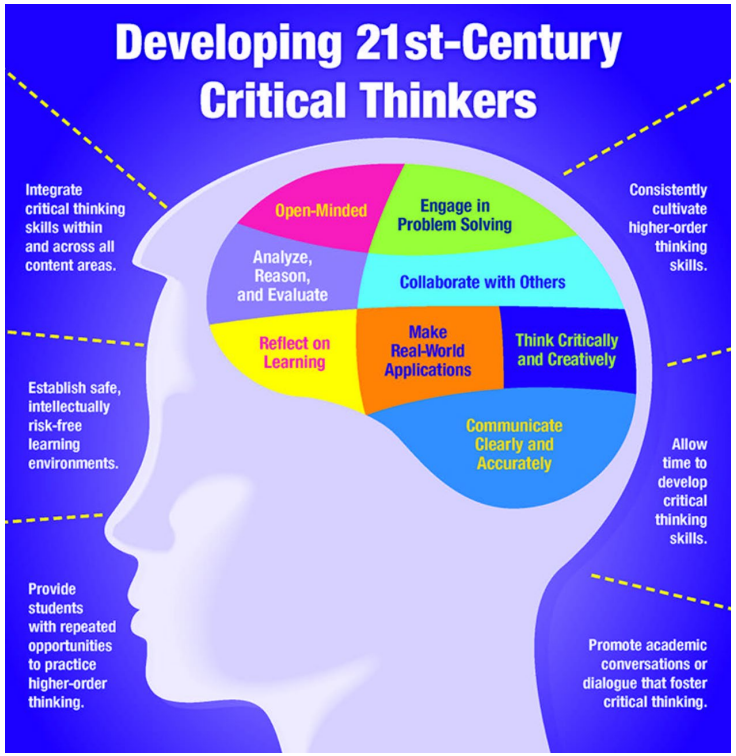
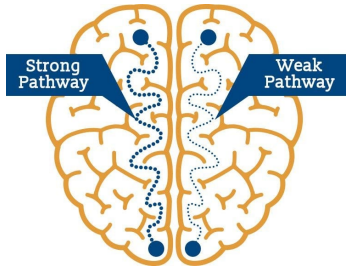
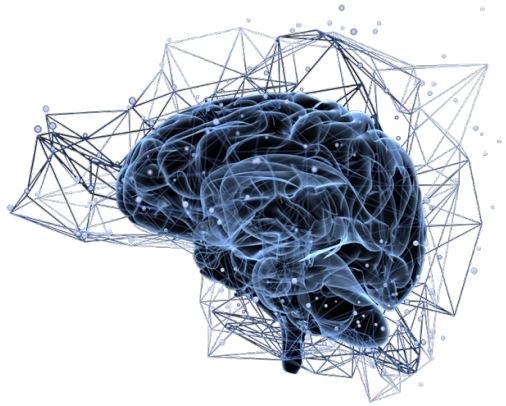
AQA A’Level Theory Revision

