Design and Technology Expectations – Sticky Knowledge

Substantive Concepts

	EYFS		KS1	Lower KS2	Upper KS2	
	Nursery	**Class 1**	**Class 2**	**Class 3**	**Class 4**	**Class 5**
Mechanical Systems	**Toys** • Know the cause & effect toys of simple mechanisms: remotes, winders, friction cars, remote control cars etc	**Toys** • Know that a programmable toy (or robot*) can be made to move by inputting information. It is then stored as a program.	**Sliders and Levers – Cycle B Summer Term** • Know that a mechanism is a device used to create movement in a product. (straight line, backwards and forwards, round in a curve) • Know that a lever is a rigid bar which moves around a pivot. Levers are used in many everyday products. • Know that a slider is a rigid bar which moves backwards and forwards along a straight line. • To know that unlike a lever, a slider does not have a pivot point. **Wheels and Axels – Cycle A Summer Term** • Know that an axle is a rod that enables a wheel to rotate. And the wheel can rotate freely on the axle or be fixed to, and turn with, the axle. • Know that the chassis is the frame or base on which a vehicle is built. • Be able to mark out, hold, cut and join wood and other materials together to make their chassis and body.	**Pneumatics – Cycle B Autumn Term** • Know how pneumatic systems create movement • Be able to assemble simple pneumatic systems with syringes to create movement. **Levers and Linkages – Cycle B Spring Term** • Know that lever and linkage mechanisms can produce an oscillating or reciprocating movement (linear, backwards and forwards, rotary or backwards and forwards in an arc) • Know that a push on a lever is the input movement and the movement is the output. • Identify levers, linkages, fixed/loose pivots.		**Cams – Cycle B Spring Term** • To know that a rotary motion is a movement that goes round. • To know that an oscillating motion is moving to and from around a pivot point, as in a lever. • To that that reciprocating motion is a backwards and forwards movement in a straight line, as in a slider. • Develop measuring, marking, cutting, shaping and joining using hacksaws, G Clamps and hand drills. **Pulleys or Gears - Cycle B Summer Term** • Using construction kits, investigate combinations of two different sized pulleys and discuss direction and speed of rotation. Use construction kits to examine gears and the speed of rotation. • Develop measuring, marking, cutting, shaping and joining skills using hacksaws, G-Clamps, bench hooks, square section wood, card triangles and hand drills to construct wooden frames. • Build a working complete circuit that incorporates a battery, motor and handmade switch
Vocabulary	push, pull, up, down, wind, press	forwards, backwards design, make, ideas.	slider, lever, pivot, design criteria, vehicle, wheel, axle, axle holder, chassis, body, fixed, free, moving, design, make, evaluate	syringe, plunger, pneumatic system, input movement, output movement, compression, pressure, inflate, deflate linear, rotary, oscillating, reciprocating prototype, lever, linkage, pivot, slot, bridge, guide system, input, process, output.		cam, snail cam, off-centre, cam, peg cam, pear, shaped cam, follower, shaft, crank, handle, oscillating, reciprocating rotation, rotary motion, pulley, drive belt, gear, driver, follower, ratio
Structures	**Modelling** • Know how to use one-handed tools and equipment, for example, making snips in paper with scissors. • Know how to make imaginative	**Modelling – Cycle A - Spring Term, Cycle B – Summer Term** • Know how to create and explore structures using different materials, different ways to fasten, both inside	**Freestanding structures – Cycle A Spring Term.** • Know that a freestanding structure is a structure that stands on its own foundation or base without attachment to anything else. • Know that their structure needs to be stable which means it is unlikely to fall over if a force is applied, practise this by folding paper – be able to discuss that this makes the paper stiffer and stronger.	**Shell Structures – Cycle A Autumn Term** • Disassemble a range of shell structures and examine how they have been strengthened – folding/shaping, laminating, corrugating, ribbing. • Use construction kits or card to make a variety of nets (faces with different shapes e.g. squares,	**Shell Structures (Using CAD) Cycle A Autumn Term** • To discover that a net is the flat or opened-out shape of an object such as a box through disassembly • To know that scoring is when you cut a line or mark into sheet material to make it easier to	**Frame Structures – Cycle A Spring Term** • To know that modelling is the process of making a 3-D representation of a structure or product. • To use a variety of joining techniques to join paper straws and make a model. (drinking straw, plastic tubing, thread and tie, pipe cleaner,

