KS2.CA.T3	Area of study: Electrical Systems Unit aims / outcome: • To create a battery-operated light using a working electrical circuit complete with a switch to operate it.

Design and Technology concepts to organise knowledge:
Systems: Systems (electrical or mechanical): groups of related things that work together as a whole.

Key concepts of learning:

Disciplinary knowledge:

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups.
- Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer aided design.

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks, for example cutting, shaping, joining and finishing, accurately.
- Select from and use a wider range of materials and components, including construction materials, textiles, ingredients according to their functional properties and aesthetic qualities.

Evaluate-

- Investigate and analyses a range of existing products
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work.
- Understand how key events and individuals in design and technology have helped to shape the world.

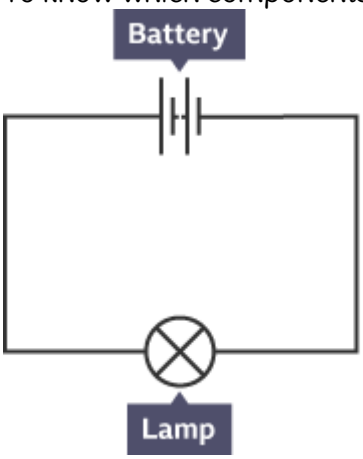
Technical knowledge-

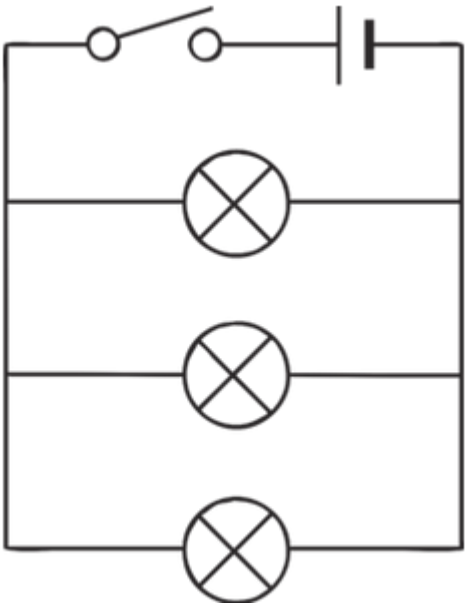
- Understand and use electrical systems in their products, for example series circuits incorporating switches, bulbs, buzzers and motors.

From earlier science topic the children should know:	Tier 2	Tier 3
• How to create and use a simple circuit. • The different components of a circuit, for example, bulb, switch etc. • What a conductor is. • What an insulator is.	**New** Circuit Series circuit Parallel circuit Fault control **Review –** *Reception*	**New** Conductor insulator **Review**

NC objective:	Vocabulary and crucial knowledge:

Design use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design. Make select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing] accurately. select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities. Evaluate investigate and analyse a range of existing products. evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. understand how key events and individuals in design and technology have helped shape the world.	<u>Context of study:</u> This topic will build on what the children have already learnt through their science topic of electricity (KS2.CA.T3). They will know about simple circuits, bulbs, batteries, switches and buzzers. They will know some language and tools needed to build and create as they make structures out of junk modelling in the freestanding structures topic (KS1.CB.T1). Children will also know a range of materials they can use which links with Science (KS1.CA.T2). They will further build on this by designing products for a target audience using a range of materials and tools competently, safely and confidently. The children will evaluate products for a target audience by reflecting on their choice and making amendments where necessary. Children will learn that circuits are part of electrical systems. Children will understand the circuit needs to be complete for the electricity to flow through it. Children will understand that using non-mains electricity helps the light be portable and moveable. <u>Crucial Knowledge:</u> <u>Design Brief</u> To know that STEM is an acronym for Science, design & Technology, Engineering and Mathematics. To know that different things have changed over time due to know technological developments. For example, show the children pictures of a device like a telephone or a tv and discuss how they have changed over time. The idea is that children can see how products and services have been improved and also how this is related to developments and discoveries. For each scenario, discuss the questions: What changes have taken place? What enabled those to happen? What have the effects been and how have they helped shape the world? To know that how we light our homes have changed over time. Explain that they will now look at some images and text of lighting throughout history. To know how light has changed over time from fire, to candles, the light bulbs to LED lighting that we have now. Children can place pictures of these in chronological order. To understand that lights might continue to change in the future, how will we light our homes in 20 years? What energy will we use? To know that the design brief is to make a torch for caving (Kibblestone/Standon Bowers). <u>Research</u> To know what different torches look like, how they work, how they turn on and off and what energy source they use.