A Level DT Revision Mind-Maps

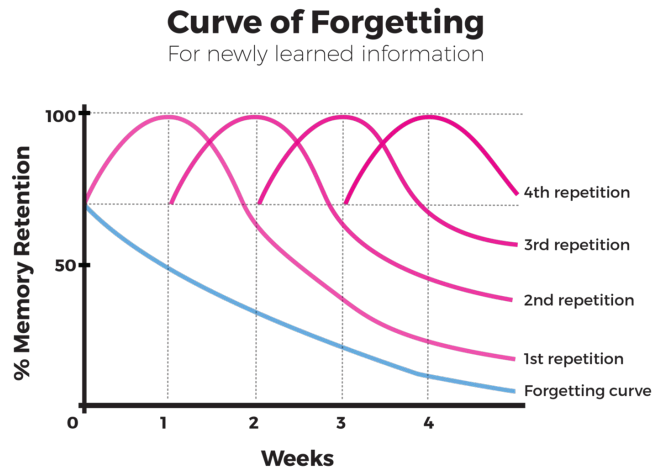






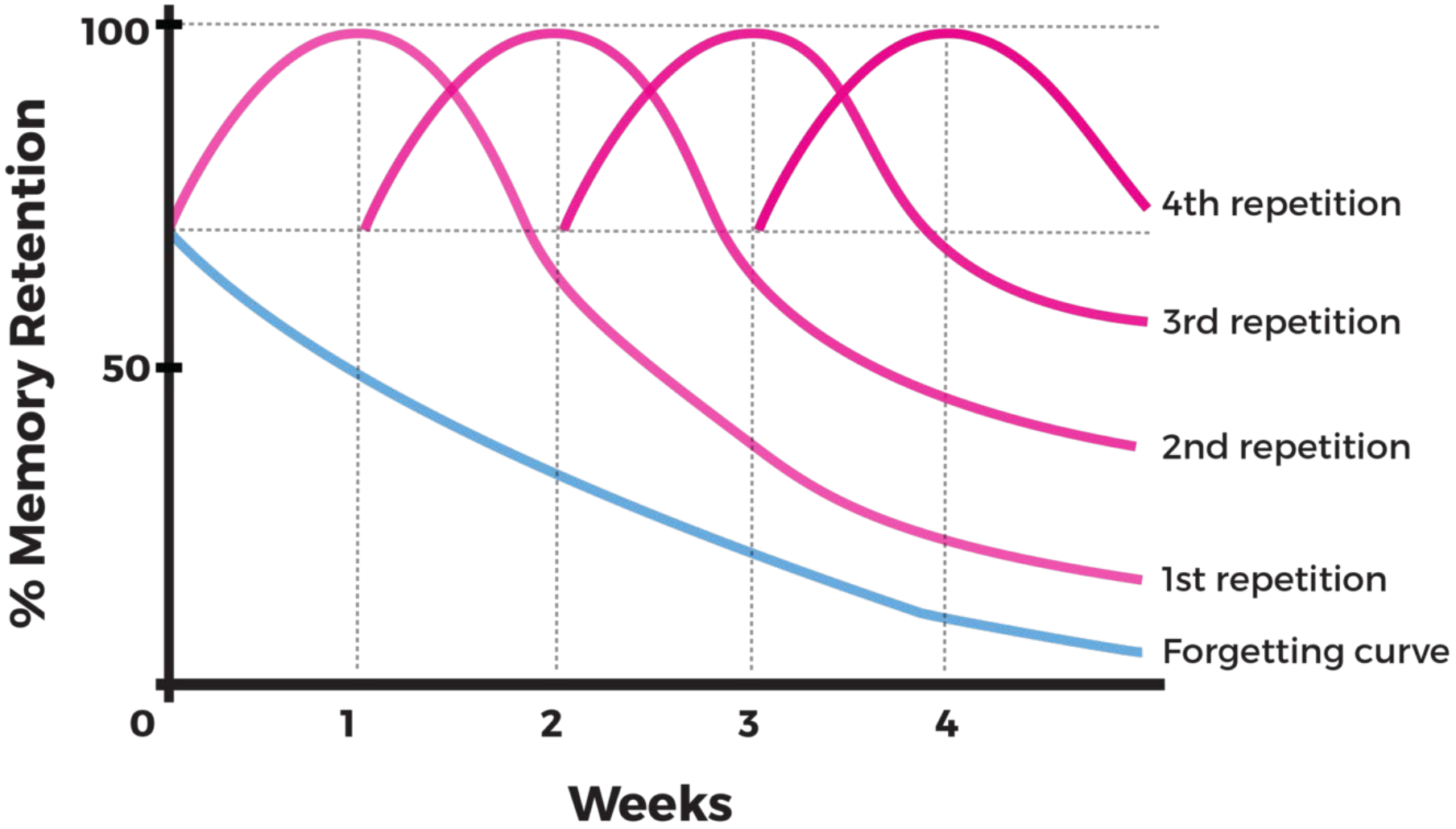
How to use:

1. **THINK HARD:** It's fine to have think time.
2. **KNOWLEDGE RECALL:** Add as much knowledge and information as you can about a topic. Continue adding as much as is possible and go onto a *separate sheet/onto the back* in needed.
3. **INTERLEAVE:** Where possible try and link between units. It doesn't just have to have knowledge about the specific unit (Link knowledge of materials from 1.1 and 1.2 to manufacturing methods in 1.4. Or 1.11 with 2.8)
4. **VOCABULARY:** Use as much DT subject specific vocabulary as possible to 'say it better'. This allows you to demonstrate deeper knowledge and understanding to access the top mark bands.
5. **Think PEE** (Make points and give examples and maybe highlight them in a different colour)



