Knowledge and understanding

KS1 Pupils should be taught to:
• learn how to use simple mechanisms
• learn how to make structures more stable and withstand greater loads
• investigate and disassemble simple products in order to learn how they function
• relate the way things work to their intended purpose
• learn that the quality of a product depends on how well it meets its purpose
• develop an awareness of health and safety as consumers as well as workers
• develop an appropriate vocabulary for naming and describing the equipment, materials and components they use.

KS2 • appreciate how the working characteristics of materials relate to the ways materials are used
• discover how materials can be combined and mixed in order to create more useful properties
• understand how simple mechanisms can be used to produce different types of movement
• understand how electrical circuits can be used to achieve functional results
• understand how structures can fail when loaded, and techniques for reinforcing and strengthening them
• investigate, disassemble and evaluate simple products and applications
• relate the way things work to their intended purpose
• distinguish between how well a product has been made and how well it has been designed
• consider the effectiveness of a product
• further knowledge and understanding of health and safety as designers, makers and consumers
• use the appropriate vocabulary for naming and describing the equipment, materials and components they use.

Tools and materials
By the end of Key Stage 1, among other materials, children following the suggestions in this pack will have had opportunities to gain experience of: scissors, paste, brushes, paint brushes, hammers, screwdrivers, needles, glue, spreaders, cutting knives, cloth, wool, weaving frames, Plasticine, card, wood, plastic, metal, raffia, cane, lino blocks, levers, wheels, ramps, recycled materials, weaving, collage, clay, puppetry, stick printing, paper folding, cutting, shaping, model-making, paper-and-paste animals, papier mâché, simple machines, gliders, balloons.

By the end of Key Stage 2, among other materials, children following the suggestions in this pack will have had opportunities to gain experience of: clamps, drills, files, gauges, hammers, hole punches, knives, mallets, needles, pins, pliers, rolling pins, saws, scissors, screws, screwdrivers, spanners, templates, trowels, wire cutters, nails, electrical circuits.

Skills and techniques
After the children have worked through Key Stages 1 and 2 they will have had the opportunity to have gained experience of: assembling, binding, bleaching, brushing, building, carving, casting, crocheting, cutting, cooking, darning, decorating, designing, displaying, drawing, dyeing, enamelling, etching, folding, gluing, glazing, grinding, knitting, knotting, measuring, mixing, mounting, planning, pressing, printing, pulping, putting, polishing, rubbing, scraping, sealing, sewing, shaping, sanding, smoothing, soldering, spinning, stencilling, sticking, stitching, styling, threading, tracing, trimming.
Year 6

**Major Design and Make Task for Term 1**

**Context:** Machinery and how it works

**Task:** Design and make machinery with some controlled moving parts

**Outcome:** Simple machines

**Materials and components:** Reusable materials, wood, metal, cardboard, fasteners, adhesives, tubes, ramps, etc

**Theme:** Mechanisms

**Experience:** Discuss common machines

**Investigation:** Look at, disassemble different types of simple machines

**Health and safety:** Safety precautions when dealing with machinery

**Major Design and Make Task for Term 2**

**Context:** Electricity

**Task:** Use electricity safely in order to design and make a number of working models

**Outcome:** Models powered by electricity

**Materials and components:** Batteries, flex, bulbs, magnets, filings, nails, wood, reusable materials

**Theme:** Mechanisms

**Experience:** Discover everyday examples of things powered by electricity

**Investigation:** Under supervision examine electrical circuits, practise breaking circuits

**Health and safety:** Study safety precautions necessary when working with electricity

**Major Design and Make Task for Term 3**

It is suggested that this term be used as a general revision period incorporating a number of the skills and techniques learnt over the past years.

**Context:** Robinson Crusoe

**Task:** Use this as a springboard for a number of skills and techniques leading to self-sufficiency

**Outcome:** Structures and systems allied to survival

**Materials and components:** Reusable materials, pots, packets, wood, plastic, steel, adhesives, fasteners, etc

**Theme:** Mechanisms

**Experience:** Discuss the environment

**Investigation:** Investigate, disassemble different kinds of survival aids

**Health and safety:** Health and safety in the environment
Designing and Making
Ask the children to design and make a siege catapult of the sort a soldier might have used hundreds of years ago to lob stones and other missiles into an enemy camp. Take a block of wood and hammer two large nails into it. Hammer two smaller nails together exactly in front of the large nails. Place an elastic band around the two large nails. Place another elastic band around the two smaller nails, but twist this second band. Put the handle of a spoon under the first elastic band and through the second band, with the bowl of the spoon just behind the first elastic band. Take great care that no one is standing in the line of fire. Put something reasonably soft in the bowl of the spoon. Bring the bowl of the spoon back and release it. The object in the bowl should be fired into the air. Experiment with the placement of the spoon and elastic bands until the spoon can hurl the object a long way. Hold a class competition, again under strict supervision, to see which catapult can hurl its load the greatest distance, measuring the distances carefully and recording them.

