

WORKBOOK SOLUTIONS

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WORKBOOK SOLUTIONS

INTRODUCTION

This teacher's manual provides the answers to many of the questions in the *Materials Technology (Wood) Workbook*. Answers are not supplied for questions requiring an illustrated answer. The material in this manual has been compiled with the level of the Junior Certificate student in mind. Teachers will, of course, supplement and add to the answers given here but it is hoped that this manual will provide a useful teaching aid, both for oral classroom work and for the correction of written exercises.

CHAPTER 1 INTRODUCTION

1. (i) Plastic.
(ii) Metal.
2. *Machines should not be used without the teacher's permission.*
3. (i) Strong. (ii) Hard. (ii) Crack/split resistant.
4. (a) Tool well.
(b) Temporary holding tools that are not being used.
5. (i) Hold materials securely. (ii) Cramping work after gluing.
6. Handle should be in a vertical position.
7. Prevent accidents and make your work area safer to work.
8. *The room should always be left neat and tidy for the incoming class. At the end of the class put all tools and equipment safely in their correct positions, sweep all shavings, chips and dust off your bench, make sure your locker and vice are closed and sweep the floor, before sitting down quietly at your bench.*

CHAPTER 2 HEALTH AND SAFETY

1. (i) Saves time. (ii) Prevents accidents.
2. (i) Untidy benchtop/tools. (ii) Liquid spilled on the floor.
(iii) Waste timber thrown on the floor.
(iv) Cord of sander wrapped around bench.
3. Point the sharp blade towards the ground.
4. *The distribution and collection of hand tools should be completed in a safe, orderly, quiet and direct manner.*
5. (i) Use with teacher's permission and under his/her supervision.
(ii) Use only if you have been properly trained in its use.
(iii) Always adhere to the manufacturer's safety guidelines.

6. (i) **Corrosive** – these substances destroy living tissues, including the eyes and skin.
- (ii) **Flammable** – these substances may easily catch fire in a workshop under normal conditions.
- (iii) **Toxic** – these substances are a series risk to health and can cause death.
- (iv) **Harmful** – these substances may produce heat as they react with other materials; they can be a fire risk.
- (v) **Oxidising** – these substances may produce heat as they react with other materials. They are a fire risk.
- (vi) **Explosive** – these substances may explode if ignited in air, exposed to heat, naked flames or sparks. A sudden shock or friction may also start an explosion.
- (vii) **Environment** – these substances are dangerous for the environment.
7. They can end up polluting lakes, ponds and waterways.
8. (i) Wear respirator, goggles and gloves when handling chemicals.
- (ii) Always wash hands after using solvents, stains, preservatives and finishes.
9. (i) Wear earmuffs.
- (ii) Wear glasses/goggles.
- (iii) Wear gloves.
- (iv) Wear respirator.
- 10.

Name	Use
(i) Dust mask	Prevent the inhalation of low levels of dust.
(ii) Respirator	Prevent the inhalation of dust and toxic fumes.
(iii) Face shield visor	Gives full protection to your face when doing lathe work.
(iv) Gloves	Protect your hands when working with rough materials, sharp edges or cleaning up.

11. (i) Driving nails.
- (ii) Using the lathe.
12. (i) **Edges** – avoid, soften or protect sharp edges.
- (ii) **Corners** – avoid protruding corners.

CHAPTER 3 IMPORTANCE OF WOOD TODAY

1. (i) Strong.
(ii) Easy to use.
(iii) Absorbs carbon dioxide.
2. Yes.
3. (i) Furniture.
(ii) Tools.
(iii) Boats.
4. Something produced in the making of something else.
5. (i) Fruit.
(ii) Nuts.

CHAPTER 4 GROWTH OF TREES

1. (i) Ash.
(ii) Oak.
(iii) Beech.
2. (i) Brings more light and heat.
(ii) Presence of water.
3. (i) Anchors the tree firmly to the ground.
(ii) Absorbs water and minerals from soil.
4. (i) Supports the leaf-bearing branches.
(ii) Main source of wood.
5. Hold out leaves to the sunlight.
6. Produce/manufacture the food (sugar) for the tree.
7. (a) Leaves. (b) (i) Sunlight. (ii) Carbon dioxide.
8. *Trees absorb water and minerals through their roots. The water is combined with carbon dioxide absorbed from the air and sunlight energy trapped by the green pigment chlorophyll in the leaves to produce sugar.*
9. **A** – growth ring/annual ring. Function – The tree's age can be determined by counting the growth rings. **B** – sapwood. Function – Stores and brings raw sap from the roots to the leaves. **C** – bark. Function – Protects the tree from animals.
10. Carries refined enriched sap/food manufactured in the leaves down to all the growing parts of the tree.
11. Carries water and minerals from the soil up the stem of the tree to the leaves.

12.

Heartwood	Sapwood
No longer active in bringing raw sap from roots to the trees.	Brings raw sap from the roots to the leaves.
Mature wood.	New wood.
Dead part of tree.	Living part of tree.
Hard.	Soft.
Natural resistance to fungi and insect attack.	Prone to attack from fungi/insects.
Not prone to distortion when dried.	Prone to distortion when dried.

13. Count the growth rings.

14. Autumn.

CHAPTER 5 CELL STRUCTURE OF WOOD

1. Store food.
2. (a) Softwood. (b) X – gives the tree support and strength.
3. (a) Hardwood. (b) Y – food-storing cells.

CHAPTER 6 IRISH HARDWOODS AND SOFTWOODS

1. (i) *Deciduous trees normally lose their leaves in winter.*
(ii) *Coniferous trees normally keep their leaves in winter.*
2. (a) (i) Oak. (ii) Ash. (iii) Sycamore.
(b) (i) Douglas fir. (ii) Scots pine. (iii) Sitka spruce.

4.

	Hardwoods (deciduous)	Softwoods (conifers)
Leaves	Leaves are broad. They lose their leaves in winter (except holly).	Narrow, needle-shaped leaves with waxy coating. Evergreen, they keep their leaves in winter (except larch).
Seeds	Contained in fleshy fruits, berries and nuts.	Generally contained in cones.
Timber	Hard, dark in colour, durable, expensive.	Soft, light in colour, less durable, less expensive.
Preferred climate	Temperate/tropical.	Cooler/temperate.
Speed of growth	Slow growing, reach maturity from 100 to 200 years.	Fast growing, reach maturity in 25 to 40 years.
Growth rings	Narrow compact growth rings giving close grain.	Wide growth rings giving open grain.
Sapwood	Sapwood can easily be identified and is brighter than heartwood.	Difficult to identify the sapwood. Much the same colour as heartwood.
Trunk	An irregular, less cylindrical trunk which often has little taper.	Very straight and cylindrical with even taper.
Crown of tree	The crown is wide, rounded and contains large, heavy branches.	The crown is narrow and pointed.
Soil	Thrives on fertile soils.	Can grow on most soil types.

5.

Timber	Reasons	Use
Oak	1. High quality, beautiful wood. 2. Very strong. 3. Finishes excellently.	High class furniture
Ash	1. Strong. 2. Outstandingly crack/split resistant. 3. Exceptionally elastic/flexible.	Hockey stick
Sycamore	1. Crack/split resistant. 2. Extremely hardwearing. 3. Odourless.	Breadboard
Beech	1. Strong. 2. No taste. 3. Wear resistant.	Woodworking tools
Birch	1. Hard. 2. Strong. 3. Crack/split resistant.	Crates
Douglas fir	1. Very strong. 2. Highly resistant to decay. 3. Takes nails and screws well.	Exterior furniture
Scots pine	1. Stable in use. 2. Cheap. 3. Takes screws well.	Door frames
Stika spruce	1. Lightweight. 2. Strong. 3. Takes nails without splitting.	Floor joists
Norway spruce	1. Lightweight. 2. Excellent tonal qualities. 3. Relatively cheap.	Musical instruments
Lodgepole pine	1. Strong. 2. Cheap. 3. Can be treated with preservative.	Fencing
Larch	1. Cheap. 2. Resists water. 3. Can be treated with preservative.	Bird table

6. (i) Beech.
(ii) Douglas fir.
(iii) Birch.
7. (i) Oak.
(ii) Scots pine.
(iii) Sycamore.

8. (i) Oak.
(ii) Horse chestnut.
(iii) Lime.
9. **D** – Oak, Sycamore, Ash, Holly. **E** – Scots pine, Larch, Douglas fir.
10. (i) Sycamore.
(ii) Ash.
11. (i) Oak.
(ii) Beech.
12. (i) Beautiful wood. (ii) Finishes excellently.
13. (i) Outstandingly crack and split resistant. (ii) Elastic (flexible).
14. (i) Crack/split resistant. (ii) Easy work with hand tools.
15. (i) Not resistant to decay. (ii) Resists impregnation with preservatives.

CHAPTER 7 IMPORTED TIMBERS

1.

Timber	Reasons	Use
Teak	1. Very strong. 2. Naturally resistant to weathering. 3. Stable.	External seat
Iroko	1. Strong. 2. Hardwearing. 3. Highly resistant to chemicals.	Counter top
Brazilian mahogany	1. Strong. 2. Hardwearing. 3. Beautiful colour.	Staircases
African mahogany	1. Low price. 2. Strong. 3. Stable.	Office desk
Rosewood	1. Very strong. 2. Resistant to bending. 3. Natural resistance to decay.	Boat building
Western red cedar	1. Lightweight. 2. Extremely resistant to decay. 3. Requires no protective finish	Garden furniture

CHAPTER 8 FORESTRY IN IRELAND

1. (i) A long growing season. (ii) Mild temperatures.
2. (i) Climatic changes. (ii) Over exploitation.

3. (i) Extensive deforestation. (ii) No profit in trees.
(iii) Negative attitude in rural people.
4. (i) Generous grants. (ii) Free technical advisory service.
5. (a) Coillte Teoranta.
(b) To maximise the return from the state forests and to oversee their development.
6. 9%.
7. (i) 90% conifers
(ii) 10% broadleaves
8. 16,000 people.
9. Fast growing.
10. (i) Tourism/leisure. (ii) Wildlife. (iii) Environment.
11. (i) Increases the risk of disease. (ii) Increases the risk of insect attack.
12. (i) Highly versatile. (ii) Tolerates all but the most difficult conditions.

CHAPTER 9 TREE PLANTING

1. (i) Mild, moist climate. (ii) Disease-free status.
2. Between leaf fall in late autumn and leaf burst in late spring.
3. (i) Birch. (ii) Alder.
4. Western red cedar or pines.
5. Stake – holds the tree in a vertical position and prevents the wind from blowing the tree down in high winds.

CHAPTER 10 MANAGED FOREST CYCLE

1. They are man-made and contain one or two types of trees, usually conifers, with all the trees the same age.
2. *Planting of bare land is called afforestation while the replanting of an area where a crop of a tree has previously been harvested is known as reforestation.*
3. (i) Planting.
(ii) Thinning.
(iii) Harvesting.
(iv) Transportation.
(v) Second rotation.
4. It creates more space for the remaining trees to grow.
5. (i) Make manufactured boards. (ii) Stakes. (iii) Pallets.
6. It is used by gardeners to control weeds and is known as bark mulch.

CHAPTER 11 DISTRIBUTION OF TREES

1. (a) Coniferous.
(b) The slender, conical shape of the tree offers little resistance to the wind; there are no big branches for the wind to catch and pull down during storms.
2. (i) Douglas fir. (ii) Red cedar. (iii) Spruces.
3. Conifers are evergreen trees, they do not shed their needles like foliage in the autumn.
4. Most of Ireland.
5. Deciduous trees lose their leaves in autumn.
6. (i) Mahogany. (ii) Teak. (iii) Iroko.
7. (i) Warm summer. (ii) Cold, frosty winter.

CHAPTER 12 TREES AND THE ENVIRONMENT

1. (i) Urban areas. (ii) Rural areas.
2. (ii) Pollution control. (ii) Provide a habitat for wildlife. (iii) Provide shelter.
3. (i) They reduce dust, air and sound pollution.
(ii) They provide a habitat for wildlife.
(iii) They reduce human stress.
(iv) Trees are beautiful to look at and soften our sometimes drab surroundings.
4. They absorb carbon dioxide and give off oxygen.
5. Deforestation is the haphazard (uncontrolled) activity or over harvesting of large areas of forests.
6. (i) Hardwoods are in demand for furniture making.
(ii) Clear land for farming.
(iii) Clear land for ranches.
7. *The greenhouse effect is caused by carbon dioxide and other gases trapping heat from the earth that would otherwise radiate back into space.*
8. Plant more trees.
9. (i) Habitat for large numbers of animals including humans.
(ii) Habitat for many rare and valuable flowers and plants.
10. (i) Use softwoods instead of hardwoods and treat them with preservative if they are for outside use.
(ii) Use wood and wood products that have been sourced in sustainable managed forests.
(iii) Use manufactured boards made from waste chippings and forest thinnings instead of solid timber.
11. Every tonne of recycled paper saves 17 trees.

12. It can cause uneven, sparse foliage unable to carry photosynthesis effectively.
13. (i) Stop the cutting down and burning of trees in the rainforests.
(ii) Reduce industrial emissions from power stations and factories.

CHAPTER 13 FELLING AND CONVERSION OF TIMBER

1. The term **felling** is used to describe the cutting down of a living tree.
2. It speeds up the seasoning (drying out) process.
3. (a) Through and through sawing.
4. (i) Cheapest method of conversion.
(ii) Fast and easy because the log doesn't have to be turned during cutting.
6. Softwoods.
7. (a) Quarter sawing.
(b) Silver grain.
8. Advantage – Excellent quality stable board is produced. Disadvantage – Costly.
9. Boards give a hardwearing surface.
10. The logs have to be turned many times during cutting.
11. (a) Tangent sawing.
(b) Waste is produced.
12. Advantage – Strong board. Disadvantage – Costly.
13. It produces a flame figuring or fiery grain on the board.
14. Through and through sawing.

15.

Through and through sawing	Quarter sawing	Tangent sawing
Cheap.	Costly.	Costly.
Fast.	Time consuming.	Time consuming.
Maximum width of boards produced.	Narrow boards produced.	Narrow boards produced.
Very little waste.	Wasteful.	Wasteful.
Poor strength.	Good strength.	Good strength.
Unattractive grain pattern.	Attractive grain pattern.	Attractive grain pattern.
Boards tend to shrink and cup.	Boards less likely to shrink and cup.	Can be prone to shrinkage and cupping when exposed to humidity in the air.
Poor wearing qualities.	Very good wearing qualities.	Good wearing qualities.