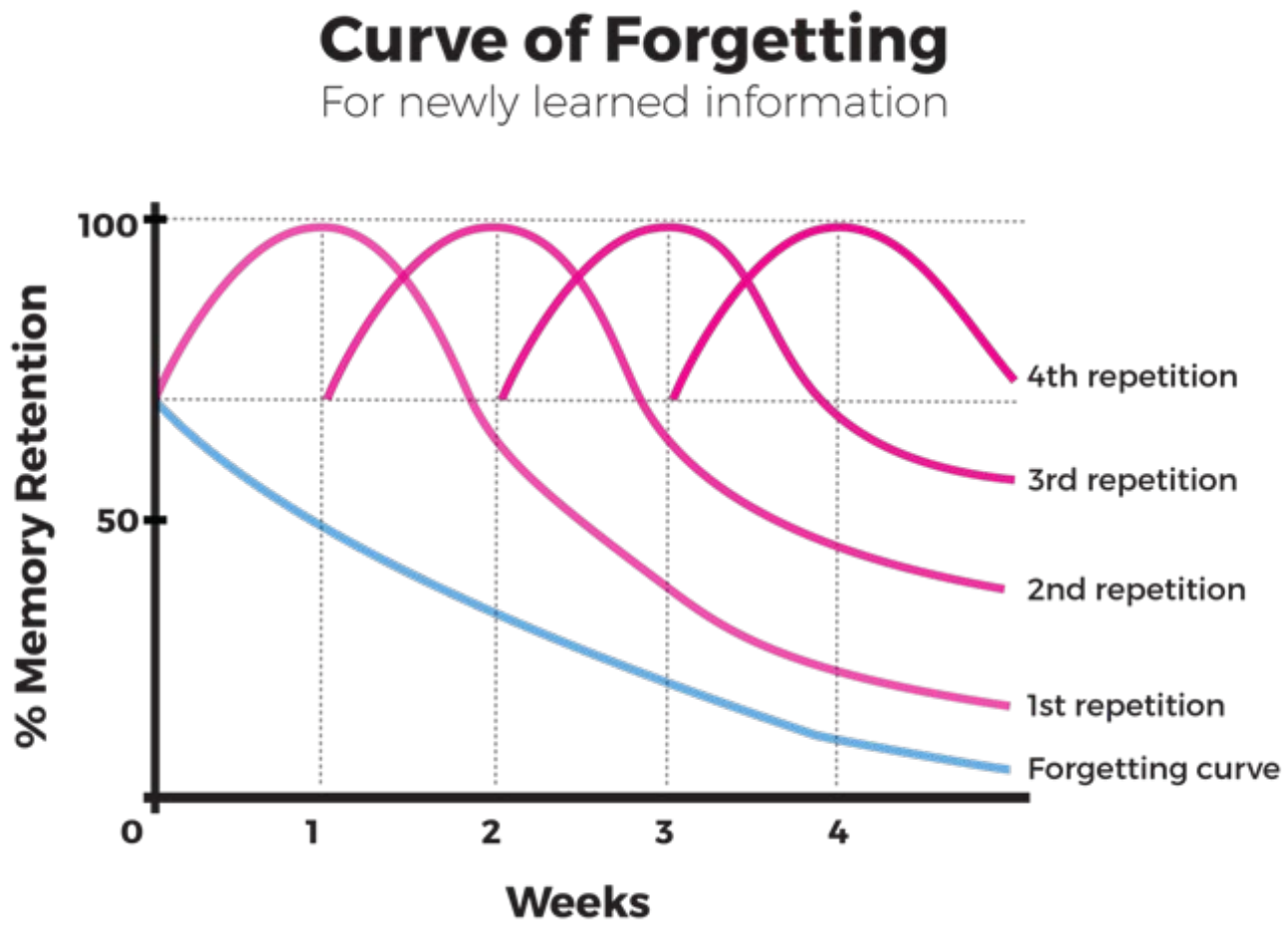
Curve of Forgetting

For newly learned information



Spaced retrieval practice of knowledge so you do not forget is vital.

How to study and recall knowledge so you do not forget it and you make it stick:



1. Read it & watch videos
2. Condense it
3. Study it
4. Recall it

- Repeat
- Repeat
- Repeat to make it stick

- Keep testing yourself and get others to test you with the keywords and your own mind maps.

Explain the difference between mechanical properties and physical properties? Bullet point a list of each (then explain verbally):

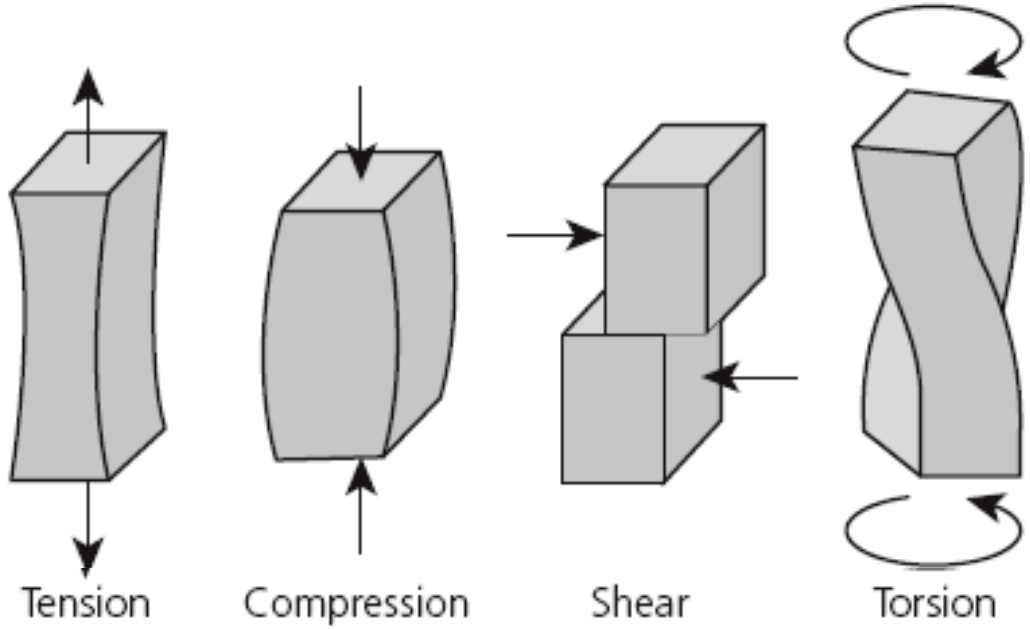
Mechanical

1. Compression
2. Tensile
3. Bending
4. Shearing
5. Torsional
6. Hardness
7. Toughness
8. Plasticity
9. Ductility
10. Malleability
11. Elasticity