Designing and Making
Read the section of the story where the Tin Soldier is placed in a paper boat. Ask the children to design and make paper boats in which they can place a toy and float it in a bowl. What sort of paper could they use? What shape should the boat be? Devise tests. What are the drawbacks to a paper boat? How long do they last? Leave a number of paper boats in a bowl and see how long they last before they start to disintegrate. What would be more suitable materials to use for a boat for a Tin Soldier? Try a number of different materials. Use a margarine tub with a straw mast and a paper sail. Design and make a boat using these materials. What other recycled materials could be used for a boat? Try to make a power-driven boat. Use a matchbox with two matches sticking out of one end, one on either side of the box. Stretch an elastic band across the two matchsticks. Wind it up by twisting the elastic. Place a paddle in the shape of a piece of stiff cardboard between the twists of the band. Release the band as the boat is placed in the water. Does it move? What is the source of power? Keep working on the boat until it can move easily.

Designing and Making
Make a study of the different component parts of boats before trying to design some. Design experiments with a number of different shapes. Use balsa wood and cut pieces up so that they are different shapes-round, square, rectangular, pointed, etc. Make each piece approximately the same size. Bore a hole in the front of each piece and thread a piece of string through the hole. Devise a testing ground—a narrow channel of water, perhaps a piece of guttering. Using the string tug each piece of wood along the length of the testing run. Use a watch to time the runs. Which shapes move most easily and quickly? What shape should a boat be? Show children the use of keels on model vessels to stop the vessels overturning. Ask them to design and fix keels of different sorts to the bottom of a detergent bottle representing a boat. Which keel seems the most effective? Devise tests.

Designing and Making
Experiment with other types of boat in which the Tin Soldier might have sailed. Show the children pictures or models of outriggers and catamarans. An outrigger consists of an ordinary sailing vessel with, usually, several poles projecting from the side and a third pole joined at right angles to the two projecting poles. A catamaran is a twin-hulled vessel, with the two hulls joined by a cross-piece. A sail is placed in the middle of the cross-piece. Ask the children to design and make models of outriggers and catamarans, using the materials and adhesives they consider most suitable. Place the completed models in a bowl of water and devise tests to see which are the most stable and which do not capsize easily in rough water. A hair-dryer operated by an adult might provide a storm. Ask the children to talk and write about the results.
Designing and Making

Show the children how paper can be recycled. Use a sheet of newspaper or something similar. Tear the paper into small pieces and put the pieces into a liquidizer together with a quantity of water. Experiment with the amount of water necessary: about 500 cm should be enough in most cases. Switch the liquidizer on for about 60 seconds. Remove the mixture and put it in a sieve of some kind, allowing most of the water to drain away. Spread the remaining mixture onto a paper towel on a flat surface. It will help to add a little paper paste. Leave the shape to dry. When it is dry it may be painted. Once the children have experimented once with making this recycled paper ask them to shape the mixture at the stage after the water has drained away. What sort of decorations could the recycled paper be used for once it has dried and been painted?

Designing and Making

Link with Geography and Art lessons to study a number of different rugs and carpets, especially those from India, China and the Middle East. Discuss the location of the countries concerned and the ways in which the rugs are made. Study the patterns and designs. Ask the children to design and paint their own version of an Indian or a Chinese rug. Conduct an investigation into the safety aspects of floor coverings. Look at the undersides of different mats and rugs. How have they been constructed so that they will not slide across polished floors? Have the manufacturers used different methods to ensure this? Ask the children to experiment with a number of different materials and select the one they consider best to be used for the underside of a rug or mat. What prevents it from sliding over the floor? Will it help if additions were stuck on to the underside? Devise tests on different surfaces to see if the material is safe on all of them.

Designing and Making

Link with Science activities and conduct experiments into rust. Establish that nails and other metal objects will not rust easily if they are coated with paint. Ask pupils to work on their own, each child to design and make two simple 'buildings' from identical nails. Provide each child with a block of wood for the base, a hammer and nails, paint and paint-brush. Ask each pupil to paint one set of nails and to leave the others unpainted. Build two identical structures by hammering the painted nails into one block of wood and the unpainted nails into the other block. Use other materials to complete each building. Place each building outside the classroom in the open air. Over the period of a term check on both constructions. Do the painted nails seem to rust? Do the unpainted nails seem to rust? What conclusions may be drawn from this? What should builders do to metal before they construct buildings from it? Does metal have to be treated with paint to keep off rust, or could other preparations be used? Try to find out. (Care should be taken with the hammer.)

Making

Allow children time to talk and write about their projects. Link with school Health and Safety policy. Make sure that pupils are familiar with fire-drill arrangements and any other school rules designed for the protection of children and staff within the school. If time permits introduce the children to the first aid containers in the school. Ask pupils to discuss their contents and the way in which they have been stored. Ask the children to use the expertise they have gained over the terms activities to suggest ways of improving the ways in which the first aid boxes are located and the manner in which they have been packed. Ask the whole class to combine to draw a map of the school showing where they think the first aid boxes could be stored. Combine to produce an attractive map showing the location of the first aid boxes, which could be hung inside the school entrance.