CHAPTER 14 TIMBER SEASONING

- When a tree is felled it contains a great deal of **moisture (water)** that could amount to 50 per cent of the overall weight of the tree. This freshly felled timber is called green timber.
- The drying out of green timber is known as seasoning.*
- The moisture content is below 20 per cent.
- (i) Outdoor furniture – 16%. (ii) Office furniture – 9–11%.
- (a) Electronic moisture metre. (b) To check the moisture content of wood.
- (i) **Fibre Saturation Point**. (ii) **Equilibrium Moisture Content**.
- (i) Natural or air seasoning. (ii) Kiln or artificial seasoning.
- The stack is raised off the ground outdoors, using blocks and beams, to allow air to circulate under the stack and to prevent the rise of dampness. Stickers are placed between each row of the boards to allow air to pass above and below each board. The boards have gaps between them for the same reason. The roof keeps most of the rain off the stack while also providing protection against direct sunlight. Over a period of months/years the natural air flow will slowly dry out the boards.*
- (a) Stickers or pile lathes.
(b) Kiln seasoning.

10. Paint the end grain of each board with bituminous paint or varnish to slow down evaporation.
11. Advantage (i) Cheapest method of drying, with natural airflow drying wood.
(ii) Easily maintained and managed.
- Disadvantage (i) Lowest moisture content that can be achieved is between 18 per cent and 22 per cent.
(ii) It is very slow, taking one year to dry a board 25mm thick.
12. (a) Compartment kiln.
(b) The steam heats the board through to its centre, which will prevent the timber drying out too fast, particularly near the surface, as this would cause case hardening.
13. The doors of the kiln never have to be opened which will save energy and prevent damage to this stack by incoming air.
14. (i) Very quick method of drying wood because the heat and humidity can be controlled during drying.
(ii) Exact moisture content of wood can be achieved.
15. Progressive kiln.
- 16.

Natural seasoning	Kiln seasoning
Cheap.	Expensive.
Very slow.	Very quick.
Minimum MC 18%.	Exact MC achieved.
No specialised equipment needed.	Specialised equipment needed.
Depends on the weather.	Doesn't depend on the weather.

CHAPTER 15 DEFECTS IN TIMBER

1.

Defect	Natural	Other
Knots	X	
End splits		X
Warping		X
Heart rot	X	
Spiral grain	X	

2. The grain around knots is twisted and irregular, which reduces the strength of the timber.
3. A dead knot is cut from a branch that stopped growing before the felling of the tree; it is dark in colour and shows signs of decay. They weaken the timber, often become loose and are prone to falling out.
4. Cracks or splits in the wood are called shakes.
5. (a) Heart shake.
(b) Shrinkage through old age or by too rapid drying.
6. (a) Star shake.
(b) Shrinkage through old age or by too rapid drying.
7. (a) Cup shake.
(b) Old age, high winds or poor felling.
8. (a) Ring shake.
(b) Old age, high winds or poor felling.
9. (a) Frost shake.
(b) Very harsh cold weather.
10. (a) Radial shake.
(b) Rapid drying of the log before conversion.
11. (a) Cross thunder shake.
(b) Severe shock during felling, lightening attack on tree while living.
12. (a) Cupping.
(b) When unequal amounts of shrinkage along the annual/growth rings pull the outer edges of the board up away from the pith.

13.

Defect	Cause
(i) Bowing	Poor stacking.
(ii) Twisting/warping	Shrinkage along spiral or interlocking grain.

15.

Defect	Cause	Prevention
(i) End splits	Rapid drying out from the sun.	Sealing the end grain with a bituminous paint.
(ii) Surface checks	Rapid drying out on the surface of the wood.	Use high humidity during the early stages of seasoning.
(iii) Honeycomb	Rapid drying out inside the kiln.	Low temperature schedules.
(iv) Case hardening	Rapid drying in the early of seasoning.	Use steam to heat the boards right through to the centre.
(v) Collapse	High temperatures and too rapid drying out at the early stages of seasoning.	Use a low temperature schedule when kiln seasoning.

16. (a) Waney edge.

(b) Too economical conversion of the log.

CHAPTER 16 WOOD PRESERVATIVE

- Lengthen the life span of wood.
 - Protect the wood from being attacked by fungi and insects.
 - Guard against weathering.
- Most preservatives are flammable.
- Brush and spray.
 - Immersion.
 - The hot-and-cold open tank method.
 - Pressure impregnation.
- Pressure impregnation.
- Tar oil preservative.
 - Easily applied by brush or spray.
 - It is oily; this has the effect of slowing down weathering.
- Gives off a strong smell, which would contaminate food.
- Long lasting.
 - It is highly toxic to marine borers.
- Odourless.
 - Non-flammable.

9. (a) Organic solvent preservative.
(b) (i) Protects against weathering. (ii) Not harmful to wildlife.
10. Organic solvent preservative.
11. Toxic chemicals.
12. Once the timber is dry, knotting, fillers, glues, paint and varnish can be applied.
13. (i) Water borne preservative. (ii) Organic solvent preservative.
14. (i) Tar oil preservative. (ii) Organic solvent preservative.

Preservative	Outside use	Inside use
Tar oils	✓	✗
Water borne	✓	✓
Organic solvent	✓	✓

CHAPTER 17 GRADING TIMBER

1. Shakes. Splits. Checks.
2. (i) Visual grading. (ii) Machine grading.
3. (i) **G**eneral **S**tructural. (ii) **M**achine **S**pecial **S**tructure.
4. The Timber Quality Bureau of Ireland.

CHAPTER 18 MANUFACTURED BOARDS

1. (i) It is expensive. (ii) It contains faults such as knots.
3. (i) Use is made of what would otherwise be waste wood (young trees, forest things, and wood machine waste).
(ii) Cheaper, more easily replaced softwoods are used for the board's core, only natural hardwood veneers or plastic laminate are used for facing veneer.
4. (i) Plywood. (ii) Blockboard.

5.

Manufactured board	Desirable properties	Undesirable properties
Plywood	Very strong	Surface veneer can easily be damaged
	Stable	Edges are unattractive
Blockboard	Stiff	Edges are unattractive
	Very strong	Expensive
Chipboard	Relatively cheap	Relatively weak
	Rigid	Easily broken
OSB board	Strong	Blunts ordinary tools quickly
	Relatively cheap	Cannot hold nails or screws well
Hardboard	Cheap	Relatively weak
	Lightweight	Buckles easily
MDF	Strong	Difficult to work
	Stable	Can be expensive

7. (i) Cheaper than equivalent-sized hardwood if veneered.
(ii) Stronger (particularly across the grain).
8. **W**eather and **B**oil **P**roof.
9. (a) Blockboard.
(b) (i) Worktops. (ii) Tabletops.
10. **O**rientated **S**trand **B**oard.
11. **M**edium **D**ensity **F**ibreboard.
12. Clonmel, Co. Tipperary.
13. The fibres in MDF run in all directions, there is no grain and the material is equally strong in every direction.
14. The dust from MDF is very fine and can damage your health if inhaled.
15. (a) MDF.
(b) The very small chips and high density uniform structure, with fine texture and no grain direction, allows the edges to be cleanly moulded with no breaking of the edges, flaking or splintering, even when the most complex profiles are produced.

Manufacturing process for plywood

1. Plies or veneers are cut from the log by rotary or knife cutting method.
2. Plies are placed on top of each other with the grain running at 90 degrees in adjacent layers.
3. Uneven number of veneers in sheet to balance faces.
4. Plies are glued together with synthetic resin adhesive glue (formaldehyde) and then extreme pressure and controlled heat are used to cure (set) the glue.
5. Boards are trimmed to standard size (1,220 mm x 2,440 mm) and the faces cleaned by sanding lightly.

Manufacturing process for blockboard/laminboard

1. Strips of timber of uniform width and thickness are selected.
2. Strips are arranged so that the pith or heartwood side is alternated in successive strips to reduce warping.
3. Strips are glued together with synthetic resin glue.
4. A facing veneer is applied at 90 degrees to the core using glue, heat and pressure.
5. Boards are trimmed to standard size (1,220 mm x 2,440 mm) and the faces cleaned by sanding lightly.

Manufacturing process for chipboard

1. Shred the raw material – wood chips from thinnings and machine waste.
2. Dry chips and mix with synthetic resin adhesive to form a thick paste.
3. Central core of large chips surrounded by two facing layers of smaller chips.
4. Mat of chips is pressed and heated to compress mat into a board of uniform thickness.
5. Boards are trimmed to standard size (1,220 mm x 2,440 mm) and the faces cleaned by sanding lightly.

Manufacturing process for MDF

1. The logs are reduced to fine chips.
2. The fine wood chips are screened and refined under pressure to produce dry wood fibres.
3. The dry wood fibres are then mixed with synthetic resin adhesive (urea formaldehyde).
4. A mat of fibres is formed and compressed to required thickness of sheet. The sheet is cured (set) with heat and steam and left to cool.
5. Boards are trimmed to standard size (1,220 mm x 2,440 mm) and the faces cleaned by sanding lightly.

CHAPTER 19 FUNGI ATTACK

1. *Merulius Lacrymans*.
2. (i) Dampness (moisture content above 20 per cent). (ii) Warm conditions.
3. (i) Appearance of fruiting bodies on the surface of the timber.
(ii) Presence of fine rust-red dust.
4. 600 mm.
5. (i) Address the cause of the dampness/infection, i.e. leaking pipes, radiators, etc.
(ii) Use sound, well-seasoned wood, with moisture content below 20 per cent.
6. *Conophora Puteana*.
7. (i) No strength. (ii) Musty smell.
8. (i) Treat timber with preservative. (ii) Treat timber with water repellent finish.
- 9.

Dry rot	Wet rot
Moisture content above 20 per cent.	Moisture content above 30 per cent.
Cube-like appearance.	Burnt-like appearance.
Affects the surrounding blockwork or plaster.	Does not affect the surrounding blockwork or plaster.

10. Wet rot.
11. (i) Sapstain. (ii) Mould growth.

CHAPTER 20 WOOD-BORING INSECTS

1. The timber in stage 2 is eaten away and weakened by the honeycomb of tunnels inside the timber. In stage 4 the presence of flight holes on the surface of the timber destroy its appearance.
2. Woodworm is the general term used to describe an attack on timber by wood-boring insects.
3. (i) Makes a honeycomb of tunnels inside the timber.
(ii) Presence of flight holes or exit holes on the surface of the timber.
(ii) Presence of dust or wood powder on the surface of the timber.
4. It kills the grub or worm, which may be burrowing deep into the timber.
5. (i) Apply a suitable preservative to the timber.
(ii) Make sure the surface of the wood is sanded smooth with no cracks or crevices.
(iii) Ensure that all surfaces have an applied finish.

6. (i) Common furniture beetle. (ii) Wood-boring weevil.
(iii) Death watch beetle.
7. (a) Common furniture beetle.
(b) Attacks hardwood and softwood.
8. (i) Shipworm.
(ii) Gribble.

CHAPTER 21 WEATHERING

1. *Weathering is the term used to describe the deterioration and breakdown in durability of wood caused by its mechanical and chemical breakdown when exposed to the action of the weather: rain, snow, fog, frost, wind and sun.*
2. The action of constant, harmful, ultra-violet light and rainwater or algae, dirt from atmospheric pollution and, in some cases, mould growth on the timber surfaces.
3. Rapid changes in the moisture content of the timber surface caused by constant exposure to wetting and drying from the rain and sun.
4. (i) Outdoor varnish. (ii) Yacht varnish. (iii) Exterior wood stain. (iv) Sadolins.
5. They will prevent chemical breakdown of the wood.

CHAPTER 22 MEASURING AND MARKING OUT TOOLS

1. (a) Tape measure.
(b) For marking and checking long and short measurements.
(c) **X** – holds the blade at any length and stops it from springing back inside the case of the tape when measuring. **Y** – belt clip.
2. (a) Try square.
(b) Marking lines at **right angles** on a workpiece.
(c) Reduce wear on the edge from constant friction.
(d) (i) Strong. (ii) Stable.
3. (a) Sliding bevel.
(b) Marking lines at **any angle** on a workpiece.
(c) Locks the blade at a certain angle.
(d) For varying its working length.
4. (a) Marking knife.
(b) Cuts fine, accurate lines across the surface of the grain before chiselling or sawing.
(c) *This tool cuts the outer fibres of the wood.*
5. (a) Marking gauge.
(b) Marks an accurate line parallel to the face or edge of timber or plastic.

- (c) Protects the marking gauge from continuous friction with the wood and reduces wear on the face of the stock.
 - (d) Beech.
6. (a) Mortise gauge.
- (b) Marks two parallel lines on the wood at a measured distance from the face side and edge of timber.
 - (c) 11 mm.
7. (a) Cutting gauge.
- (b) Cuts small grooves in wood.
 - (c) Keeps the blade in place.
8. (a) Thumb gauge.
- (b) Marking lines for a chamfer/bevel/fillet on wood.

CHAPTER 23 HANDSAWS

1. Set.
2. Clear large amounts of sawdust from the kerf.
3. (i) Cross cut teeth.
- (ii) Rip saw teeth.
- 4.

Saw	Straight cut	Curved cut
Dovetail saw	X	
Rip saw	X	
Pad saw	X	
Coping saw		X
Compass saw		X

5.

Types of saw	Use
(i) Tenon saw	Cuts light bench work with/across the grain, especially tenons, which is how it got its name. It is also suitable for cutting acrylic.
(ii) Dovetail saw	Cutting fine light work or dovetail joints.
(iii) Bow saw	Cuts both internal and external shapes and curves.
(iv) Coping saw	Cuts small curves, slots and intricate shapes in lightweight wood, plastic, glass fibre and mild steel. It can also be used when making dovetail joints to remove some of the waste between the pins and the tails.
(v) Fret saw	They are designed to make extremely tight curved cuts in thin wood or sheet material like manmade boards or veneers. It is used for producing fretwork designs in furniture, toys, etc.
(vi) Compass saw	Cuts internal shapes and curves quickly in wood, plywood or wallboard, which are beyond the range of the coping saw and bow saw.
(vii) Pad saw	Cuts internal shapes and curves in awkward places and is more suitable than a compass saw for cutting tight curves.