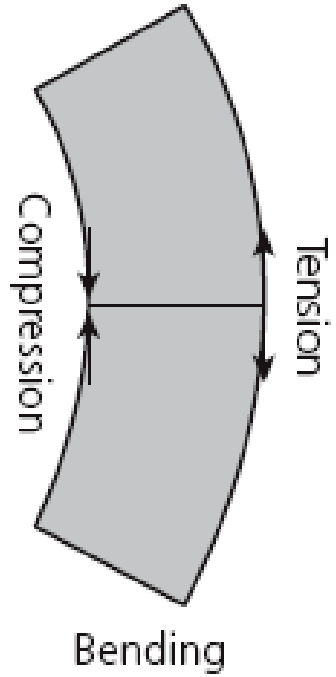
Physical

1. Electrical conductor and insulator
2. Thermal conductor and insulator
3. Thermal expansion
4. Optical properties (opaque, translucent, transparent)
5. Density
6. Fusibility
7. Magnetism
8. Corrosion/degradation

Label the forces and stresses below



A B C D



Explain the following industrial tests with an example:

IZOD

1. Test for toughness
2. Notched material secured vertically
3. Pendulum released resulting it the test piece being hit with force
4. Energy absorbed is calculated and recorded
5. Materials that absorbs the most impact is toughest (this is recorded by measuring the distance the pendulum swings after impact and breaking the material. The lesser the swing the tougher the material)

Tensometer

1. Test piece is clamped in Tensometer
2. One side is fixed and other side moves on a worm gear
3. As the worm gear travels the test piece is put under tension
4. Load and distance travelled is plotted recording details of:

- Elastic limit
- Yeild point
- Maxium load
- Break point after ‘necking’.

Explain the following industrial tests with an example:

Rockwell

1. Preload applied with a diamond indenter
2. Surface of the materials is broken
3. Preload depth acts as the datum (reference point)
4. Additional load is applied (dwell time)
5. Load released and distance between the two loads is measured

Vickers

1. Used for very hard materials (Diamonds will not deform under load)
2. Diamond square based pyramid indents surface
3. Microscope measure size of the indent

Brinell

1. Steel ball forced into a material using a preload
2. Diameter of the indent is measured
3. Smallest indent = hardness material

Explain how a fair comparable test can take place for material hardness in a workshop:

1. Materials all same size and thickness
2. Materials hit in exact same area
3. Room conditions (temperature etc)
4. Surface being used the same
5. Same equal force applied (as close as possible)

Explain timber conversion?

- Trees and felled (green timber)
- Trees debarked
- Tree trunks and cut into planks
- Waste by-product used to make manmade boards

State the four types of conversion?

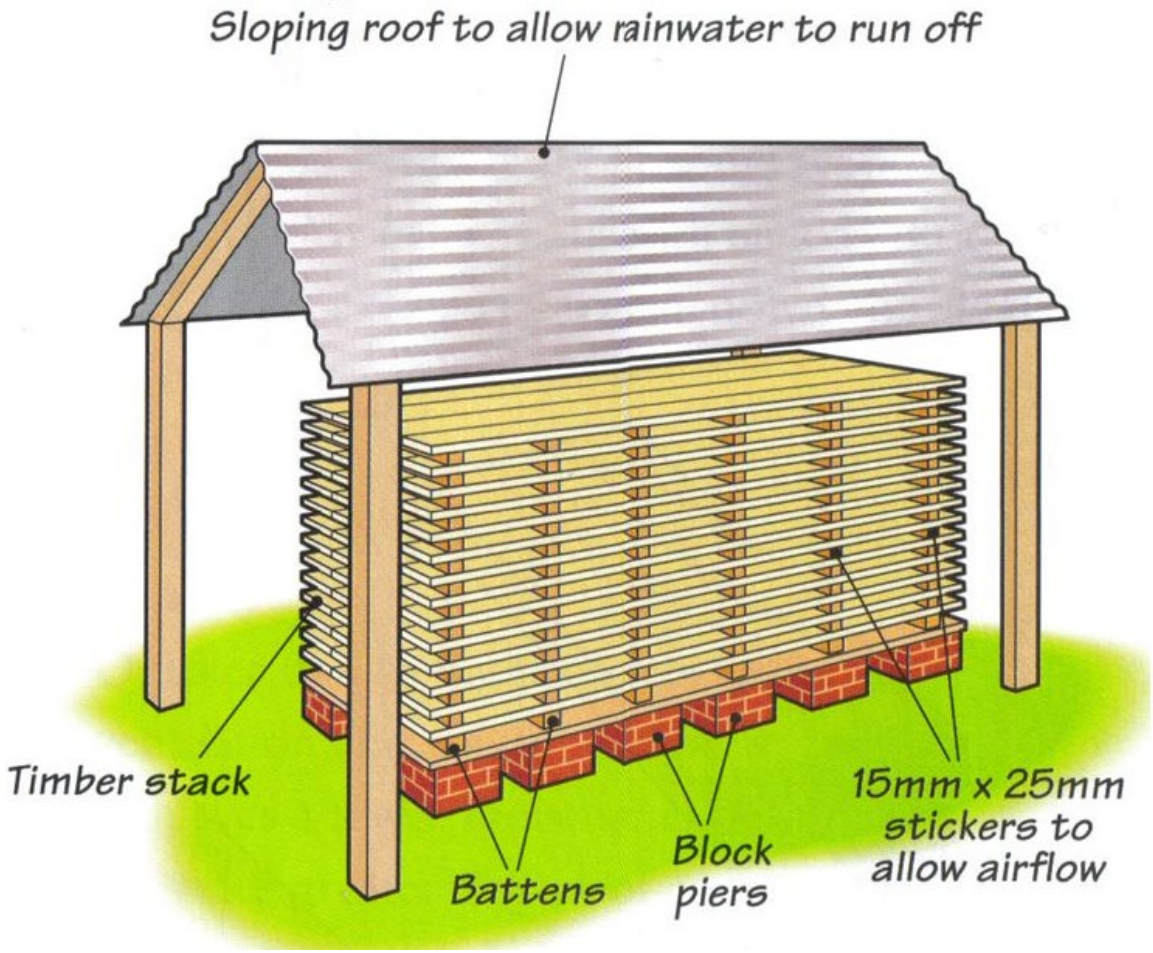
1. Baulk
2. Through and through
3. Tangial cut
4. Quarter sawn