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	and complex 'small worlds' with blocks and construction kits, such as a city with different buildings and a park.	and outside of the classroom • Know how to use tools, such as scissors, with increasing confidence. • Join materials together using tape and glues.	• Knows that brick bonding can improve the performance of the structure or improve its appearance	rectangles, triangles, hexagons). If using card, join the faces with tape. • Use cutting out and assembling with tape, applying strengthening techniques.	fold, using rulers to make the folds stronger. • Experiment with strengthening techniques e.g. laminating, corrugating, ribbing. • To use tabs to enable the joining of the net.	glue, flattening the straws, creasing the straws, tape, splitting the straws) • To know that triangulation (the use of triangular shapes) is effective in strengthening a structure. • To accurately join square sectioned wood together. (card strips, card triangles, elastic bands)
Vocabulary	cut, corner, scissors, build	fold, join, thinner, thicker, point, straight, circle, triangle, square, rectangle	Structure, wall, tower, framework, weak, strong, base, top, underneath, side, metal, wood, plastic, cuboid, cube, cylinder	shell structure, shape, net, corrugating, ribbing, laminating, strengthened.	three-dimensional (3-D), length, width, breadth, marking out, scoring, tabs, adhesives, font, lettering, text, graphics, evaluating, prototype	frame structure, stiffen, strengthen, reinforce, triangulation, stability
Textiles	**Exploring materials** • Explore different materials freely, in order to develop their ideas about how to use them and what to make. • Develop their own ideas and then decide which materials to use to express them.	**Exploring materials Class 1 – Cycle A Summer Term** • Make objects from different materials, including natural materials • Explore a range of materials, including natural materials • To know that you can join two pieces of fabric together using pinning, safety pin, gluing or stapling.	**Templates and Joining Techniques Class 2 - Cycle B Spring Term** • To make their own templates or paper patterns. • To know that you can join two pieces of fabric together using a running stitch or overstitch. • To be able to thread a needle. • To know that textiles can be decorated in different ways including textile paints, sequins and shiny fabrics, fabric crayons	**2D shape to 3D product – Cycle A Summer Term** • To know a seam is a line of stitching that joins pieces of fabrics together. • To know a prototype that a model that is made to test whether a design will work. • Experiment with a range of joining techniques e.g. running stitch, overstitch and blanket stitch and discuss which joining technique makes the strongest seam. • To know that textiles can be decorated in different ways including embroidery such as cross stitch or velcro.	**2D shape to 3D product – Cycle B Summer Term** • Create a template using 2D shapes, placing pattern pieces to limit wastage • To know a seam allowance is the extra fabric allowed for joining together and this is usually 1.5cm. • To know that textiles can be decorated in different ways including applique • Experiment with a range of joining techniques e.g. running stitch, overstitch, blanket stitch, back stitch and backward running stitch.	**Combining different fabric shapes – Cycle A Autumn Term** • Know that a mock up - quick 3-D modelling using easy to work and cheaper materials and temporary joints – can be useful for checking proportions and scale. • Experiment with a range of joining techniques e.g. running stitch, overstitch, blanket stitch, back stitch and backward running stitch and discuss which joining technique makes the strongest seam. • To know that textiles can be decorated in different ways including applique, embroidery (stem stitch, satin stitch, chain stitch, lazy daisy stitch) • To explore a range of fastenings (sewing on a button, zip, toggle, ties, clasps or press studs)
Vocabulary	glue, join, stick, tape	decorate, materials, attach, fabric	template, pattern pieces, design brief, design criteria, make, evaluate, purpose, running stitch, overstitch	fabric, fastening, templates, stitch, seam, blanket stitch, running stitch, overstitch, cross stitch	applique, seam, seam allowance, pattern pieces, back stitch, backward running stitch, overstitch, blanket stitch	right side, wrong side, mock-up, zip, button, toggle, ties, clasps, press studs, stem stitch, satin stitch, chain stitch, lazy daisy stitch.
Healthy Eating	**Healthy eating** • Know that some foods are healthy and nutritious. • Explore eating a range of fruit and vegetables at snack time.	**Healthy eating & Food preparation Cycle A (Fruit Cocktail – Autumn Term)** • Know that some food comes from plants. • Describe some fruits and vegetables by	**Preparing fruit and vegetables – Cycle A (Fruit Smoothies – Autumn Term) Cycle B (Vegetable Soup – Autumn Term)** • Know that food has to be farmed, grown elsewhere (e.g. home) or caught. • Taste a range of different types of fruit and vegetables from the UK and around the world and be able to evaluate which they	**Healthy and Varied Diet – Cycle A Spring Term, Cycle B – Summer Term** • Know that food is grown (such as tomatoes, wheat and potatoes), reared (such as pigs, chickens and cattle) and caught (such as fish) in the UK, Europe and the wider world.	**Healthy and Varied Diet – Cycle A Summer Term** • Know that everyone should eat at least five portions of fruit and vegetables every day • Discuss all food groups from the Eatwell Plate and give examples of food from each group	**Celebrating culture and Seasonality – Cycle A Summer Term, Cycle B Autumn Term** • Know where food is grown and where it comes from around the world and discuss seasonality of different foods.