6. (i) Wood. (ii) Acrylic (perspex).
7. Strengthens, stiffens and keeps the blade straight.
8. It helps to steady the saw, giving you greater control over the blade, and prevents the handle from twisting in your hand.
9. *When starting the saw cut, cut on the waste side of the marked line.*
10. (i) Keep your hands away from the cutting line, unless you are starting a cut.
(ii) Never force a saw blade.
11. (i) 45 degrees.
(ii) 60 degrees.
12. To apply tension to the blade.
13. Coping saw.
14. Towards the handle.
15.
 1. Remove the old blade.
 2. Turn the handle anticlockwise to reduce the gap between the sighting pins.
 3. Place the blade in slots with teeth facing the handle.

4. Tighten the handle to give tension to the blade.
5. Align the sighting pins by eye so the blade is straight.

CHAPTER 24 CHISELS AND GOUGES

1. **A** – handle. **B** – ferrule. **C** – neck. **D** – blade. **E** – cutting edge.
2. The metal ferrule reinforces the wood and prevents it from splitting when hit heavily and repeatedly with a mallet or hammer.
3. (i) Close grained. (ii) Crack/split resistant.
4. (i) Strong. (ii) Impact resistant.
5. Material – high carbon steel. Properties (i) Very strong. (ii) Tough.
6. (i) **Firmer chisel** – vertical and horizontal paring, roughing out, housing, trenching and light chopping.
(ii) **Bevel-edge chisel** – light work, paring trenches, reaching into awkward corners, paring dovetails and chamfering.
(iii) **Mortise chisel** – heavy-duty work, chopping out mortises and slots.
7. (i) Firmer chisel.
(ii) Bevel-edge chisel.
8. It absorbs and softens the blows of hammering with the mallet.
9. 6 mm, 10 mm, 12 mm, 18 mm and 25 mm.
10. A sharp chisel is a safe chisel.
11. (i) Keep both hands on the chisel.
(ii) Keep both hands behind the cutting edge of the chisel.
12. (i) Walk: do not run. (ii) Hold the blade loosely and point it towards the ground.
13. (i) Both hands are behind the cutting edge of the chisel.
(ii) The work is securely held in the vice.
14. A gouge is a chisel, which is designed with a curved blade.
15. (i) **Firmer gouge** – scooping out hollows, roughing out bowls and carving work.
(ii) **Paring gouge** – vertical paring and curves cutting moulding, channelling and other paring work.

CHAPTER 25 PLANES

1. (i) **Jack plane** – squares up rough timber to correct size and quick removal of waste wood.
(ii) **Smoothing plane** – puts a final smooth planed surface on the wood.
(iii) **Try plane** – planes extra long surfaces and edges to a smooth finish.
(iv) **Block plane** – for chamfering, end grain work and other small jobs. The low pitch of the blade allows work on plastic laminate.

- (v) **Rebate plane** – works out a step at the edge or end of wood.
 - (vi) **Plough plane** – cuts a groove (slot) along the grain in a piece of timber.
 - (vii) **Router plane** – levels the bottoms of grooves or trenches to a precise depth.
 - (viii) **Spokeshave** – smoothes and shapes a curved edge or surface.
2. **E** – depth adjustment wheel, function – controls the protrusion of the blade below the sole of the plane, therefore the depth and thickness of cut.
F – lateral adjusting lever, function – to adjust the cutting iron so that the cutting edge is parallel to the sole of the plane.
 3. Jack plane.
 4. Cap iron – gives extra strength and rigidity to cutting iron.
 5. (a) Cast iron.
(b) Keeps the cutting assembly locked firmly in place on the frog of the plane.
 6. Prevent damage to the cutting edge.
 7. *Always use the plane in the direction of the grain.*
 9. They reduce friction between the sole of the plane and timber, making it easier to slide.
 11. Rebate.
 12. Plough plane.
 13. (i) Flat faced spokeshave. (ii) Curved faced spokeshave.
 15. It will not leave dust if used correctly.

CHAPTER 26 SHARPENING TOOLS

1. (i) Cuts more accurately. (ii) Takes less effort. (iii) Gives a superior finish.
2. (i) Very strong. (ii) Naturally hard.
3. (a) 25 degrees. (b) 30 degrees.
4. Striking a nail or screw.
5. (a) High-speed grinder.
(b) X – protects your eyes from the shower of sparks and abrasive particles which are thrown off. Y – supports the blade while being ground.
6. In case they get caught in the wheel.
7. The blade is cooled with water.
8. Lubricates the stone to reduce friction, which speeds up the sharpening.
- 9.

1. Grinding
2. Honing
3. Removal of burr

10. (i) The blade can be placed with back flat on the oilstone and backhoned.
(ii) A leather strop can be used to remove the wire edge/burr.
11. (i) Slipstone.
(ii) Leather strap.
(iii) Motorised whetstone.
12.
 1. Hold the saw
 2. Top
 3. Sharpen
 4. Set
 5. Side dress

CHAPTER 27 TOOLS FOR HOLDING MATERIALS

1. (i) To give you maximum control and safety.
(ii) To keep materials firmly in position.
- 2.

Tool	Use
(i) Vice	Holds materials securely and firmly to the workbench and cramps work after gluing.
(ii) G-cramp	Holds materials down to the bench or in the gluing up of work.
(iii) Fast/quick action cramp	It is useful when you want to hold materials down to the bench quickly and the glue is drying quickly.
(iv) Sash/bar cramp	Gluing up of large timber frames or objects, such as doors or tabletops.
(v) Edge cramp	Secures edging strips on straight or curved surfaces.

3. Prevents marking or damage to the acrylic from the knurled metal jaws of the vice.
4. Holds wood steady while sawing.
5. Supports the wood when planing long lengths or small sections.
6. (i) For holding two pieces of wood together while glue sets.
(ii) For holding small and large objects.
7. Protect the material.
8. (a) G-cramp.
(b) Grip awkward, non-square pieces of wood and apply pressure evenly.

9. (a) Secure materials firmly to the top of the bench in positions that an ordinary clamp would not reach.
(b) **A** – foot. **B** – collar.

CHAPTER 28 TOOLS FOR NAILING AND MALLETS

1. In terms of weight.
2. **Hardened** – hardening is heat-treating metal to increase resistance to indentation/marks. **Tempered** – tempering is relieving brittleness by reducing hardness.
3. Expands the handle so as to fix the hammer head to the handle.
4. (i) **Claw hammer** – drives large nails and removes straight and bent nails.
(ii) **Cross pein hammer** – drives small nails and pins, and knocks joints apart.
(iii) **Pin hammer** – drives very small nails, panel pins, tack and staples.
5. Pull nails out.
6. Start small nails and pins.
7. Protect against flying nails.
8. (i) The correct weight and type of hammer was not used.
(ii) The face of the hammerhead is greasy or dirty.
9. (a) Nail punch. (b) Driving a nailhead in flush or below the surface of the wood.
10. Improve leverage and prevent damage to the wood.
11. (a) (i) Striking the handle of a chisel.
(ii) Knocking together or apart pieces of wood that are tightly joined.
(b) **Beech** – it is closed grained and resistant to impact.
12. (a) The head tightens with every blow and prevents the head of the mallet from flying off in use, making it self-tightening.
(b) The mallet strikes the head of the chisel squarely.

CHAPTER 29 ABRASIVE TOOLS

1. (i) Flat file.
(ii) Half round file.
(iii) Round file.
(iv) Square file.
(v) Three square file.
2. Draw filing.
3. The shape of their teeth: the surface of the rasp is designed with large individual teeth shaped differently than those of a file.
4. Gives a rough finish.

5. (i) Allows for a better hold on the file.
(ii) Protects the user from the sharp pointed tang.
6. (i) Plywood. (ii) Chipboard.
7. They remove wood quickly.
- 8.

Abrasive tool	Uses	Finish
(i) File	Shaping wood, plastic and metals.	Smooth or rough.
(ii) Rasp	Shaping wood quickly and is also used on leather and soft metals.	Rough.
(iii) Surform	Shaping wood, plywood, chipboard, fibre glass, soft metals and plastic.	Smooth or rough.

CHAPTER 30 BORING TOOLS

1. Offer greater control.
2. (i) **Bradawl** – bores small starter/pilot holes in softwood for small screws to prevent the wood splitting. Bores small starter/pilot holes in wood before drilling.
(ii) **Gimlet/hand auger** – bores deep starter/pilot holes in softwood for small screws to prevent the wood splitting. Bores deep starter/pilot holes in wood before drilling.
3. (i) Wood. (ii) Plastic.
4. Provides extra pushing power for deep holes.
6. (a) Ratchet. (b) It allows movement in one direction only.
7. Universal or alligator.
8. (i) Centre bit.
(ii) Fostner bit.
(iii) Expansion bit.
(iv) Flat or spade bit.
9. Helps you to start drilling in the right place.
10. It allows a hole to be bored only part of the way into the wood.
11. Stand a try square on the work beside the drill.
12. Torque or turning force.
13. Place a scrap piece of wood behind the piece to support the bit as it comes through.

CHAPTER 31 SCREWDRIVERS

1. (i) Strong. (ii) Straight grain.
2. Polypropylene.
3. Torque/torsion or turning power.
4. Cabinet screwdriver.
5. (i) Cabinet or fluted head screwdriver. (ii) Philips screwdriver.
6. (a) Pozidrive/supadriv slot. (b) Improves the grip on the screw.
7. Ratchet screwdriver.
8. Spiral ratchet screwdriver.
9. (i) To drive a screw, hold it and the screwdriver in a straight line.
(ii) Always match the screwdriver tip to the size and type of screw.

CHAPTER 32 PLUGS AND FUSES

1. *In Ireland, electricity from the mains supply has a voltage of 220 volts; this supply is routed through the workshop to various wall socket outlets.*
2. Brass.
3. Prevents the user getting a shock if the plug is pulled partly out of the socket.
6. (i) Bare wires exposed at terminals.
(ii) Wires wrong length; either too long and twisted or too short and stretched.
(iii) Outer sheathing carelessly cut back; core insulation damaged.
7. **X** – fuse.
8. (a)

Terminals/pins	Wire colour
Live	Brown or red
Neutral	Blue or black
Earth	Yellow/green or green

- (b) It is a safety device that prevents overloading and protects against short circuits.
9. (i) Cracked plug top terminals could become exposed.
(ii) Badly frayed insulation on flex.
10. Watts.

CHAPTER 33 PORTABLE ELECTRIC TOOLS

1. (a) Transformer.
(b) Step voltage supply down from 220 volts to 110 volts. Lower voltage means less danger of an electric shock being serious or even fatal if cables get cut, tools become wet, etc.

2. The portable electric tool is double insulated.
3. The extension reel is being unwound fully.
4.
 - (i) **Jig saw** – makes straight, curved or angled cuts in wood, particularly manufactured boards, plastic (acrylic, PVC, glass fibre/GRP), leather, steel, ceramic tiles and soft metals such as aluminium, copper and brass.
 - (ii) **Standard electric drill** – bores small holes in wood, plastic and metal, inserts, removes and countersinks screws.
 - (iii) **Hammer drill** – drills holes in wood, plastic, metal and hard surfaces like concrete, brick, marble, granite and ceramic tiles. Also tightens wood screws and machine screws.
 - (iv) **Orbital/finishing sander** – finely sands flat work.
 - (v) **Random orbit/disc sander** – finely sands flat and curved work.
 - (vi) **Belt sander** – removes large, flat areas of wood quickly, trims off excess wood, strips old paint and finish.
 - (vii) **Router** – grooves, cuts, shapes decorative mouldings, carves and machines wood, MDF and plastic.
 - (viii) **Spray gun** – apply finishes such as varnish, lacquer or paint quickly and efficiently to wood.
 - (ix) **Cordless drill** – cordless power drills are run on unplugged power; they are designed for situations where it's difficult or impossible to plug into a mains supply.
5. The blade cuts on the upstroke.
6. Can cut into supporting tables, benches, trestles, etc.
7.
 - (i) *Select a fast speed for drilling holes in wood.*
 - (ii) *Select a slow speed for drilling wood screws and drilling holes in metal, plastic and hard surfaces.*
8.
 - (i) Always select the correct speed for the work to be completed.
 - (ii) Use safety goggles and ear protectors when using the electric drill.
9. To avoid it twisting or snatching in your hand and taking off.
10.
 - (i) Always unplug the sander before changing sheets.
 - (ii) Always hold sanders with both hands.
11.
 - (i) Always wear the correct protective equipment : safety goggles, respirator and ear protectors.
 - (ii) Before making adjustments to the router, such as changing the cutter, switch off the wall socket.
12. A – rechargeable battery pack. Provides the power to run the power tool.
13. Advantage – can be used in areas away from power supply.
Disadvantage – over-exposure to cold and heat will damage the battery pack.
14.
 - (i) Reduced risk of electric shock.
 - (ii) No long extension leads to get in the way.
15.
 - (i) Insert the battery casing into charger with polarity the correct way.

- (ii) Do not leave your battery on charge continually.
 - (iii) Do not overcharge the battery.
16. (i) When using a jig saw. (ii) When using the electric sander.

CHAPTER 34 MACHINE TOOLS

1. (i) **Chisel mortiser** – to remove mortises for mortise and tenon joints.
(ii) **Band saw** – for cutting curves, general shaping of work and re-sawing. It can also be used to make straight cuts in wood, plastic and metal.
(iii) **Sanding machine** – sanding, smoothing, buffing and sharpening narrow pieces of straight, curved or odd-shaped wood.
(iv) **Drilling machine** – drilling holes in wood, plastic or metal.
(v) **Scroll saw** – for making intricate and accurate curved and piecing cuts.
2. (i) Never turn the mortiser on until the table is clear of all objects.
(ii) Always keep hands, fingers and hair away from rotating bit.
3. (i) Never allow yourself become distracted when operating a bandsaw.
(ii) Never leave the bandsaw until the blade has stopped running.
4. The workpiece was not moved back and forth while sanding.
5. (i) Hold the work firmly.
(ii) Wear safety glasses/goggles, ear protectors, dust mask or respirator.
6. Prevents damage to the drill bit and drill press table; it also supports the acrylic and prevents it chipping and shattering.
7. Safety guard – prevents injury to the user by stopping loose clothing and hair from getting caught in the rotating chuck and protects against flying debris.
8. Slow speed.
9. (i) Only one student at the machine.
(ii) Drill safety guard in place.
(iii) No loose clothing.
10. (a) (i) Solid wood. (ii) Plywood. (iii) Plastic.
(b) Keeps the workpiece clear of debris.