Explain timber seasoning?

- Trees contain moisture
- Two types (air) and (kiln).
- Unseasoned timber is difficult to work
- Unseasoned timber is vulnerable to rotting and insect attack

Air Seasoning

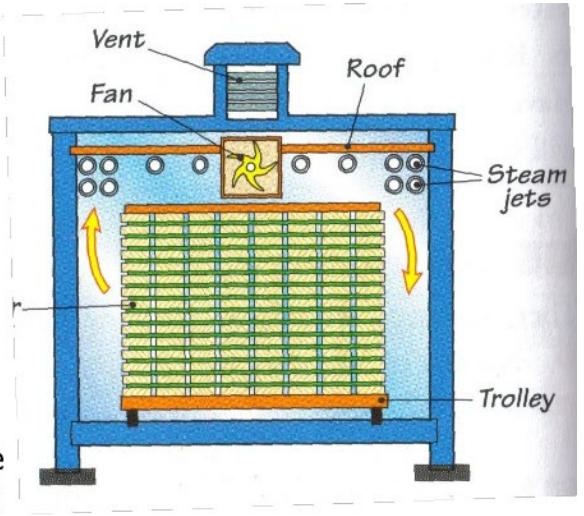
- Cheaper method
- Longer process (can take years)
- Less controlled

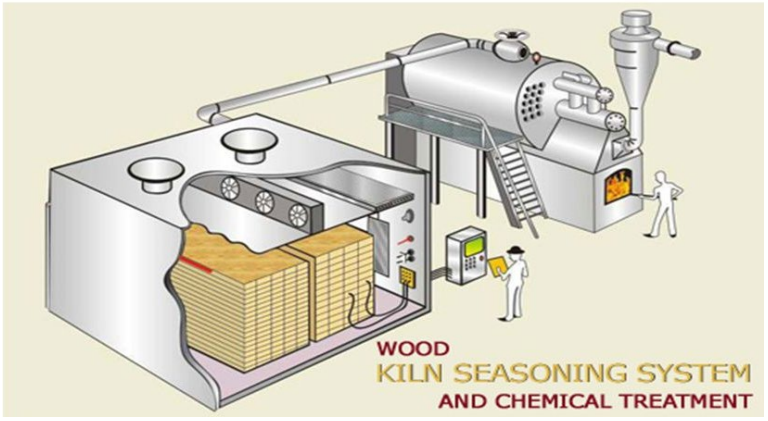


Kiln Seasoning

- Expensive method
- Quicker method
- Can be easily controlled to achieve specific moisture level

- This kiln is a single enclose container or building, etc.
- The timber is stacked same manner as air seasoning
- Whole stack is seasoned using a programme of settings(temperature and humidity) until the whole stack is reduced to the MC required.





Explain the following terms in relation to timber stock forms?Rough sawn, PSE, PAR

- Rough sawn: planks with spliters cut direct from the log (cheapest)
- PSE (Planed square edge): Two edges planed smooth (mid price)
- PAR (Planed all round) : All four sides of the plank planed smooth (most expesive)

Describe 3 advantages and 3 disadvantages of using manmade boards for flat packed furniture?

Advantages:

1. Low cost compared to natural timber
2. Available in a large range of styles/shades due to lamination of different imitation finishes (Light and dark oak, solid white)
3. Can be transported flat on the same day in a car
4. Easy to assemble with minimal tools

Disadvantages:

1. Prone to moisture damage
2. Edges and chip and break more easily
3. Not as robust and durable as traditional timber furniture
4. Has to be assemble once home and mistakes can occur

Describe the four types of manufacturing processes?