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		their shape, colour, feel and taste. **Cycle B (Vegetable Soup -Autumn Term)** • Change materials by heating and cooling, including cooking • Know that some food comes from plants. • Describe some fruits and vegetables by their shape, colour, feel and taste.	like best from the taste, smell, texture and appearance (inside and outside the fruit/vegetable) • Be able to discuss their understanding about food hygiene – washing hands and food before preparing and eating and why we do this. • Know how to use techniques such as slicing, squeezing, peeling and grating.	• Know how to use a range of techniques such as peeling, chopping, grating, mixing, spreading, kneading and baking. • Use the bridge and claw method to slice safely. • Know that a healthy diet is made up from a variety and balance of different food and drink, as depicted in The Eatwell Plate	• Discuss the importance of food hygiene and minimising risk. • Develop and agree on own design criteria **Celebrating culture and Seasonality – Cycle B Spring Term** • Be able to discuss senses and how touch, taste, smell, sight, texture can help us evaluate food types. • Measure out, cut, shape and combine food. • Know the importance of finishing in terms of their presentation/ the appearance of the product – shape, decoration and colour. • Know that recipes can be adapted to change the appearance, taste, texture and aroma.	• Know how food is processed into ingredients that can be eaten or used in cooking. • Know that different food and drink contain different substances – nutrients, water and fibre – that are needed for health. • Use appropriate utensils to knead, beat, rub and mix.
	fruit and vegetable names	Sensory vocabulary such as: soft, juicy, crunchy, sweet, sticky, smooth,	sensory vocabulary e.g sharp, crisp, sour, hard, flesh, skin, seed, pip, core, slicing, peeling, cutting, squeezing, ingredients,	grown, reared, caught, frozen, tinned, processed, chopping, grating, mixing, spreading, kneading, baking, bridge and claw, eatwell plate	healthy/varied diet, hygienefat, sugar, carbohydrate, protein, vitamins, dairy (plus food types to go in these groups) design criteria Texture, taste, touch, smell, sight, aroma ingredients, texture, appearance, smell, combine, shape, decoration, recipe.	yeast, dough, bran, flour, wholemeal, unleavened, baking soda, seasons, processed, source, seasonality, fold, knead, , mix, rubbing in, beat
Electrical systems					**Simple Circuits & Switches - Cycle B Autumn Term** • Make simple circuits with batteries, buzzers and switches, knowing that an open switch causes a break in a circuit, whereas a closed switch makes the circuit complete. • Make a range of switches using simple classroom materials. • To know and describe what conductors and insulators are. • To know that you can use a simple computer control program to control output devices.	**Monitoring and Control – as part of the Pulleys and Gears unit (Cycle B Summer Term)** • To know that some components (e.g. buzzers and LEDs) need to be connected the right way around in a circuit, ensuring positive and negative match the outputs of the interface box or microcontroller. • To know that output devices are components that produce an outcome e.g. bulbs and buzzers and know that input devices are components that are used to control an electrical circuit e.g. switches. • Understand how more complex electrical circuits and components