CHAPTER 35 BASIC JOINTS

1. (i) How strong must the joint be to resist the forces acting on it?
 (ii) Is the joint a feature or is it concealed?
 (iii) What type of wood is to be joined?

2.

Joint	Advantages
Butt joint	Very little preparation.
	Easy to make.
Mitred butt joint	Simple and quick to make.
	Decorative.
Lap joint	Improve appearance over butt joint.
	Easy to make.
Edge-to-edge joint	Large gluing area.
	Strong.
Halving joint	Fairly easy to make.
	Fairly strong.
Housing joint	Simple to make.
	Strong.
Bridle joint	Relatively strong.
	Large gluing area.
Mortise and tenon joint	Neat and very strong.
	Large surface area for gluing.
Dovetail joint	Strongest of all the joints.
	Large gluing area.
Finger joint	Strong.
	Decorative.
Dowel joint	Neat and strong.
	Simple, quick and easy to make.
Biscuit joint	Strong, rigid, tight and extremely accurate joint.
	Quick to make.

3. (a) Butt joint. (b) Joining lightweight basic frames or small boxes. (c) Weak.
4. (a) Mitred butt joint.
(b) Join lightweight frames.
(c) (i) Nails. (ii) Pins. (iii) Biscuits. (iv) Plywood tongue.
5. (a) Mitre box.
(b) Guide the saw accurately when cutting the 45° angle for mitres. It is also used to aid cutting timber squarely.
6. (a) Lap joint.
(b) Joins corners of boxes.
7. (a) Tongued and grooved joint.
(b) Joins narrow boards.
(c) Tongue.
8. (a) Cross halving joint.
(b) Joins horizontal members that cross vertical members in frames.
9. (a) Through housing joint.
(b) Fixing shelves to vertical panels in cabinets.
10. (a) Corner bridle joint.
(b) Lightweight frames.
(c) **A** – $\frac{1}{3}$, **B** – $\frac{1}{3}$, **C** – $\frac{1}{3}$.
11. (a) Through mortise and tenon.
(b) Door frames.
(c) **A** – tenon. **B** – mortise.
(d) One-third the thickness.
12. (a) Haunched mortise and tenon.
(b) Prevents twisting.
13. (a) Rebated mortise and tenon.
(b) The rebate allows glass or a solid panel to be fitted.
14. (a) Grooved haunched mortise and tenon.
(b) It allows the frame to take a solid panel.
15. (a) Tee dovetail joint.
(b) Join frames.
(c) **A** – pin. **B** – tail.
(d) Softwood – 1:6. Hardwood – 1:8.
16. (a) Through dovetail joint.
(b) Constructing drawers.
17. (i) Edge-to-edge dowel joint.
(ii) Cross halving joint.
(iii) Oblique halving joint.

- (iv) Tee halving joint.
 - (v) Stopped housing joint.
 - (vi) Tapered housing joint.
 - (vii) Tee bridle joint.
 - (viii) Wedged mortise and tenon.
 - (ix) Stopped mortise and tenon.
 - (x) Double mortise and tenon.
 - (xi) Corner dovetail joint.
 - (xii) Lapped dovetail.
 - (xiii) Finger joint.
 - (xiv) Dowel joint.
18. Increase gluing area.
19. (a) Biscuit jointer.
(b) Cuts oval slots for the placement of flat, wooden biscuits.
20. (a) To give maximum strength.
(b) Allow space for glue and increases the gluing area.
21. (i) Use sharp blades only, remove and throw away bent blades.
(ii) The motor must be running before you plunge the blade into the work.
(iii) Watch for kickback and keep your fingers away from the blade.

CHAPTER 36 PRACTISE JOINTS

4. **A** – marking gauge. **B** – tenon saw. **C** – router plane.
6. Protects the bench from damage from the edge of the chisel.
8. **A** – marking gauge. **B** – try square. **C** – dovetail template. **D** – dovetail saw.
E – coping saw. **F** – bevel-edge chisel.
9. Dowels.
10. Dowel pins.

CHAPTER 37 ADHESIVES

1. Advantages (i) Most are stronger than the material being joined.
(ii) Most are permanent.
- Disadvantages (i) They need to be held in position, then left anywhere from one hour to a day to gain maximum strength.
(ii) Most joints cannot be dismantled after gluing.
2. (i) What type of material I am gluing?
(ii) What size is the area to be glued?
(iii) Will the piece be used indoors or outdoors?
3. **M**oisture **R**esistant. **W**eather and **B**oil **P**roof.

4.

Adhesive	Advantages	Disadvantages
Animal glue	1. Thermoplastic qualities; heat or moisture can resoften it.	1. Strong odour.
	2. Requires very little pressure to make the glue set.	2. Not water or heat resistant.
PVA	1. Environmentally friendly.	1. Wood can sometimes swell leaving stains after glue has dried.
	2. Strong bond.	2. The glue line can sometimes be seen after polishing.
Urea formaldehyde	1. Strong bond.	1. Short pot life.
	2. Can withstand cold water and is heat resistant.	2. Can only withstand hot water for a limited time.
Phenol formaldehyde	1. Very strong bond.	1. Requires high temperature to set.
	2. Resistant to wood preservative.	2. Expensive.
Epoxy resin adhesive	1. Very strong, solvent-free bond.	1. Irritating to eyes and skin.
	2. Sets hard.	2. Very expensive.
Cyanoacrylates (super glues)	1. Extremely quick bond.	1. Can leave a glue line.
	2. Very strong bond achieved.	2. If they come in contact with skin, they are difficult to remove.
Contact/impact adhesive	1. Very strong instantaneous bond.	1. Repairs to work are nearly impossible.
	2. Requires very little pressure to make the adhesive set.	2. Adhesion can be patchy.
Hot-melt glue	1. Glue can be applied quickly and accurately.	1. Weak bond is formed.
	2. Instant bond (20 to 90 seconds).	2. Poor resistance to heat.

5. **Polyvinyl Acetate** – **Bond** solid wood (softwood, hardwood).
6. (i) Non-toxic. (ii) Non-flammable.
7. Resorcinol formaldehyde.
8. Gives off harmful toxic fumes and a strong unpleasant smell.
9. Contact/impact adhesive. Very strong instantaneous bond. Requires very little pressure to make the adhesive set.
10. (i) Wear a respirator or keep the workshop well ventilated at all times by opening doors and windows or turning on fans.
(ii) Do not use near naked flames.
11. (i) Wood. (ii) Metal. (iii) Leather.
12. (i) Non-flammable. (ii) Odourless. (iii) Non-toxic.
13. (i) Animal glue. (ii) Casein glue. (iii) PVA.
14. (i) Epoxy resin adhesive. (ii) Cyanoacrylates (super glue).
15. (i) Contact/impact adhesive. (ii) Hot melt adhesive.
16. (i) Glue roller.
(ii) Three-tip glue applicator.
- 17.

Job that you are gluing	Adhesive to choose
Indoor woodwork (dry conditions).	PVA or waterproof resin adhesive.
Indoor woodwork (damp conditions).	PVA or waterproof resin adhesive.
Outdoor woodwork.	PVA or waterproof adhesive.
Loose joints.	Standard PVA or waterproof resin adhesive if large gaps need filling.
Metal to sheet laminate.	Epoxy resin adhesive.
Fixing fabric to card or paper.	PVA.
Fixing metal to brick outdoors.	Heavy-duty epoxy resin adhesive.
Mending a toy or piece of kitchenware made from rigid plastic.	Epoxy resin adhesive.

CHAPTER 38 SCREWS

1. (i) They provide a better grip than nails.
(ii) They draw the two parts of the work together more tightly than a nail does.
2. Surrounds the shank and cuts/bites into the fibres of the wood as the screw is turned, pulling it into the wood.
3. (i) Straight slotted
(ii) Philips
(iii) Pozidrive

4.

Material	Property
Mild steel	Very strong.
Brass	High resistance to rust.
Black iron	Rust resistant.
Stainless steel	Attractive.

7. Easier to insert screw, and prevents the wood from splitting.

CHAPTER 39 NAILS

- Round wire nail.
 - Oval wire nail.
 - Wiggle nail.
- Oval wire nail.
 - Upholstery nail.
- A
 - To prevent/reduce the risk of splitting the wood.
- To protect against flying nails.
- They are used for ornamental effect.
-

Nail	Use
(i) Panel pin	For furniture making.
(ii) Wiggle nail	Holds together lightweight mitre joints.
(iii) Cut tack	Attaches fabric to wood.
(iv) Clout head nail	Fixes roofing felt.
(v) Staples	Fix fence wire.

8. There is less chance of the wood splitting.

CHAPTER 40 KNOCKDOWN FITTINGS

- Advantage – fewer tools needed during assembly.

Disadvantage – some can be slow to fit.

2.

Type	Use
(i) Chipboard insert	Make a really strong fixing in the edge of chipboard.
(ii) Screw connector	Join man-made boards without the aid of inserts.
(iii) Screw sockets	Bolting man-made boards together.
(iv) Tee nut and bolt	Joins wooden frames.
(v) Cabinet connector	Links adjoining cupboards or kitchen cabinets side by side.
(vi) Plastic block joint	Joins panels at right angles, for example cabinet corners.
(vii) Right angle brackets	Support shelves.
(viii) Corner plates	Join table rails and legs together at each corner.

3. Supports adjustable shelves.

CHAPTER 41 HINGES

1. (a) Butt hinge.

(b) Brass.

2.

Hinge	Material	Use
(i) Rising butt hinge	Brass, mild steel.	When a door has to rise over a sloping floor.
(ii) Lift-off hinge	Brass.	Where it may be necessary to lift-off hinged components like doors or dressing table mirrors.
(iii) Centre hinge	Brass.	Where ordinary butt hinges do not fit, for example in shaped cabinets.
(iv) T-strap hinge	Mild steel that is galvanised, painted or black japanned.	For hanging garage doors.

(v) Strap hinge	Mild steel that is galvanised, painted or black japanned.	Hanging doors.
(vi) Decorative hinge	Brass.	A decorative flush fixing on the face of fine wood furniture.
(vii) Back flap hinge	Brass, mild steel.	Where there is considerable stress on the hinge screw, for example box lids.
(viii) Flush hinge	Brass.	For lightweight doors only.
(ix) Piano hinge	Brass.	Where extra strength is required on kitchen press doors.
(x) Cranked hinge	Brass.	Fine cabinetwork with lay-on (i.e. non-recessed) doors or flush inset cabinet doors.
(xi) Concealed cabinet hinge	Mild steel.	For inset and overlaid cabinet doors.

CHAPTER 42 LOCKS

1.

Lock	Use
(i) Mortise lock	Secures final exit doors in houses.
(ii) Cylinder nightlatch	Secures front doors.
(iii) Rim lock	Secures internal doors in a house.
(iv) Double-handed, straight cupboard lock	Secures cupboard doors.
(v) Cut door lock	Secures drawers.
(vi) Box lock	Secures first class work.
(vii) Single ball catch	Secures flush, overlay and unset cupboard and cabinet doors.
(viii) Roller catch	Secures heavy doors without locking them.
(ix) Magnetic catch	Holds press doors.

2. (i) Resists rusting. (ii) For better weathering.

CHAPTER 43 PROPERTIES OF MATERIALS

1. A – Compression. B – Tension.
2. A
3. Pulling force.
4. B
5. (a) Hardness.
(b) The chisel must have the ability to resist wear, scratching, cutting or denting.
6. (i) Resist impact. (ii) Resist blows.
7. Too brittle.
8. Elastic limit.
9. Durability.
10. Transparent – glass. Opaque – wood.

CHAPTER 44 METALS

1. (i) Solid at room temperature (except mercury).
(ii) Shiny appearance when polished (except mercury).
2. (a) A mixture of two or more metals.
(b) Brass.
- 3.

Metal	Type
Copper	Pure metal
Aluminium	Pure metal
Bronze	Alloy
Steel	Alloy

4. *Metals can be divided into two main groups, ferrous and non-ferrous. The difference between the two categories is that non-ferrous metals do not rust.*
5. (i) Cast iron. (ii) Steel.
6. (i) Aluminium. (ii) Copper.

7.

List A	Metal	Properties	
Kitchen sink	Stainless steel	Shiny attractive appearance.	Excellent resistance to corrosion.
Spokeshave body	Cast iron	Hard.	Good resistance to wear.
Ladder	Aluminium	Lightweight.	Resistant to corrosion.

8. (i) Aluminium.

(ii) Copper.

9. (i) Soft. (ii) Toxic.

10. (i) Zinc. (ii) Brass.

11.

Metal	Type
Copper	Non-ferrous
Iron	Ferrous
Lead	Non-ferrous
Brass	Non-ferrous
Steel	Ferrous
Zinc	Non-ferrous
Aluminium	Non-ferrous

12.

Metal	Properties	Use
Cast iron	1. Easy cast 2. Hard.	Fire grate
Mild steel	1. High strength 2. Low cost.	Bicycle frame
High carbon steel	1. Very strong. 2. Wear resistant.	Saw blade
Medium carbon steel	1. Strong. 2. Hard.	Railway tracks

Stainless steel	1. Strong. 2. Lightweight.	Watch back
High speed steel	1. Very strong. 2. Withstands heat.	Hacksaw blade
Aluminium	1. Lightweight. 2. Resistant to corrosion.	Soft drink cans
Copper	1. Resistant to corrosion. 2. Easy to work.	Water pipes
Brass	1. Attractive appearance. 2. Wear resistant.	Musical instruments
Bronze	1. Resistant to corrosion. 2. Wear resistant.	Coins

13. Apply paint.

14.

Metal	Will rust	Will not rust
Copper		X
Brass		X
Steel	X	
Zinc		X
Iron	X	

15.

Tool	Use
(i) Metal scribe	Marking layout and cutting lines on the surface of metal and plastic before cutting.
(ii) Odd leg callipers	Marking lines to a given edge.
(iii) Centre punch	Starting holes in metal and plastic.
(iv) Spring dividers	Scribes circles, arcs and parallel lines on metal and plastic.
(v) Hacksaw	Cutting metal/plastic.

(vi) Junior hacksaw	Cutting light metal/plastics especially in awkward places.
(vii) Snips	Cutting thin sheet metal.
(viii) Vice grips	Holding light work.
(ix) Riveting pliers	Inserting light aluminium rivets into sheet.

