.
1 TONNE.
Sheet Metal passes through press
THE PRESS DROPS DOWN ON THE SHEET METAL
THE PRESS RAISES AND A PUNCH EJECTS THE PRESSED PLATE
LUGS OR LOCATION PINS
DROP PRESSES HAVE A LARGE WEIGHT ABOVE THAT USES GRAVITY. IT IS SIMILAR TO A PAPER PRESS OR PUNCH.
THE SHAPES FORMED NEED TO BE SIMPLE AND HAVE DRAFT ANGLES. DRAFT ANGLES ARE SLIGHT TAPERS / ANGLES OF THE SIDE TO MAKE IT COME OUT OF PRESS EASY. OTHER FUNCTIONS LIKE CUTTING AND FOLDING CAN BE DONE AS WELL AS FORMING.
Iron + Steel are forged.
EXTRACTION
COALS
FORGE
ANVIL
USED TO SHAPE HOT METAL
long tong
ANNEAL (SEE METALS)
Air is blown, compressor onto coals to produce hot flame
Forming + Bending
LEVER
MECHANICAL ADVANTAGE
PIPE BENDER (plumbing)
COPPER PIPE.
PIPE is bent around two plates
SHAPES
BAR AND "FLAT"
MALLET
FIXTURE (VICE.)



ANTHROPEMETRIC – MEASUREMENT OF HUMAN ANATOMY

ERGONOMICS - HOW WELL PRODUCT IS DESIGNED FOR HUMAN ENVIRONMENT