Wastage:

When you **REMOVE** material from a solid materials to create a desired shape.
Examples: CNC Router, CNC lathe, CNC Milling machine

Redistribution:

When you heat material and redistribute the molten material into the cavity of a mould. Examples: Injection mould, Blow moulding, casting metal

Addition:

When you **ADD** material to create/build a desired shape. Examples: 3D printing, lamination

Forming:

When you CHANGE THE SHAPE of a material. Examples: Vacuum forming, Bending sheet metal, line bending/strip heater

Technical Principles : *1.3*

Name and describe all the different polymer enhancements methods/processes?

1. Lubricants: Allows lower moulding temperatures saving energy during manufacture
2. Thermal antioxidants: Prevents oxidising or discolouring due to heat during manufacture
3. Pigments
4. Anti-statics: Use on electrical wires and plug sockets to prevent build up static charges that attract dirt and dust.
5. Flame retardants: Used on products exposed to heat to prevent combustion (car engines, plug sockets)
6. Plasticisers: Added to allow polymers to become less hard and brittle (hosepipes, LDPE Clingfilm food wrap).
7. Fillers: Provide bulk to the product (saw dust and wood flour) reducing the amount of polymer needed during manufacture. They help increase thermal conductivity also.
8. Antioxidants (prevent degradation from the oxygen in the air)
9. UV light stabilisers (prevent degradation from sunlight)
10. Biodegradable plasticisers: (speeds up degradation time
11. Bio-batch additives: Speed up degradation time using oxygen (oxy-degradable), water (hydro), UV Light (photodegradable)

Technical Principles : *1.3*

Name and describe all the different metal enhancements methods/processes?

1. Work hardening: Cold worked such as bending , rolling to increased hardness and tensile strength
2. Annealing: Metal is heated and slowly cooled. Annealing is done to make work hardened metal easier to work
3. Case Hardening (hardens the surface of a metal via two stages)

- ***Carburising*** *(increasing the carbon content of a metal by heating it to 950c and exposing it to carbon)*
- ***Quenching*** *(hot metal is quenched in cold water to rapidly cool the metal)*

4. Hardening: Improves hardness but makes metal more brittle
5. Tempering: Increases the toughness of a metal that has been hardened and makes it less brittle)

Describe Case Hardening?

Carburising:

1. Heat **LOW** carbon steel in a ceramic box full of carbon to 950c.
2. **Carbon atoms diffuse** and absorb **into the surface** of the steel **increasing the carbon content.** *(Making the surface harder)*
3. Remove the product and re-heat to 760c
4. Quench

Note: The longer its expose to carbon the deeper the layer and therefore harder the surface

Describe hardening and tempering?

Hardening:

- Heat **MEDIUM** and **HIGH** carbon steel to change the crystalline structure
- **QUENCH** the hot steel to harden the surface (this increases brittleness)

Tempering *(reduce excess hardening and brittleness)*:

- Re-heat the hardened steel to BELOW its critical point
- Allow to slowly cool

1. H: Heat
2. H: Quench
3. T: Re-heat below critical
4. T: Allow to slowly cool

Technical Principles : *1.3*

Name and describe all the different timber enhancements methods/processes?

1. Preservatives: (Tanalising, pressure treatments, flame retardants, natural polysaccharides to improve hardness)

2. Resins: Urea Formaldehyde in MDF and chipboard

3. Laminations:

- Structural Composite Lumber (SCL)
- Cross Laminated Timber (CLT)
- Laminated Veneers Lumber (LVL)

Describe 3 methods of good materials management and effienct use of materials?

1. Always mark out from a DATUM edge
2. Always set of CNC devices from 0,0,0 co-ordinates DATUM point
3. Use Nesting software (tessellation) to ensure maximum efficiency from s standard size board (2440mm x 1220mm)
4. Ensure you **design and plan manufacture** making efficient use of materials using the standard sizes of sock forms.
5. Careful selection of materials sections to minimise material used.
6. Use processes such as addition or redistribution to minimise waster

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Explain the following?

QRM

1. Quick response manufacturing
2. Reduces lead time
3. Responds to consumers needs quickly
4. Customers are given high priority throughout the design and production process

UPS

1. Unit production Systems
2. Used extensively in textiles
3. Overhead transporter systems are used
4. Movement is often computer controlled
5. Careful organisation is required
6. Reduced number of handling operations to facilitate optimal use of labour

Vertical in house production

Supply chain is owned by the company

Advantages

1. Minimises the use and reliance of external companies
2. Reduces costs and unexpected price increase for parts
3. Improved security to protect ideas
4. Better integrate QA

Disadvantages

1. Reduction in flexibility
2. Increased administration

Describe and FEA and give two examples of its use?