16. Pointing forward away from the blade.
17. (i) Tinplate. (ii) Copper. (iii) Brass.
18. For bending and shaping soft metals.
19. Sinking.
20. (a) Flux.
(b) To clean the surface of the metal and avoid the formation of oxides.
21. Lead solder is toxic.
22. Check that the soldering tools are earthed and wires are sound.
23. **Special goggles** – to protect the eyes from the glare from the flame when welding. **Apron** – protect against flying sparks.
24. (i) Distributes pressure under the bolt.
(ii) Protects the surface from any damage.
25. (i) Welding. (ii) Adhesives.
26. (i) Coach screws. (ii) Carriage bolts.
27. (i) No change in materials properties due to heat.
(ii) No heat required.
(iii) No specialised equipment needed.
29. (a) Zinc.
(b) Zinc is non-corrosive and protects the metal against corrosion.
28.
 1. Remove grease, rust and dirt.
 2. Score the surface.
 3. Apply rust primer.
 4. Undercoat no 1.
 5. Undercoat no 2.
 6. Finishing coats.
30. Dip-coating.

31.

List A	Finish
Dustbin	Galvanising (zinc)
Garden bench	Paint
Refrigerator shelves	Plastic coating

37. (i) Paint. (ii) Galvanising.

38. (a) Planishing.

(b) Copper.

CHAPTER 45 PLASTICS

- Advantage – good chemical and weather resistance.
Disadvantage – not environmentally friendly.
- They are not biodegradable they tend to end up as rubbish and spoil the environment.
- Thermoplastic plastic.
- Thermosetting plastic.
- Molecule.
- (a) Thermoplastic.
(b) They can be heated, moulded and shaped **any number of times**.
- Advantage – 10x impact resistant compared to glass.
Disadvantage – easily scratched.
- PolyVinyl Chloride. Unplasticised Polyvinyl Chloride.**

10.

Plastic	Item
Polypropylene	Chisel handle
Acrylic	Machine guard
Nylon	Power tool casing

11.

Plastic	Item
Nylon	Gearwheels
uPVC	Windows
Expanded polystyrene	Cup

12. Wear resistant.

13.

Plastic	Type
Polyethylene	Thermoplastic
Nylon	Thermoplastic
Polyester	Thermosetting
Acrylic	Thermoplastic
PVC	Thermoplastic
Polycarbonate	Thermoplastic
Formica	Thermosetting

14.

Plastic	Property	Use
Acrylic	1. Non-toxic. 2. Easy clean.	Food container
PVC	1. Flexible. 2. Water resistant.	Hose pipe
High density polythene	1. Strong. 2. Hard.	Toys
Polystyrene	1. Soft. 2. Good at absorbing shock.	Padding for bicycle helmet
Nylon	1. Strong. 2. Water resistant.	Fishing lines
Polypropylene	1. Wear resistant. 2. Very strong.	Stackable chairs
Cellulose acetate	1. Lightweight. 2. Resists blows/ impact.	Chisel handles
Phenolic resin	1. Strong. 2. Inexpensive.	Telephones

15. 1. Marking out. 2. Cutting. 3. Drilling. 4. Filing. 5. Finishing. 6. Bending.

16. To protect the gloss finish on plastic; in this way finishing is reduced.

17. Hot wire cutter.

18. Give support and prevent the drill bit from breaking through and shattering/ chipping the acrylic and damaging the drill bit itself or the machine vice.

19. When boring a piece of acrylic, the drill is used at low speed with a constant, light, slow, even feed pressure in on the piece.
20. (a) Draw filing.
(b) Silicon carbide abrasive (wet and dry paper).
21. (a) Strip heater.
(b) Heat a sheet of acrylic, polystyrene or PVC sheet until it is soft enough to be formed into any desired shape.
22. The acrylic overheating; this will cause oxygen to form in the acrylic and blister the surface.
23. (a) They are used to reproduce the same item accurately several times.
24. (i) Epoxy resin adhesive. (ii) Solvent welding.
25. (i) Epoxy resin adhesive. (ii) Raised head screws.
26. Self-tapping screws.
27. Acrylic can burn and stick to your skin.
28. Vacuum forming.
29. (i) Blow moulding.
(ii) Injection moulding.
31. **Glass Reinforced Plastic.**
32. (i) Resistant to weather and most chemicals.
(ii) Excellent resistance to water and corrosion.

CHAPTER 46 CERAMICS

1. Desirable property – high strength at high temperatures.
Undesirable property – brittle and are prone to cracks.
2. Advantage – huge range of colours and designs available.
Disadvantage – very expensive.
3. Glazed finish.
4. The dust created is very fine and can be harmful to a person if they are exposed to it for long periods.
- 5.

List A	List B
Display cabinet	Float glass
Fish tank	Toughened glass
Shelving	Laminated glass

6. Wear leather gloves and strong shoes.
7. (i) Prevents your hands or fingers getting cut on the edges of the glass.

- (ii) Improves the appearance of the finished glass.

CHAPTER 47 FABRICS

1.

Fabric	Properties	Use
Wool	1. Warm. 2. Soft.	Carpet
Silk	1. Very strong. 2. Light but warm.	Shirt
Leather	1. Very strong. 2. Very flexible.	Machine belt for drills
Cotton	1. Strong. 2. Lightweight.	Kites
Linen	1. Hardwearing. 2. Washes well.	Tea towel
Polyester	1. Lightweight. 2. Waterproof.	Sail for boat
Acrylic	1. Wears well. 2. Easy clean.	Upholstery
Polyamide	1. Strong. 2. Hardwearing.	Rope
Polypropylene	1. Waterproof. 2. Stain resistant.	Floor mat

2. (i) They can be mass-produced. (ii) Specialist finishes can be applied.
3. (i) Improve its working qualities. (ii) Enhance its appearance.
4. (i) Flame proofing. (ii) Moth proofing.
5. (i) Tough. (ii) Durable. (iii) Stain resistant.
6. Attach fabrics to wood.
7. (i) Leather. (ii) Wool.

CHAPTER 48 SURFACE AND APPLIED FINISHES

1. A good surface finish is essential and should be smooth, clean and free from scratches or marks.
2. Smoothing plane or scraper.
3. Heavy sanding is likely to result in an uneven surface.
4. (i) **Glasspaper** – finishing of softwoods.
(ii) **Garnet paper** – excellent finish to hardwoods and softwoods.

- (iii) **Silicon carbide paper** (wet and dry paper) – finishing metals or edges of acrylic sheet.
5. Cork.
7. (i) Belt sander. (ii) Orbital sander. (iii) Random orbit or disc sander.
8. When you rub a surface with a fine abrasive paper or steel wool until the surface finish is flat and smooth, or rubbing down between coats of polish.
9. (i) To remove dust after sanding. (ii) Thin oil-based paints and varnishes.
10. (i) Use in well-ventilated place. (ii) Avoid naked flames and sparks.
11.
 1. Remove any original finish.
 2. Punch any nails or pins below surface of timber.
 3. Fill any holes or imperfections.
 4. Use abrasives to produce smooth finish.
 5. Brush down to remove dust.
 6. Wipe with white spirits to remove fine dust and oils.
12. (i) To change the colour.
(ii) To improve the appearance of bland (dull) timber.
13. (i) Wear PVC gloves. (ii) Wear a protective apron.
14. Prevent a pitted and uneven finish.
15. The filler may not hold its pores.
16. (i) It improves the appearance of the article.
(ii) It is more hygienic, protects wood from dirt and makes it easier to clean.
17. Allows the wood to breathe by allowing moisture vapour to pass in and out of the timber to which they are applied, but they still offer great resistance to the passage of liquids like water, rain and snow.
18. (i) Protects against continual knocks and scratches.
(ii) Withstands wear and tear.
19. (i) Weather resistant. (ii) Water repellent.
20. (i) Varnish is flammable so avoid naked flames and sparks.
(ii) Avoid contact with skin and eyes, wear PVC gloves and goggles.
21. Soapy water.
- 22.

Finish	Advantages	Disadvantages
Lacquer	1. High decorative good quality finish. 2. Dries extremely quick.	1. Difficult to apply. 2. Time consuming to apply.

Oils	<ol style="list-style-type: none"> 1. Non-toxic oil available. 2. Very easy to apply and repair. 	<ol style="list-style-type: none"> 1. Time consuming to apply. 2. Affected by moisture in the timber (bloom).
Wax polishes	<ol style="list-style-type: none"> 1. Easily applied. 2. Easily removed if damaged for refinishing. 	<ol style="list-style-type: none"> 1. Can be time consuming to apply. 2. Becomes dirty due to trapped grime.
French polish	<ol style="list-style-type: none"> 1. Can be used on most timbers. 2. Extremely attractive finish 	<ol style="list-style-type: none"> 1. Not suitable for external use. 2. Not heat or water resistant
Paints	<ol style="list-style-type: none"> 1. Hardwearing 2. Long lasting 	<ol style="list-style-type: none"> 1. Time consuming to apply 2. Expensive

23. (i) Wear protective gloves and overalls at all times when applying lacquer.
(ii) Avoid naked flames and sparks.
24. Non-toxic.
25. The wax by itself will offer little protection to timber and will rapidly wear off.
26. (i) Traditional French polishing/rubber application.
(ii) Brushing French polish.
27.
 1. Make a rubber.
 2. Charge the rubber with polish.
 3. Build up a base coat with the rubber.
 4. Rub out blemishes by cutting back.
 5. Body up, apply coats of polish to body up the finish.
 6. Spirit off marks with methylated spirits.
 7. Burnish.
28. (i) Extra protection. (ii) Seal holes, crevices, and exposed end grain.
29. (i) Build up a full system of protective paintwork.
(ii) Provide a key for the gloss paint.
30. Sanding. Priming. Filling. Undercoat. Finish coat.
31. It is harmless to animals and plants and it has a low odour.
32. (i) Water repellent. (ii) Colours will not fade.
33. (i) Yacht varnish. (ii) Wood stain. (iii) Sadolins.

34.

List A	Finish
Garden shed	Garden wood stain
Kitchen press	Cellulose lacquer
Writing desk	Beeswax

36.

List A	Finish	Property
Garden furniture	Yacht varnish	Weather resistant.
Staircase	Polyurethane varnish	Withstands wear/tear.
Carving	Wood finishing oils	Easy to apply.
Veneered table	French polish	High decorative shine.

35.

Artefact	Finish	Reason 1	Reason 2
Small tool box	Polyurethane clear varnish	Protects against continual knocks and scratches.	Easy to apply.
Toast rack	Polyurethane clear varnish	Heat resistant.	Easy to apply.
Window box	Yacht varnish	Weather resistant.	Highly water repellent.
Chopping board	Vegetable oil	Non-toxic	Easy to apply
Picnic table	Exterior wood stain	High protection against Irish weather.	Water repellent.
Central heating radiator cover	Flame retardant paint	Highly inflammable.	Easy to apply.
Decorated wooden box	French polish	Attractive	Decorative
Blanket box	Lacquer	Highly decorative.	Hardwearing.
Bird bath	Garden wood stain	Harmless to animals.	Waterproof.
Side table	Wax polish	Easy to apply.	Attractive.

Mobile bookcase	Quick drying clear varnish	Protects against knocks and scratches.	Withstands wear and tear.
Cake stand	Vegetable oil	Non-toxic.	Easy to apply.
Play house for pre-school kids	Enamel paint	Range of colours available.	Non-toxic

CHAPTER 49 WOODTURNING

1. **A** – Toolrest.
B – Bed.
C – Headstock.
2. **D** – tailstock. Function – supports the end of workpiece for between centre turning.
3. (i) Drive centre.
(ii) Live centre.
4. Holds the wood when making bowls, plates, dishes, goblets etc.
5. (a)

Artefact	Turning speed
Eggcup	1500 RPM
Bowl	300 RPM

(b) *As the item being turned gets bigger, the lathe's speed is reduced/slower.*

6. Anticlockwise.
8. (i) Skew chisel.
(ii) Parting tool.
9. To protect you from flying wood chips.
10. To ensure that it rotates freely without catching the tool rest.
11. It should produce fine shavings and leave a smooth surface that requires very little sanding.
12. (i) Only one person at the lathe. (ii) Sleeves rolled up.
13. (i) Between centre (spindle) turning.
(ii) Faceplate (bowl) turning.
14.
 1. Draw diagonal lines at the ends of the workpiece to locate the centres.
 2. Draw the largest possible circle on the ends using these centres as a guide
 3. Draw tangents to the circles to create an octagon on the ends.

4. Hold the workpiece in the vice and plane off the corners until it is octagonal in shape. It is now ready for mounting on the lathe.
15. (i) Easier to turn. (ii) Safer to use with the cutting tools.
17.
 1. Select a block of wood that is large enough for your purpose and free from splits.
 2. Mark out a disc slightly larger than the bowl to be turned with a compass.
 3. Using the bandsaw, coping saw or other, true the base and round off the edges of the disc – square corners are dangerous.
18. Boring a hole on the lathe.
19. Finish – French polish. Application – while the artefact is turning at a slow speed on the lathe, apply a number of coats with a rubber or brush.
20. To protect your mouth in case any finish might be thrown off the lathe.

CHAPTER 50 BENDING AND LAMINATING WOOD

1. A natural characteristic of wood is that it can be bent and shaped into curves.
2. (i) Ash. (ii) Oak. (iii) Sycamore. (iv) Beech.
3. The steam gradually softens the fibres of the wood and makes it flexible/bendable.
4. (a) Steam chest.
(b) Boiling water is heated to generate steam to soften the fibres of the wood.
5. (a) Metal strap.
(b) Supports the wood during bending and helps prevent fibre break on the outer fibres.
6. (a) Former.
(b) Allows materials to bend around it.
7. (i) Use tongs. (ii) Wear gloves.
8. 60 minutes for every 24 mm.
9. Advantage – allows wood to bend. Disadvantage – can be expensive.
10. Steam the laminate.
11. Advantage – strong. Disadvantage – allows some creep after the glue has set.
12. (i) Sets rock hard.
(ii) Contains no water so the laminates won't swell.

CHAPTER 51 WOODCARVING

1. (i) Decorate and enhance the appearance of artefacts.
(ii) Make simple or complex sculptures.
2. (i) Easy to carve (relatively soft).
(ii) They are closed grained which makes them easier to work.

3. (i) It is soft. (ii) It has no grain.

4.