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					Simple Programming and Control – Cycle A Spring Term • Understand and make a complete circuit and be able to troubleshoot problems. • Know a range of switches and how to make your own. • Understand that computer control systems can be used to control the device.	can be used to create functional products. • Build a working complete circuit that incorporates a battery, motor and handmade switch
Vocabulary					Batteries, buzzers, open switch, closed switch, conductor, insulator, toggle switch, push-to-make switch, push-to-break switch complete circuit , toggle switch, push-to-make switch, push-to-break switch	reed switch, toggle switch, push-to-make switch, push-to-break switch, light dependent resistor (LDR), tilt switch, wire, parallel circuit, bulb, bulb holder, wire

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Disciplinary Knowledge

	EYFS	KS1		Lower KS2		Upper KS2	
Aspect		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Designing	• Develop their small motor skills so that they can use a range of tools competently, safely and confidently. • Create collaboratively, sharing ideas, resources and skills.	**Understanding contexts, users and purposes:** • Work confidently within a range of contexts, such as imaginary, story-based, home, school, gardens, playgrounds, local community, industry and the wider environment. • State what products they are designing and making. • Say whether their products are for themselves or other users. • Describe what their products are for. • Say how their products will work. • Say how they will make their products suitable for their intended users. • Use simple design criteria to help develop their ideas. **Generating, developing, modelling and communicating idea:** • Generate ideas by drawing on their own experiences. • Use knowledge of existing products to help come up with ideas. • Develop and communicate ideas by talking and drawing. • Model ideas by exploring materials, components and • construction kits and by making templates and mock-ups. • Use information and communication technology, where appropriate, to develop and communicate their ideas.		**Understanding contexts, users and purposes:** • Work within a wider range of contexts, such as the home, school, leisure, culture, enterprise, industry and the wider environment. • Describe the purpose of their products. • Indicate the design features of their products that will appeal to intended users. • Explain how particular parts of their products work. • Gather information about the needs and wants of particular individuals and groups. • Develop their own design criteria with support and use these to inform their ideas. **Generating, developing, modelling and communicating idea:** • Share and clarify ideas through discussion. • If appropriate, model their ideas using prototypes and pattern pieces. • Use annotated sketches, cross-sectional drawings and exploded diagrams to develop and communicate their ideas. • Use computer-aided design to develop and communicate their ideas. • Generate realistic ideas, focusing on the needs of the user'. • Make design decisions that take account of the availability of resources.	**Understanding contexts, users and purposes:** • Work confidently within a range of contexts, such as the home, school, leisure, culture, enterprise, industry and the wider environment. • Describe the purpose of their products and how they link to the design brief. • Indicate the design features of their products that will appeal to intended users. • Explain how particular parts of their products work. • Carry out research, using surveys, interviews, questionnaires and web-based resources. • Identify the needs, wants, preferences and values of particular individuals and groups. • Develop a simple design specification to guide their thinking. **Generating, developing, modelling and communicating idea:** • Confidently share and clarify ideas through discussion. • Model their ideas using prototypes and pattern pieces. • Use annotated sketches, cross-sectional drawings and exploded diagrams to develop and communicate their ideas. • Use computer-aided design to develop and communicate their ideas. • Generate innovative ideas, drawing on research. • Make design decisions, taking account of constraints such as time, resources and cost.
Making	• Select and use activities and resources, with help when needed. This helps them to achieve a goal they have chosen or one which is suggested to them. • Choose the right resources to carry out their own plan.	**Planning:** • Plan by suggesting what to do next. • Select from a range of tools and equipment, explaining their choices. • Select from a range of materials and components according to their characteristics. **Practical skills and techniques:** • Follow procedures for safety and hygiene. • Use a range of materials and components, including • construction materials and kits, textiles, food ingredients and mechanical components. • Measure, mark out, cut and shape materials and components. • Assemble, join and combine materials and components. • Use finishing techniques, including those from art and design.		**Planning:** • Begins to select tools and equipment suitable for the task. • Explain their choice of tools and equipment in relation to the skills and techniques they will be using. • Begins to select materials and components suitable for the task. • Explain their choice of materials and components according to functional properties and aesthetic qualities. • Order the main stages of making. **Practical skills and techniques:** • Follow procedures for safety and hygiene. • Use a wider range of materials and components than KS1, including construction materials and kits, textiles, food ingredients, mechanical components and electrical components. • Measure, mark out, cut and shape materials and components with some accuracy. • Assemble, join and combine materials and components with some accuracy.	**Planning:** • Select tools and equipment suitable for the task. • Explain their choice of tools and equipment in relation to the skills and techniques they will be using. • Select materials and components suitable for the task. • Explain their choice of materials and components according to functional properties and aesthetic qualities. • Produce appropriate lists of tools, equipment and materials that they need. • Formulate step-by-step plans as a guide to making. **Practical skills and techniques:** • Follow procedures for safety and hygiene. • Use a wider range of materials and components, including construction materials and kits, textiles, food ingredients, mechanical components and electrical components. • Accurately measure, mark out, cut and shape materials and components. • Accurately assemble, join and combine materials and components. • Accurately apply a range of finishing techniques, including those from art and design.