1. Finite element Analysis
2. Computer modelling of forces and stresses acting on a material
3. Simulates vibrations, shock loads and static loads.
4. Highlights potential week points as part of NDT

Examples include:

1. Testing an I-Beam for a bridge or building support
2. Testing how a buling would withstand and earth quake

Describe and CFD and give two examples of its use?

1. Computational Fluid Dynamics
2. 3D CAD simulation software
3. Simulates the flow or air, gases and water
4. Saves time and money on producing actual 3D cad models to identify possible problems before moving into actual 3D physical models

Examples include:

1. Testing a the wind drag in the development of a new car
2. Testing how a boat/ racing yacht will move through the water

Describe the health and Safety law requirements for safe working practices in the workshop and industry?

Provide suitable PPE ***(personal protective equipment)*****:**

Ensure people have the correct safety equipment to carry out the task.

Ensure correct safety signs are displayed:

Visual reminders prevent accidents and display health and safety information.

Ensure regular Risk Assessments are carried out:

These should be done for all new procedures to identify risks before they happen.

Ensure correct maintenance of equipment:

This should be done yearly so ensure equipment is safe.

Ensure regular training for all tools and equipment

People may need recapping on training and need new training.

Designing and Making Principles : *2.1*

- Describe what is meant by a ‘iterative’ design approach?
- Continuous development using:

testing, prototypes and analysis to refine a design/product

- Describe what is meant by a ‘user centred’ design approach?
- Products that are easy to use
- Products designed to solve problems
- Client based approach with the users consulted throughout
- Designing through customer/client feedback (ITERATIVE)

- Describe what is meant by a ‘collaborative’ design approach?
- Large companies (Rolls Royce) having teams of designers working together to solve problems and share ideas
- Different teams may have different specialism (ergonomic, electronics)

Designing and Making Principles : *2.2*

- Describe the work of the designer **Marcel Breuer?**

- Describe:

1. Designed **iconic** 'Wassily' chair
2. Part of the **Bauhaus** movement
3. Use **tubular steel** due to:
4. Its **affordability**
5. Its ability to be easily **mass produced.**
6. He has influenced others to focus on **'Function over Aesthetics'** he designed very simple but functional furniture

Describe the work of the designer **Dieter Rams:**

- German designer that worked for Braun post WW2 (1950s to 1970s)
- Used simple forms that are still relevant today (He influenced Sir Jonathon Ive of Apple)
- Developed the 10 principles of Good Design including:
- Good design is honest
- Good design is innovative
- Good design is unobtrusive

- **Products:**
- Sk4 radio/record player
- Innovative use of polymers and electronics at the time
- Many iterations followed

Describe the Art Deco design era and state three designers:

- Key features to describe the style?

1. Sunburst
2. Steeped pyramids (Egyptian influence)
3. Simple geometric forms

Art Deco

- State three designers?

1. Clarice Cliff
2. Eilen Gray
3. Alvar Alto

Typical mistake

Don't confuse Art Deco with Art Nouveau! Art Deco designs were generally more geometric, whereas Art Nouveau used natural forms such as flowers, leaves and tendrils.

Describe the Bauhaus design era and state three designers:

- Find three key features to describe the style?

1. Form follow function
2. Geometrically pure
3. Everyday product for everyday people (design for the masses)

- State three designers?

1. Marcel Breuer
2. Marianne Brandt
3. Walter Gropius

Describe the Post-modernist design era and state three designers:

- Key features to describe the style?

1. Bold and colourful designs
2. Challenging forms that compromised on function
3. Simplistic juxtapositions of geometric forms (geometric forms but the position could be quite random)

- State three designers?

1. Marc Newson
2. Danny Lane
3. Ettore Sottsass

Describe the Streamlining design era and state three designers:

- Find three key features to describe the style?

1. 1920s through to 1960s
2. Flowing curves and smooth exteriors
3. Chrome detailing
4. Aerodynamics incorporated into the flowing lines

Streamlining

- State three designers?

1. Henry Dreyfuss
2. Raymond Loewy

Describe the Arts and Craft design era and state two designers:

- Find three key features to describe the style?

1. 1850s through to early 1900s
2. Rebellion against the machine age
3. Appreciation of natural materials (beauty of timber)
4. Appreciation of craftsmanship
5. Natural forms and inspiration from nature

- State two designers?

1. William Morris
2. Richard Norman Shaw

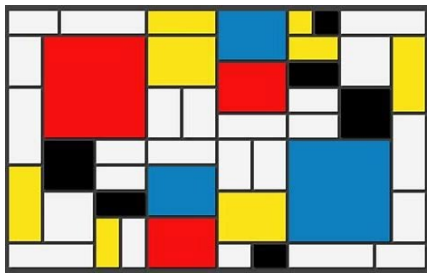
Describe the work Charles and Ray Eames:

- Find three key features to describe the style?