	(a) Part	(b) Material
A	Handle	Hardwood
B	Ferrule	Brass
C	Blade	Steel

5.

- (i) **Straight chisel** – General shaping, cutting straight lines and finishing.
- (ii) **Skew chisel** – Finishing and undercutting.
- (iii) **Straight gouge** – For fast cutting and general shaping.
- (iv) **Parting/V tool** – V-shaped channels and grooves with and across the grain and for texturing the background in relief carving.

6. Heavy cuts.

7. **A** – stab knife. **B** – cutting knife.

8. Carver's mallet.

9. (a) Sycamore.

(b) Carver's punch.

10. To prevent it slipping or moving as you cut your carvings.

11.

1. Draw a careful, **accurate** drawing of carving out on paper.
2. Tape the drawing on to one edge of the wood with masking tape to prevent it from slipping.
3. Insert a sheet of carbon paper underneath the drawing.
4. Trace over the design, thereby transferring it through the carbon paper onto the wood.
5. Check that all lines are traced before removing tape and drawing.

12. (i) Using a template. (ii) Mark directly on to the wood.

14. (i) Chip carving.

(ii) Incised carving.

(iii) Relief carving.

(iv) Wood sculpture.

15. (i) Easier. (ii) Safer.

16. 1. Study wood. 2. Transfer design. 3. Outline. 4. Set in. 5. Ground. 6 Shape.

17. (i) Non-toxic. (ii) Water resistant.

18. (i) Extremely hardwearing. (ii) Tough.

19.

Item	Finish	Reason
(i) Knife holder	Vegetable oil	Non-toxic
(ii) Bookend	Danish oil	Hardwearing
(iii) Moneybox	Polyurethane varnish	Easy apply
(iv) Ornamental plaque	Linseed oil	Enhances the wood

CHAPTER 52 VENEERING, MARQUERTY, PARQUETRY AND INLAYING

- Veneer.
 - Manufacture plywood.
- It makes it easier to cut the veneers.
- Rotary cutting.
 - Half-round
 - Flat slicing or plain slicing
- It can decorate a plain artefact.
 - Economical use of rare and expensive timbers.
 - Good for the environment because it saves trees.
 - You can make good use of rare cuts of timber, e.g. birds-eye maple burr.
 - You can produce special decorative effects, e.g. cross-banding.
- Stable and will not warp or twist in warm, dry centrally heated environment.
 - Flat-sanded, dust-free surfaces.
-

Veneering tools	Use
(i) Veneer saw	Cross cut veneers of any thickness.
(ii) Electric iron	Soften hot-melt glues such as glue film.
(iii) Veneer hammer	Pulled along the veneer to press it down to remove excess glue and trapped air.
(iv) Cauls	Flatten veneers and apply even pressure to veneers while bonding groundwork.

- Book matching.
 - Butt matching.
 - Quarter diagonal.
 - Diagonal reverse diagonal.
- Impact/contact. Reason – very strong instantaneous bond/grip.

9. The paper helps prevent blisters and air holes in the finished veneer by preventing the veneer bonding to other parts of the groundwork before pressing by the pressing block.
10. (a) G-cramps.
(b) PVA/urea formaldehyde.
11. Strips of veneer that are cut across the grain.
12. To decorate and improve the appearance of solid wood and veneered items.
13. Natural forms.
14. An inlay is when one piece of wood is inserted decoratively into another to improve its appearance.
15. (i) It is light cream in colour and gives a contrast with the surrounding wood.
(ii) It is dense and close grained.
16. *Materials like ebony, brass and mother of pearl can also be inlaid into wood.*
17. (a) **A** – marking gauge.
B – scratch stock.
C – bevel-edge chisel.
D – Warrington hammer.
(b) PVA.
- 18.

Finish	Advantage	Disadvantages
Oil	Non-toxic oil available.	Time consuming to apply.
Wax polish	Easy to apply.	Can be time consuming to apply.
French polish	Can be used on most timbers.	Not suitable for external use.

CHAPTER 53 FRETWORK

1. *Fretwork is the technique of cutting intricate shapes from pieces of wood.*
2. (i) Decorate furniture. (ii) Make toys and jigsaw puzzles.
3. (i) Hardwood. (ii) Man-made boards.
4. (i) Coping saw. (ii) Fret saw. (iii) Bow saw. (iv) Scroll saw

CHAPTER 54 MOULDINGS

1. *Mouldings are also known as profiles.*
2. (i) Soften the edges for safe, comfortable handling.
(ii) Improve the appearance by making the edges more decorative.
3. Chamfer.

4. (a) Stopped chamfer.
(b) Thumb gauge.
5. (a) Scratch stock.
(b) Moved along the wood to shape the moulding.
6. (a) (i) Rebate. (ii) Wavy edge.
(b) Router.
7. Ovolo – A. Rounding over – B. Roman ogee – C.
8. (a) MDF.
(b) It has a high-density, uniform structure of small chips with fine texture and no grain direction, which allows the edges to be cleanly moulded smooth with no tearing, breaking, flaking or splintering of the edges.
- 9.

Material	Suitable for moulding
Hardwood	Yes
Softwood	Yes
MDF	Yes
Plywood	No
Laminboard	No
Chipboard	No

CHAPTER 55 STRUCTURES AND FORCES

1. A structure is an assembly or arrangement of selected materials arranged in a manner that maintains its general shape under load.
2. (i) Buildings. (ii) Leaf.
3. (i) Tension. (ii) Compression. (iii) Torsion.
4. B. Nails work best in under shear because they rely on friction forces, one material slides along another.
5. Turning force (or torque).
6. (i) Torque. (ii) Shear.
7. (i) Members in compression are called struts.
(ii) Members in tension are called ties.
8. (a) Compression. (b) Tension.
9. Tension.
11. Compressive load.

CHAPTER 56 MECHANISMS

1. Advantage – they can be designed to perform a wide range of tasks.
Disadvantage – moving parts wear unless lubricated.
2. (i) They have input and an output.
(ii) They make the task easier to complete.
3. **Revolutions Per Minute.**
4. (a) Square thread. (b) Car lifting jacks.
6. The parts of mechanisms can twist, bend and rub against each other during use, all of which will make the mechanism less efficient.
7. (a) Parallel linkage.
8. (i) Flexible. (ii) Strong.
9. Clockwise.
10. B
11. (a) Pulley B spins clockwise.
(b) $VR = \frac{75}{15} = \frac{5}{1} = 5:1$
$$OS \text{ (RPM)} = \frac{70}{5:1} = \frac{70 \times 1}{5} = 14 \text{ RPM}$$

B will rotate at 14 RPM
12. Advantage – gears can transmit large drive forces. Disadvantage – high cost.
13. Compound gear train.
14. Bevel gears.
15. Worm gears.
16. (a) Rack and pinion.
(b) Overhead projector.
17. (a) Gear wheel B will spin anticlockwise.
(b) Speed for driven gear B = $\frac{12}{6} \times 600$
Speed for driven gear B = 1200 RPM
B will rotate at 1200 RPM
18. (a) Y
(b) Speed for driven gear B = $\frac{20}{30} \times 24$
Speed for driven gear B = 16 RPM
B will rotate at 16 RPM

19. (a) Gear wheel C will spin clockwise.
 (b) Speed for driven gear B = $\frac{36}{12} \times 200$
 Speed for driven gear B = 600 RPM
 Speed for driven gear C = $\frac{12}{12} \times 600$
 Speed for driven gear C = 600 RPM
 C will rotate at 600 RPM
20. Ratchet gear and pawl.
22. Cam.
23. To help bore holes in awkward or confined spaces where there is no room or the brace to make a full sweep.

CHAPTER 57 BASIC ELECTRICITY AND ELECTRONICS

1. Amps.
2. Copper wire.
3. (i) **A**lternating **C**urrent (ii) **D**irect **C**urrent.
4. Direct Current (DC).
5. The electric shock could cause a fatal accident and damage equipment.
6. Identify the value of the resistor.
7. Yellow, violet, black.
8. Parallel.
9. (a) A
 (b) The lights in A are wired in parallel, if one bulb blows the second bulb will remain lit. Lights will not be significantly duller than if just one bulb is connected.
10. (i) Radio. (ii) Microwave. (iii) Telephone.
- 11.

Component
(i) Battery
(ii) Switch
(iii) Lamp
(iv) Buzzer
(v) Resistor
(vi) Variable resistor
(vii) Light dependant resistor
(viii) Transistor

(ix) Thermistor
(x) Diode
(xi) Light emitting diode
(xii) Capacitor
(xiii) Motor

12. *Electronic systems are made up of three main parts: input, process/control and output.*
13. Resistance.
14. **Light Dependant Resistor.**
15. The light in the bulb will turn on.
16. B
18. Motor – provides forward/backward power. Gearbox – changes speed, direction and controls power output.
19. **Light Emitting Diodes.**
20. It is the shorter of the two legs.
- 24.

Symbol	Component
	Bulb
	Battery
	Switch

25.

Symbol	Component
	Battery
	Switch
	Buzzer

26.

Symbol	Component
	Transistor
	Light dependant resistor
	Variable resistor

CHAPTER 58 COMPUTERS AND APPLICATIONS

1. **P**ersonal **C**omputer.
2. **C**entral **P**rocessing **U**nit.
3. (i) **R**ead **O**nly **M**emory. (ii) **R**andom **A**ccess **M**emory.
4. Hardware is literally all the hard parts of a PC you can touch and is involved in data processing or communications such as the mouse, keyboard, monitor. Software is the stuff that you can't touch, the programmes that run the computer.
5. *Input devices allow you to put information into the computer.*
Output devices enable the computer to present information to the user.

6.

	Name	Input/output
A	Floppy disk drive	Input/output
B	CD writer drive	Input/output
C	DVD-ROM drive	Input
D	Monitor	Output
E	Speaker	Output
F	Printer	Output
G	Scanner	Input
H	Keyboard	Input
I	Mouse	Input

7. Hard copy.
8. Connects your computer via a cable to the phone lines and from there to other PCs, allowing you access the Internet/email/faxes/use the computer as a phone.
9. Email is send/receiving electronic mail.
10. (i) Floppy disk.
(ii) CD-ROM.
11. (i) Don't slide the metal door off a floppy disk.
(ii) Don't store near a magnetic field.
12. (i) Store in a dry place. (ii) Store in a clean place.
13. **D**igital **V**ersatile **D**isc.
14. (i) When not in use, store in a protective case.
(ii) Hold the disc by the inner and outer edges and do not touch the surface.
15. **C**omputer **A**ided **D**esign.
16. Icons.

17. (i) Extremely accurate dimensional drawing can be produced.
(ii) Faster, similar drawings produced more quickly.
18. CNC LATHE.
19. (i) Greater accuracy and speed.
(ii) Objects can easily be mass-produced.
20. (i) Text and information can be stored for further use/editing.
(ii) Errors can be corrected before printing.
21. **Internet** – bold. *Worldwide* – italic.
22. (i) Storing lists. (ii) Keeping accounts.
23. (i) Controlling stock, sales and ordering. (ii) Looking after accounts.
24. Prepare design drawings accurately.

CHAPTER 59 GRAPHICAL COMMUNICATON

1. (i) To show what something will look like when made, both in size and in shape.
(ii) To explain how to design/manufacture an item.
2. (i) It helps to organise ideas quickly. (ii) It helps in designing.
3. (i) Oblique. (ii) Isometric. (iii) Perspective.
8. A – vanishing point. B – horizon line.
13.
 - 1:10 Indicates the drawing is a tenth the full size of the object.*
 - 1:5 Indicates the drawing is a fifth the full size of the object.*
 - 1:4 Indicates the drawing is a fourth the full size of the object.*
 - 1:2 Indicates the drawing is a half the full size of the object.*
 - 2:1 Indicates the drawing is twice the full size.*
 - 1:1 Indicates the drawing is full size.*
15. To show the internal structure of an object.
16. *Broken lines in development are used to indicate fold lines.*
18. 260
19. (i) Takes up less space. (ii) It is quick.
20. Indicate to the examiner first-hand research/manufacture of your chosen project.

CHAPTER 60 DESIGN PROCESS

1. *When you design an object you are creating its shape, structure and function.*
2. A man-made object.
3. Aesthetics is the term used to appreciate designs that are pleasing/attractive to look at (look good) or pleasing to experience.
4. (i) Adding mouldings. (ii) Adding carvings. (iii) Adding veneers.
5. The size and dimensions of the design as a whole will be arranged correctly.
6. (i) A brief which outlines a problem, need or situation.
(ii) Observation or recognition of need want, desire or problem.

7.
 - **A design brief** is a short clear statement describing the problem to be solved.
 - **Analysis** – analysing the brief will identify the exact requirements for finished artefact.
 - **Investigation** is completed to gain information and knowledge on possible solutions to the design problem.
 - **Possible solutions** are ideas and possible solutions set out in the brief that can be developed mainly with small rough sketches. Lots of ideas (two or more) can be tried out until one is found that works.
 - **Working drawings** are neat, clear, fully dimensioned drawings which contain all the necessary information from which the artefact can be made.
 - **Realisation** is when you make the object you have designed.
 - **Evaluation** is an assessment of the finished article to see if it fulfils the requirements of the brief and does it do what it was intended to do.
8. Design and make an artefact to hold your materials technology wood drawing equipment. The artefact should be lightweight, portable and sturdy in construction.
9. Design and make decorative artefact that would store a remote control unit when not in use. The artefact should also incorporate a device that would indicate when a control unit has been replaced.
10. Design and make an artefact to display a set of crockery in the kitchen. The artefact should be wall-mounted and attractive.
11. The **analysis** should contain the key questions to which you must respond in the development of the ideas.
- 12.

Artefact	Requirement 1	Requirement 2	Requirement 3
Toy box	The toys should be easy take out/put back.	Include a feature that a child would find attractive.	Non-toxic, bright, cheerful colours for finish.
Chopping board for vegetables	Lightweight.	Portable.	Non-toxic finish.
Mantelpiece clock	Attractive.	Stylish in Appearance.	Well finished.
Bird table	Materials must be weather resistant.	Stable.	It must be easy to clean.
Portable seat for sporting events	Strong.	Lightweight.	Easily assembled, dismantled and transported.
Barbeque trolley	Materials must be heat resistant.	Sturdy in construction.	Easily cleaned.