	To research different torches using pictures, books and iPads/computers. To discuss torches that they have at home and what makes a torch good or useful. To know the difference between mains and non-mains electricity. To know mains electricity requires an object to be plugged in. To know non-mains electricity requires a battery for its energy and power. <u>Technical Knowledge</u> To understand that sometimes we need a light which uses non-mains electricity like a torch to help us if there isn't any mains electricity- like if we are in a garden or away from home. To know what a diagram of a simple series circuit (single pathway) to a light bulb looks like. To know which components the symbols represent.  To know that a series circuit will only work if the circuit is complete and there are no gaps. To know that a series circuit doesn't work if there is a fault in one of the components of the electrical system.

	To know that another option to a series circuit would be to make two smaller circuits with each bulb having its own circuit parallel to one another.  An advantage of parallel circuits is that if there is a fault in one component, the other continues to function. Show the diagram of the two types of circuits. To know how to make both types of circuit and how to draw them using the correct symbols. To know that a light will be on permanently so we need a switch to be able to turn our torch on and off. (Explain that the outside of switches are often made out of plastic, which is an insulator (does not easily allow electric to pass through it) and the material used to create the inside of the switch should be a conductor (a material which allows electric to pass through it). Demonstrate two different ways of making a home-made switch (first with a piece of card, two split pins and a paper clip, second with card and foil). Children make the same switches which were demonstrated by the teacher. They will then use them as part of a circuit to turn a bulb on and off. To know how a switch impacts a circuit and draw a simple circuit to include a switch. <u>Design</u> To know what is meant by design criteria and why do we need design criteria when making a product? Explain design criteria specify and what they are for. Explain that the children will develop their own design criteria for a battery-operated archaeologist's head lamp. These will be used later in the lesson to inform their designs. Ask the children - Who is the lamp for? Where will it be used? What will it be used for To know that their design criteria needs to include, the light being portable, lightweight and have a homemade switch to turn it on and off.

	To know how they will connect the electrical system to their junk modelled light. To know what materials, they will need for joining and building. To know how the light is going to work and which type of switch they will use. To decide whether your lamp is a tube shape or box shape. (a tube should start with a plastic bottle or a card tube or a box then should start with a cardboard box or a net that forms a box. . Explain that the key idea is to use materials that are already similar to the effect you want to achieve <u>Make</u> To understand and gather the materials needed to make their chosen design. To choose the batteries, bulbs and switches for their light. To build the outer part of the light out of junk modelling, following their design picture. To form their complete circuit, including homemade switch. To think about how best to join the electrical circuit to their light. They then start to make the main outer part of the lamp. To decide where the switch needs to be so it can be accessed properly by the person using the light. <u>Evaluate</u> Children need to know that evaluating means looking at the strengths and weakness of the product they have created. Children need to explain what they did and how they made their final product. Children need to know why they chose to put the wires and circuit inside the torch and whether their home-made switch worked effectively or not. Children need to compare their torch to their original plan and the design criteria. Have they met the objective that was originally set out? Is the decoration similar? Is the torch fit for purpose? Explain that through discussion children have just evaluated the electrical systems and that this is something they will be doing throughout their learning on systems- they have put something together to make it work as a whole. Benjamin Franklin- could be mentioned as the creator of electricity.