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			• Apply a range of finishing techniques, including those from art and design, with some accuracy.	• Use techniques that involve a number of steps. • Demonstrate resourcefulness when tackling practical problems.
Evaluating	• Return to and build on their previous learning, refining ideas and developing their ability to represent them.	**Own ideas and products:** • Talk about their design ideas and what they are making. • Make simple judgements about their products and ideas against design criteria. • Suggest how their products could be improved. **Explore existing products and consider:** • What products are • Who products are for • What products are for • How products work • How products are used • Where products might be used • What materials products are made from • What they like and dislike about products **Key events and individuals:** Projects may be linked to other topics and holidays celebrations, but it not a requirement.	**Own ideas and products:** • Begin to identify the strengths and areas for development in their ideas and products. • Begin to consider the views of others, including intended users, to improve their work. • Refer to their design criteria as they design and make their product. • Use their design criteria to evaluate their completed products. **Explore existing products and consider:** • How well products have been designed • How well products have been made • Why materials have been chosen • What methods of construction have been used • How well products work • How well products achieve their purposes • How well products meet user needs and wants In early KS2 pupils should also investigate and analyse: • who designed and made the products • where products were designed and made • when products were designed and made • whether products can be recycled or reused **Key events and individuals:** Learn about inventors, designers, engineers, chefs and manufacturers who have developed ground-breaking products. These may be linked to topics on curriculum maps.	**Own ideas and products:** • Identify the strengths and areas for development in their ideas and products. • Consider the views of others, including intended users, to improve their work. • Critically evaluate the quality of the design, manufacture and fitness for purpose of their products as they design and make evaluate their ideas and products against their original design specification. **Explore existing products and consider:** • How well products have been designed • How well products have been made • Why materials have been chosen • What methods of construction have been used • How well products work • How well products achieve their purposes • How well products meet user needs and wants • Investigate and analyse how much products cost to make • Consider how innovative products are • Investigate and analyse how sustainable the materials in products are • Consider what impact products have beyond their intended purpose **Key events and individuals:** Learn about inventors, designers, engineers, chefs and manufacturers who have developed ground-breaking products. These may be linked to topics on curriculum maps.

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