-
13. (i) Sketches and notes. (ii) School library. (iii) Public library. (iv) Newspapers.
 14. Ideas/possible solutions.
 15. A prototype or 'mock up' is a full size or scaled model of the final solution, constructed before the actual artefact is made in order to assess the overall suitability, size, shape, strength, form, rigidity, safety, proportions, stability and appearance.
 16. Working drawings.
 17. (i) The same detail need never be drawn twice.
(ii) It is very easy to correct errors.
 18. (i) You cannot sketch on AutoCAD.
(ii) It gives an overall picture of the object.
(iii) It saves time.
 19. A cutting list is a detailed list of all the piece sizes that need to be cut and prepared to make the project.
 20. Evaluating the article is very important and it allows the designer to assess the good/bad points of her/his design and to make modifications if similar articles are to be manufactured in the future.
 21. (i) Design. (ii) Manufacture/making. (iii) Finished artefact.
 22. (i) Table – height of table.
(ii) Boat – waterproofing.
(ii) Clothes peg – weather resistance.
(iv) Seesaw – strength.
(v) Cooking utensil – non-toxic finish.
 23. (i) Table – bad. It has dangerous protruding corners, looks poor and your feet would hit the legs when walking past.
(ii) Tie holder – bad. Ties are not displayed. Ties will crease and will slip off the holder very easily.
(iii) Video cassette rack – bad. The front of the videos cannot be seen, you must turn your head to see video titles. The rack is too low.
(iv) Kettle – bad. The spout is too low.
(v) Bookshelf – bad. The legs could collapse because of their angle to the ground.
(vi) Ice cream jar – bad. You cannot gain access to the ice cream as the opening is too small.
(vii) Wheelbarrow – bad. The wheelbarrow would be too high when the user picks it up and all the weight would be at the wrong end. The handle is too low; you would hurt your back picking up the wheelbarrow.

24.

Artefact	Defect	Remedy
(i) Table lamp	The base of the lamp is too small for the top; it would overbalance (topple over).	Widen the base.
(ii) Wooden stool	Looks like it could easily overbalance (topple over). The legs are too thin and spindly (long, slender and frail) and could possible break. No cross rail support between the legs makes it very weak.	Use thicker legs. Include cross rails.
(iii) T-square	One edge is not straight, you wouldn't be able to position the T-square squarely against the edge of a drawing board.	Square the edge.
(iv) Salt holder	The opening is too wide; you would have no control on how fast the salt comes out the opening.	Make the opening smaller.
(v) Seesaw	The seesaw is not balanced correctly; the fulcrum is in the incorrect position.	Position the fulcrum in the middle.
(vi) Bookcase	Bending shelves. Legs are poorly located, it could overbalance (topple over). The legs are too thin, and could possible break. No cross rail support between the legs makes it very weak.	Support shelves in the middle. Position legs near the edges. Use thicker legs. Include cross rails.
(vii) Tenon saw	There is no brass rib/strip to strengthen, stiffen and keep the blade straight.	Fit a brass rib/strip to the top of blade.

CHAPTER 61 DESIGNING FOR OUTDOORS

- (i) Teak. (ii) Iroko.
- With initial treatment with preservatives and regular maintenance, softwoods will last a good number of years.*
- Most of the joint is hidden in the timber, protected from the weather by tenon shoulders.
- PVA
- So that rainwater quickly runs off, rather than soaking in to the end grain.
- (a) **A.** The slatted design prevents the water accumulating and soaking into the table.
- Brass.

CHAPTER 62 PROJECTS

Select projects from either Ordinary Level or Higher Level to give to the students.

Design briefs (Ordinary Level)

- **Design and make a paperweight.**
The paperweight should be attractive and suggest a sea theme.
- **Design and make salad tongs.**
The tongs should be lightweight and stylish in appearance.
- **Design and make a bin for a study.**
The bin should be lightweight and tough.
- **Design and make a feeding tray for birds.**
The tray should be wall-mounted and easily detached for cleaning.
- **Design and make an artefact to hold one pen.**
The artefact should also double up as a pen stand.
- **Design and make an artefact to hold fruit.**
The artefact should be attractive and well finished.
- **Design and make a squirrel feeder for a garden.**
The feeder should be mounted on a tree.
- **Design and make an artefact for holding fresh food.**
That artefact should be lightweight, hygienic and hinged to allow for easy access to the food.
- **Design and make a toy that would appeal to a young child.**
The toy should be attractive, safe and incorporate an interesting form of motion that would attract the attention of the child in use.
- **Design and make a stock cube dispenser.**
The stock cube dispenser should be wall-mounted and match the units in the kitchen.
- **Design and make a toilet paper holder.**
The holder should match the wooden seat of the toilet and its brass fittings.
- **Design and make an artefact to hold cakes.**
The artefact should have three tiers and be capable of holding a range of different sized cakes.
- **Design and make an artefact to hold kitchen ornaments.**
The artefact should be wall-mounted, attractive and have adjustable shelves.
- **Design and make a waste bin for your kitchen.**
The waste bin should hold a disposable bin bag and fit/blend in with the units in the kitchen.
- **Design and make an artefact to hold soaps, shampoos, sponges, oils etc. in the bathroom.**
The artefact should be wall-mounted, attractive and have a sea theme.

- **Design and make an artefact to store needlecraft and embroidery tools.**
The artefact should be portable and decorative.
- **Design and make an artefact for holding mugs.**
The artefact should hold eight mugs and spin on a small turntable to allow easy access to all sides.
- **Design and make an artefact to hold business cards.**
The artefact should be combined with a penholder and thrummet to make an attractive desk accessory.
- **Design and make a wine bottle rack.**
The bottle rack should be strong, stand on a horizontal surface and be capable of holding three bottles of wine.
- **Design and make an attractive artefact for serving cheese.**
The artefact should be lightweight and well finished.
- **Design and make an elegant storage unit for DVDs and CDs.**
The artefact should be attractive and stylish in appearance. The discs should be easily accessible.
- **Design and make an artefact for storing sharp kitchen knives.**
The artefact should be safe, stand on a horizontal surface, and fit/blend in with the kitchen units.
- **Design and make a nursery mirror.**
The mirror should be wall-mounted, provide storage for personal grooming items and be decorated with a selection of butterflies and birds.
- **Design and make a sit and store unit.**
The unit should be sturdy, attractive and have lockable castors. Easy access should be provided to the storage compartment.
- **Design and make an artefact for holding umbrellas in your hall or porch.**
The artefact should be wall-mounted and be able to hold umbrellas that are either open or shedding rain, or closed and ready to use.
- **Design and make a wall mirror unit suitable for use in a bathroom.**
The mirror should suggest any one of the following shapes: octagon, hexagon or pentagon. The unit should include a facility for holding a small number of personal grooming items.
- **Design and make a bedside lamp for a child's room.**
The lamp should be safe in use, have an easy access switch and have features that are attractive to a child. All electrical connections and fittings should comply with current safety standards.
- **Design and make a two-sided desk easel.**
The easel must be sturdily constructed for desktop use. It should also have dry wipe and chalkboard surfaces with storage trays for pens, paints etc. on each side. The easel should also fold flat for ease of storage.
- **Design and make an artefact for storing eggs.**
The artefact should be strong, stand on a horizontal surface and suggest a farm theme.

- **Design and make a cutlery tray.**

The cutlery tray should be lightweight and stylish in appearance.

- **Design and make a notice board.**

The notice board should be wall-mounted and incorporate a space for a notebook, keys and a pen.

- **Design and make an artefact to hold coats and hats.**

The artefact should be wall-mounted and attractive.

- **Design and make an artefact for holding letters.**

The artefact should hold a selection of letters of different size.

- **Design and make a folding step stool.**

The stool should be lightweight, safe in use and compact.

- **Design and make a toy truck.**

The toy truck should be safe in use and include two headlights in the front of the truck.

- **Design and make an artefact to hold meat while cutting it into slices for serving.**

The artefact must be easy to use, clean and store.

- **Design and make an artefact for holding spare rolls of toilet tissue.**

The artefact should stand on a horizontal surface and hold three paper rolls.

- **Design and make a storage unit for ten videocassettes.**

The unit should be attractive and stylish in appearance. The design should allow the titles of the videocassettes to be easily visible and suggest a movie theme.

- **Design and make a photograph holder to display a picture of your school basketball team.**

The holder should stand on a horizontal surface and be easy to clean.

- **Design and make an artefact for holding vases and plants in a hallway.**

The artefact should be wall-mounted and also be able to hold coats.

- **Design and make a stool.**

The stool should be strong, well finished and provide a storage facility.

- **Design and make a small toolbox to hold a selection of basic hand tools.**

The small toolbox should be portable, sturdy in construction, strong and be designed to contain a selection of tools suitable for minor repairs in the home.

- **Design and make an abrasive roll dispenser for the materials technology (wood) room.**

The dispenser should be simple to use, prevent the abrasive getting dusty and be wall-mounted.

- **Design and make an artefact to hold screwdrivers.**

The artefact can be wall or bench-mounted.

- **Design and make an artefact to hold cassette tapes.**

The artefact should be attractive and stand on a horizontal surface. The design should allow the titles of the cassette tapes to be easily visible and should suggest a music theme.

- **Design and make a bedside table.**

The table should be sturdy and look good.

- **Design and make a decorative window box for holding and displaying a colourful collection of flowers.**

The window box can be designed for a wide ledge or it can be mounted on a wall.

- **Design and make an artefact to air clothes.**

The artefact should be designed for use as an over-bath or free-standing airer and should fold flat for storage.

- **Design and make a children's toy box.**

The toy box should be sturdy in construction, store toys and playthings and be well finished with bright, cheerful colours to make it more appealing.

- **Design and make a tray for serving food and drinks.**

The tray should be stylish in appearance and suitable for indoor and outdoor use.

- **Design and make a candleholder that may be used as a centrepiece for a dining table.**

It must be decorative, safe to use and hold three candles.

- **Design and make a roll and store box.**

The box should have a pulley lead for easy manoeuvre and a lockable, sturdy lid for easy access.

- **Design and make a decorative artefact for holding coats in the hallway.**

The artefact should be wall-mounted and incorporate a picture frame/s to hold one or more of your favourite photos, and a mirror to check your appearance before going out.

- **Design and make a dish drainer.**

The drainer should hold 16 plates and 14 saucers and fold flat for storage.

- **Design and make three storage jars to hold sugar, tea and coffee.**

Each jar should be easily identified and have rubber seal lids.

- **Design and make an artefact to hold bread.**

The artefact should have a roll top and be well finished.

- **Design and make a wind vane.**

The wind vane should be mounted on a wooden pole.

- **Design and make an artefact to hold toothbrushes and toothpaste.**

The artefact should be attractive, wall-mounted and hold three toothbrushes.

- **Design and make an artefact for holding books in a child's bedroom.**

The artefact should be safe, sturdy, freestanding and be capable of holding large, medium and small books. The design should allow the titles of the books to be easily visible and should suggest a literary theme.

- **Design and make an artefact to hold spice jars.**

The artefact should stand on a horizontal surface and revolve to provide easy access to the jars.

- **Design and make a mobile phone desk holder.**

The holder should combine with a pen holder and note pad to make an attractive desktop accessory.

- **Design and make an artefact that represents your favourite musical group.**

The artefact should be decorative and well finished.

- **Design and make an artefact for holding medals and small trophies.**

The artefact should be attractive and be placed in a walk around display cabinet in the school foyer.

- **Design and make a display stand to promote recycling amongst young people.**

The display stand should be attractive and well finished.

- **Design and make a box to hold stationary.**

The box should be lightweight, portable and be decorated with simple inlays and/or carvings.

- **Design and make a desk that will accommodate a growing child through the years.**

The desk should have an open shelf at the top to take a small A4 drawing board or clipboard and have fitted drawers for storing pens, pencils, paper, calculator and books.

- **Design and make a colourful headboard for a child's bed.**

The headboard should fit a normal single bed with twin bolts at the head to secure the headboard. It should also have an animal or sport theme.

- **Design and make an attractive artefact to teach young children how to tell the time.**

The artefact should stand on a horizontal surface and be finished with bright cheerful colours.

- **Design and make a travel table.**

The table should be suitable for use in the garden and on the beach.

- **Design and make a toy ship.**

The toy ship should stand up well to the rough and tumble of play and have two rollers on the underside of the hull so that the ship can be easily be pushed along the carpet to increase its play value.

- **Design and make an artefact to hold cook books**

The artefact should hold your book perfectly open and also provide a facility to hold numerous other cookbooks.

- **Design and make a picnic table for children.**

The table should be attractively designed with integral benches. It must be solidly built and should accommodate four children comfortably.

- **Design and make a baby walker.**

The baby walker should safely help toddlers take their first steps and also hold their play bricks or toys.

- **Design and make a decorative trellis and plant box.**
The trellis and plant box must be strong and designed to resist harsh weather.
- **Design and make an artefact for carrying a computer games console.**
The artefact should be lightweight and sturdy in construction.
- **Design and make a stylish telephone stand.**
The stand should provide an easy access storage space for biros, notepads and telephone books.
- **Design and make a hanging basket for flower pots.**
The artefact should be strong and designed for use outdoors.
- **Design and make a folding picnic table suitable for use by two people.**
The table should be lightweight, sturdy in construction and designed for use both indoors and outdoors.
- **Design and make an artefact for hanging coats and keys in a hallway.**
The artefact should be wall mounted and incorporate a mirror with a night-light.
- **Design and make an artefact for holding plants/flowers.**
The artefact should be square or rectangular in shape, stand on a horizontal surface and resist harsh weather.
- **Design and make a home breadbin.**
The breadbin should allow for easy removal of the bread and incorporate a pull-out chopping board.
- **Design and make a paper roll holder.**
The holder should be divided up in to six compartments and designed for storing rolls of various sizes.
- **Design and make a mobile bookcase.**
The bookcase should be strong and have a sloping book display with rear storage shelves.
- **Design and make an attractive side table.**
The side table should be designed to fit against a wall in a restricted space, match the existing furniture and be well finished.
- **Design and make a suitable carrying case for fishing tackle.**
The carrying case should be strong, lightweight and weather resistant.
- **Design and make an indoor plant stand.**
The plant stand should be stylish in appearance, stand on a horizontal surface, and display a maximum of four potted plants.
- **Design and make an abacus for introducing counting, addition and subtraction to young children.**
The abacus should be sturdy, attractive and large in size, and be easy to use for classroom demonstrations and special needs children.
- **Design and make an artefact to hold health information leaflets in a doctor's waiting room.**
That artefact should be lightweight, stand on a horizontal surface and suggest a health theme.