1. Modernists
2. Designed the Eames house based on Modernist architecture
3. Laminated plywood
4. Moulded polymers such as fibreglass

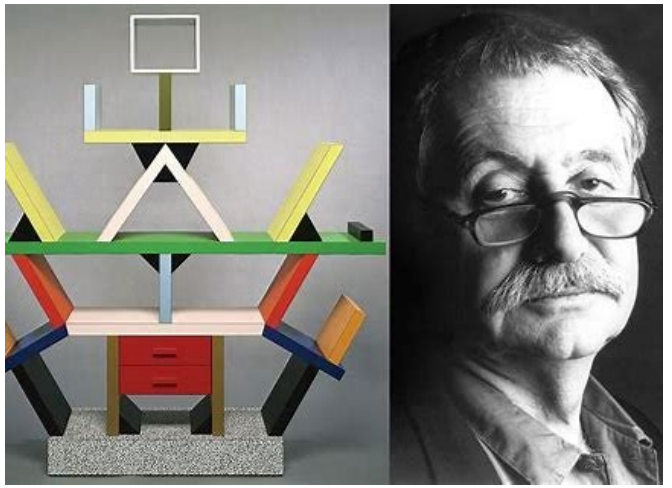
A central courtyard of brick and wood blocks connects the studio with the residence (left). This space is filled with flowers and plants, just as when the Eameses lived here. The house exterior (top) is a rigorous steel structure with playful accents of blue, red and gold. A spiral staircase is visible through the front door (right); its gently curved railing was found by Ray in a ship's catalogue.

Compare and contrast Modernism and Post-Modernism



- MODERNISM:
  - Form follows function
  - Geometrically pure forms
  - Everyday products for everyday people
- Bauhaus (Marcel Bruer, Marriant Brandt, Mies Van Der Rohe)
- De Stijl (Gerard Rietveld, Piet Mondrian)

- **POST**-MODERNISM:
  - Rebellion against simplicity and functional nature of Modernsim
  - Use of **Anthropomorphic** and **Zoomorphic**
  - Aesthetics compromised functionality
  - Bold, colourful, playful designs
  - Memphis (Ettore Sottsass)



How have the following developments in Technology impacted the work of designers?

- Microelectronics:
- **Transistors** replaced **Thermionic Valves**
- **IC**s (Integrated Circuits) contained billions of transistors in **Silicone Chips**
- Microelectronics responsible for ever more powerful computers and miniaturisation of electronics
- Microelectronics and computers have changed how designers and manufactured work (pg 216)
- *Research, generating ideas, design collaboration, modelling and testing (FEA)*
- *Manufacturing (Greater used of CAD, CAM and CNC)*

How have the following developments in Technology impacted the work of designers?

- **Polymer Moulding Techniques and Timber Laminating:**
- Rapid production of mass produced products (**PP Robin Day chair**)
- *Made furniture purchases more affordable in the 1950s*
- ***KD fitting*** *were starting to be extensively used to sell flat packed furniture*
- ***Lovet Table*** *from IKEA by Gillis Lundgren*

How have the following developments in Technology impacted the work of designers?

- New Materials:
- **Glulam :** Natural defect with timber eliminated, strong and durable with excellent resistance to compressive and tensile forces, used in construction, better strength to weight ratio than steel, very sustainable compared to steel.
- **Kevlar:** Aromatic Polymide (ring like molecules connected in long chains), outstanding toughness & tensile strength. Woven and combined with resin into strong and durable uses such as Bullet-proof vests, puncture proof tyres, and aeronautical applications such as the Boeing 787 Dreamliner.
- **Nanomaterials: Extremely small particles (0.00001 to 0.0001mm)**

Revolutionary medical and energy applications – Used in suns creams and cosmetics. Samsung's Graphene coated anodes to extend battery life. Lack recyclability, potentially toxic in some applications.

Explain the social issues associated with designing and manufacturing products? (5 bullet points)

- Contamination of water supplies (poor drinking water)
- Oil leaks (damage to marine life and local people)
- Felling of trees to create all the packaging for products
- Carbon being produced through sourcing materials
- Carbon being produced whilst making products
- Use of fertilisers and pesticides that affect animals and local rivers

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What social and moral issues should designers and manufacturers consider? (3 bullet points)

- Energy consumption (carbon emissions) during manufacture
- Can the product be easily repaired, reused and disassembled for recycling
- Workers rights

1. Employment should be a choice and not forced
2. Workers should be safe at work
3. Workers should be free to join a workers union
4. No child labour
5. Workers should not suffer harsh treatment by scrupulous employers

Explain the term carbon footprint and the different between primary and secondary?

- The total carbon produced from primary and secondary sources to make a product

- **Primary is direct emissions from:**
- *Energy to extract materials*
- *Energy used to manufacture*
- *Energy used to transport*
- **Secondary is indirect Co2 emissions:**
- *How much enery a product uses (cars, wasing machinbes etc)*
- *The energy used to make something not needed (plastic bags compared to bag for life)*

Explain the term Circular Economy?

- Method of designing and manufacture that aims to use materials as a continual cycle of reuse and re-manufacture.
- Reducing the sourcing of new raw materials
- Cradle to cradle approach

- **Considers two nutrients:**
- Biological nutrients: Materials that are non-toxic and can be composted
- Technical nutrients: Materials that can be recycled with high quality (products such as car and washing machines)