- **Design and make an artefact to hold toast.**

Each letter T, O, A, S and T should be used as the dividers for the toast. The artefact should have a sturdy base to support the letters and ample space in between for the hot toast.

- **Design and make a baby-changing unit.**

The top changing shelf should be made from wipe clean Formica. The unit should feature separate storage shelves for nappies, towels, creams, etc. The unit should include lockable castors for easy mobility.

- **Design and make an artefact for holding a telephone and answering machine.**

The artefact should be wall-mounted, small and compact.

- **Design and make a mirror.**

The mirror should have a coastal theme and be capable of being hung vertically or horizontally.

- **Design and make a student suggestion box for your school library.**

The suggestion box should be sturdy in construction and include an attractive feature to indicate where it is being used.

- **Design and make an attractive bathroom unit.**

The unit should be wall-mounted, have shelving for storing bathroom accessories and incorporate a towel rail.

- **Design and make an artefact to store abrasive paper.**

The artefact should be capable of holding five different grades of abrasive paper and be wall-mounted.

- **Design and make a blackboard for a child.**

The blackboard should be magnetic, have easy access storage trays and fold flat for easy storage.

Design briefs (Higher Level)

- **Simple finishing touches to a room can make all the difference.**

Design and make an attractive picture frame and mirror with a geometric theme that suits your chosen picture or photograph.

- **Cramps are difficult to store in the workshop.**

Design and make an artefact for storing cramps. The artefact should also provide storage space for adhesives.

- **The correct storage of T-squares is very important to prevent them from getting damaged in the materials technology (wood) room.**

Design and make an artefact for holding ten T-squares safely. The artefact should be wall-mounted and the T-squares should be easily hung/removed.

- **Electronic components are used in materials technology (wood) projects.**

Design and make an artefact for holding electronic components. The artefact should have separate trays for each component and be lightweight for carrying around the room.

- **People have had a need for something to put their feet up for almost as long as they had feet.**

Design and make a footstool. The footstool should be strong, attractive and well finished.

- **Books and videos can be difficult to keep tidy.**

Design and make a free-standing shelf unit that will hold books and videos while also having a theme that will fit/blend in with cottage-style décor.

- **Bank statements, insurance documents, papers etc. can cause clutter around the home.**

Design and make a sturdy, portable, attractive filing chest for storing bank statements, insurance documents and papers in an orderly fashion.

- **The mouse of your computer can easily get damaged when left on your desk.**

Design and make an artefact for holding a mouse. The artefact should be lightweight, smooth and easily cleaned.

- **Get ready for summer barbecues.**

Design and make an aesthetically pleasing trolley for serving summer barbecue needs.

- **Design and make a desk easel for holding an A4 sketch pad.**

The desk easel should be adjustable in height and include an integral drawer for materials.

- **Pens/pencils, paperclips, rubbers, rubber bands, erasers, sharpeners, calculators etc. are thrown around your desk, making it very untidy.**

Design and make a desk tidy suitable for placing on a desktop. It should give easy access to pens and pencils and incorporate storage for other stationary items.

- **Wind direction and speed varies from day to day.**

Design and make an artefact that will provide information on wind direction and give some indication of wind speed.

- **Wind chimes add a little eastern charm to homes.**

Design and make an attractive wind chime.

- **Toothbrushes and toothpaste are generally thrown up on the bathroom sink with soap, shaving equipment etc.**

Design and make a one-piece toothbrush and toothpaste holder that can be mounted on the wall.

- **A portable writing desk can be used to write memoirs and travel correspondence.**

Design and make an attractive writing desk with a clock inset.

- **Medicines, soaps and shampoos should be kept out of reach of children.**

Design and make an artefact for storing these items in the bathroom. The artefact should be wall-mounted and have sliding mirror doors.

- **Bread can be easily damaged if not stored correctly.**

Design and make an attractive artefact to store bread. The artefact should have a roll-top mechanism to allow easy access to the bread.

- **Kite flying is fun.**

Design and make a kite. The kite should be strong, suggest a theme and have bright cheerful colours.

- **Rainforests cover less than 6 per cent of the earth's land surface but an area about five times the size of Switzerland disappears every year through deforestation.**

Design and make a suitable artefact that could be displayed in your school to show the benefits of forest preservation for everyone.

- **The soft glow of candlelight at Christmas brings a touch of seasonal warmth to your festive celebrations.**

Design and make an artefact to hold five Christmas lights. It can be used on a sideboard, mantelpiece or as a centrepiece on the Christmas dining table.

- **Accidents can easily happen in the home.**

Design and make an artefact to hold first-aid items. The artefact should have adjustable shelves to accommodate packages of different heights.

- **A local industry has invited designs for a trophy to be presented to the best student of materials technology (wood) at Junior Certificate level in your school.**

Design and make a suitable trophy that incorporates a logo that represents that subject materials technology (wood).

- **Every year an average European family throws away about 700 plastic bottles, 600 cans and paper equivalent to six trees. At least half of all household rubbish could be recycled.**

Design and make a suitable artefact for the kitchen/utility room that could be used to hold plastic bottles, cans and paper separately, ready for recycling.

- **The Olympic Games takes place ever four years. Athletes from all parts of the world will compete for the coveted medals but only a few can win.**

Design and make a trophy suitable for presentation to any member of the Irish Olympic Team, in recognition of their participation.

- **Providing birds with water is as important as providing them with food. They need water to drink and to bathe in.**

Design and make a bird bath. The bath should be safe and designed to last for several years.

- **The World Cup takes place ever four years. Players from all parts of the world will compete for the coveted medals but only a few can win.**

Design and make a trophy suitable for presentation to any member of the Irish soccer team, in recognition of their participation.

- **Children enjoy playing with vehicles.**

Design and make an attractive, lightweight vehicle that will automatically turn on its front headlights when it gets dark.

- **A mirror is an item of necessity in a bathroom or bedroom.**

Design and make a decorative mirror with a night-light. The design should suggest a theme that is of particular interest to you. All electrical connections and fittings should comply with current safety standards.

- **Small, beautifully decorated wooden boxes with trays have always being popular for holding personal possessions, valuables and documents.**

Design and make a wooden box for holding personal possessions, valuables and documents. The box should be lockable and decorated with simple inlays and/or carvings.

- **Throwing a horse saddle on the floor/ground can damage the saddle.**

Design and make artefact to hold one saddle, it should be suitable for both indoors and outdoors.

- **A wooden planter, brimming over with summer bedding plants, will enhance patios, front door steps and even gardens themselves.**

Design and make a wooden garden planter. The planter should be sturdy in construction, square or rectangular in shape and weatherproof.

- **Photographs of family, friends or events are appealing.**

Design and make an attractive artefact that will hold two of your favourite photographs and have a clock inset incorporating a night-light.

- **Artefacts with moving parts are displayed in shop windows to attract customers.**

Design and make an attractive artefact suitable for display in a sports shop window. Incorporate a mechanisms/device to give the artefact repetitive motion.

- **The library is lined with books from floor to ceiling.**

Design and make an artefact to enable people to reach the top shelf without a difficult stretch. The artefact should be safe in use and be lightweight for carrying.

- **A novelty playhouse is required for a pre-school.**

Design and make a novelty playhouse. The playhouse must be safe in use, lightweight, weather resistant and easily dismantled for storage.

- **Cookware, like pots and pans, present difficult and frustrating storage problems.**

Design and make an elegant artefact that will hold cookware overhead.

- **The young environmentalist award is a national competition rewarding environment projects that raise awareness and demonstrate how to protect and improve our environment.**

Design and make an attractive artefact that could be presented to the winner.

- **An essential piece of equipment for every nursery and infant classroom is a balance/scales.**

Design and make a balance/scales that will be strong in construction, able to withstand rough handling but still weigh sand, water etc. accurately.

- **Many toys are attractive to children because they appeal to their senses.**

Design and make a toy that would appeal to a child. The toy should be both stimulating and attractive and should include a device or mechanism that is capable of producing sound when the toy is in use.

- **Brushes, wallets, books, letters, envelopes and bills need to be stored safely.**

Design and make an artefact to store these items. The artefact should be wall-mounted, attractive and give easy access to the items stored.

- **Young children should be encouraged to save money.**

Design and make an attractive moneybox for a child based on a nursery rhyme theme. It should also indicate in a novel way when money has been inserted.

- **Space-saving devices in the kitchen will allow you to keep kitchen areas clear.**

Design and make a waste bin that can be mounted inside a cupboard door. The lid of the waste bin should open as the cupboard door opens.

- **A good-looking garden wagon is ideal for moving plants, loose soil, materials and tools around the garden.**

Design and make a garden wagon. The wagon should be strong and have a front steering mechanism, which will allow you pull or push the wagon around the garden.

- **Sports gear can be difficult to store.**

Design and make an artefact to store sports gear in a garage or shed. The artefact should be sturdy in construction and incorporate a seat.

- **The member states of the EU have different traditions, languages and national identities but share many common values such as commitment to democracy and human rights.**

Design and make a decorative artefact for display in the European parliament that represents the EUs commitment to democracy and human rights.

- **An overflowing bath can cause series damage in a bathroom.**

Design and make an attractive artefact that will indicate with sound when the water has reached a certain level. The artefact should also be capable of holding soaps, sponges, bath oils, etc.

- **Suitable space for seating and storage is rarely provided for in a bathroom where space is at a premium.**

Design and make a suitable artefact for sitting on in the bathroom. The artefact should be sturdy, hardwearing and provide for easy access storage space.

- **Being physically fit improves your health and well being and gives you more energy and confidence.**

Design and make an artefact that could be used in a physical education class to help maintain or increase your fitness. The artefact must be safe and easy to use.

- **A mini-greenhouse is perfect for those who are not blessed with acres of grounds and must garden on a more limited scale.**

Design and make a mini-greenhouse that will stand against a wall and take up not more than 1.2 m x 0.6 m of space, yet will provide plenty of space for trays of bedding plants and seedlings and pot plants that need frost protection during winter.

- **Toys help children to develop numeracy and literacy skills.**

Design and make a toy for a child of 18 months or more that contains a range of functions which require skills and concentration for task completion. The toy can

be flat or standing and should incorporate a mirror to provide additional attraction.

- **A number of magazines are lying around the house.**

Design and make a decorative artefact to hold magazines. The artefact should be attractive to look at and allow for easy removal of the magazines.

- **Plants enhance an indoor environment.**

Design and make a decorative artefact that will display a maximum of four potted plants. The artefact should be stylish in appearance and designed to compliment the beauty of the plants. It should incorporate a device to indicate when the plants need water.

- **A colourful mobile will provide interest and stimulation for babies and young children.**

Design and make a butterfly mobile. The mobile should be hung from the ceiling; the butterflies should flutter and dance with gentle spin of the hanging disc or a slight breeze.

- **A stepladder is invaluable around the home for a variety of different tasks including reaching high cupboards and decorating.**

Design and make a stepladder. The stepladder should be safe in use and sturdy in construction.

- **A telephone is an item of necessity in the home.**

Design and make an attractive artefact to hold a telephone, telephone book, notepad and pencil. The artefact should be wall-mounted and should allow the notepad to be written on when the phone is in use.

- **Reading books is a very enjoyable activity but for people with impaired vision reading is a difficult task.**

Design and make an attractive, well-presented book rest. The book rest should incorporate a light that is automatically activated when a book is placed on the rest.

- **Pinboards are useful features both at home and in public places such as schools, clubs and offices.**

Design and make an attractive pinboard that suggests a theme that is easily recognisable and is of particular interest to the school, club or office it will be used.

- **The Irish road safety endeavour awards are presented to people or organisations that made outstanding contributions to road safety. The aim of these awards is to give recognition to those who have contributed to the continuous effort to save lives and prevent injuries.**

Design and make an attractive artefact that could be presented to the winner of the award.

- **Wind energy is one source of renewable energy.**

Design and make an attractive artefact to show the benefits of using wind energy.

- **The absence of suitable storage stage for shoes can result in clutter at the bottom of a wardrobe.**

Design and make an artefact for storing shoes. The artefact should hold four pairs of adult shoes and be easy to move, even with the shoes in it.

- **For today's lifestyle' shops and companies now supply modern 'flat pack' self-assembly furniture that is easy to assemble in seconds.**

Design and make a 'flat packed', easy assembly CD tower. The tower should have sleek contemporary contours. Include clear, easy to read instructions on how to assemble the CD tower.

- **Ornaments like cut glass bowls, vases, glasses etc. are attractive to look at.**

Design and make an eye-catching artefact that could be used to display ornaments in the sitting room of a house.

- **An occasional table in the living room is very useful for holding drinks, displaying ornaments etc.**

Design and make an attractive and stylish occasional table for the living room that should reflect the theme 'Saving the rain forest'.

- **Blankets and linen can be difficult to store in wardrobes.**

Design and make an artefact for storing blankets and linen. The artefact should be strong and well finished.

- **Young children should be encouraged to read.**

Design and make an attractive artefact to store books, magazines, games and puzzles. The artefact should suggest a theme that will encourage children to investigate the contents of the artefact.

- **Umbrellas and walking sticks should be kept in one place for quick and easy access.**

Design and make an attractive artefact to hold both. The artefact should be suitable for use even in a small hallway.

- **If a computer were not resting on the correct surface you would strain your wrists, arms or back while working at the keyboard.**

Design and make a computer workstation that will be comfortable to use and incorporate a storage facility for associated accessories.

- **Gaisce is a national challenge award from the president of Ireland to young people between 15 and 25 years of age.**

Design and make a decorative artefact that could be presented to an individual or group who won the award.

- **A rocking horse will give years of enjoyment to anyone small enough to ride it.**

Design and make an attractive rocking horse. The rocking horse should give a safe and effective rocking action.

- **As well as being competitive fun, the game of chess helps to develop logical thought.**

Design and make a lightweight, portable chessboard. The chess pieces need not be made.

- **Standing at some sporting events can be very tiring.**

Design and make a suitable portable seat for use at sporting events. The seat must be strong, lightweight, easily assembled, dismantled and transported.

- **A grower wants to protect plants in a greenhouse from frost.**

Design and make a suitable electronic artefact, which will switch on a heater automatically when the temperature falls to near freezing.

- **Children enjoy working together in groups and through role-play this everyday environment enhances confidence, co-operation and sharing in young children.**

Design and make an artefact that will teach early skills through play.