BILSTON CHURCH OF ENGLAND PRIMARY

MEDIUM TERM PLANNING

Subject	Topic/Key Question	Year Group	Term	Time Allocation
Design and Technology	Light Up Sign	3	Summer 1	6 hours
End of lower key stage 2 objectives.	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. 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. 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. Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] Apply their understanding of computing to program, monitor and control their products			
Programming and Electrical systems				
End of unit objectives	I can explore and analyse illuminated signs.			

	• I can create a simple circuit with incandescent bulbs and a switch. • I can describe the difference between an LED and an incandescent light bulb. • I can create a simple circuit with an LED bulb and a resistor. • I can make a circuit with a string of LED lights. • I can design an illuminated light box against a set of design criteria. • I can select materials, tools and components to create a free-standing structure. • I can make a stable, free-standing structure to house an electrical circuit. • I can strip, twist and join wire to make permanent connections. • I can insert an electrical circuit into a free-standing structure to create an illuminated light box. • I can evaluate the effectiveness of my finished product against the design criteria.	
Vocabulary	Design	Design, criteria, product, attractive, step by step, plan, order, equipment, tools, describe, labelled, sketch, realistic
	Make	Follow, plan, equipment, materials, select, appropriate, tools, techniques, product, accurate, measure, cut, holes, shape, electrical component.
	Evaluate	Explain, how, improve, know, why, has been successful, has not been successful, changes, make designs better if . . .
	Mechanisms	Mechanisms, make, product, components, choose, materials, suitability, light, switches, electrical system.

Lesson Sequence	Time Allocation	Key Question/WALT	Teaching Activities	Resources
Technical knowledge Lesson 1	1 hour	To investigate and analyse illuminated signs.	Show a variety of illuminated signs, advertisement hoardings, information boards etc. What are the purposes of illuminating these signs? Think, pair, share, then show some suggested reasons. • Show the slides explaining how some common illuminated signs work, e.g. lightboxes, neon signs, frontlit signs, back-lit signs and bulb lettering (like fairground illuminations or theatre marquees). • Although often used for advertising and information, illuminated signs can be decorative, too! Show some examples of domestic light-up signs and lightbox lamps. • Do you know how to make an electric circuit with one lightbulb? Show a set of electrical components, separated. Challenge children to draw them connected as they think they should be, then show a correctly drawn circuit. • Show an illustration of a basic box/enclosure in the shape of a letter 'T'. How could we fit a series circuit with 3 lightbulbs inside this shape? How could we hide some of the wiring? Think, pair, share, then show the example Activity Give pairs of children Circus Sign 1B, as well as sufficient equipment to make a circuit with two bulbs. Children are challenged to make a circuit and hide the wiring behind their sheet so only the bulbs show through, as instructed. Questions for assessment	Plan Bee lesson 1 Slides Resources Circus Sign 1A/1B/1C sheets Electrical components (see Teacher's Notes) Teacher's Notes Light-Up Signs Checklist 1 (FSD...? activity only)

			Can children suggest reasons why it is helpful to illuminate signs? • Can children identify distinguishing features of a variety of illuminated signs? • Can children investigate ways in which very simple circuits for illuminated signage might be constructed?	
Technical knowledge Lesson 2	1 hour	To understand how LEDs may be used instead of traditional incandescent bulbs in series circuits.	Show an image of a simple circuit with a small, incandescent screw-fit bulb. What other types of bulbs have you noticed at home, around school or elsewhere? Discuss. • Very few modern electrical products use traditional incandescent bulbs. Many use LEDs. Why do you think this might be? Discuss. • LEDs are very bright, very long-lasting, incredibly cheap to make, cool, use very little electricity and come in a range of colours. You probably have many products at home, and around you at school, containing LEDs. Can you see any around you now? • Individual LEDs often can't be connected directly to a battery; they can easily 'blow', meaning the tiny metal parts inside melt and break when too much electricity flows through them. To prevent this, we put tiny electrical components called resistors before LEDs in a circuit. Resistors reduce the flow of electricity from the battery, through the LEDs. Show the analogy of someone treading on a hose pipe. What happens to the water? Discuss. Explain how electricity in a circuit flows in one direction, like water in a hose pipe. The slides also explain how electricity only flows through typical LEDs in one direction.	Plan Bee Lesson 2 Slides Resources Worksheet 2A/2B Electrical components (see Teacher's Notes) Teacher's Notes FSD...? activity only: Inexpensive strings of battery-powered LED lights Challenge Card 2 Art/DT materials and scrap materials (see card)

			• Show the slides with images of a simple circuit with a resistor and an LED. Which end is connected to the positive terminal of the battery? Which is connected to the negative terminal? Activity Independent work. Worksheet 2A includes detailed instructions for making a simple circuit with an LED, optionally adding a switch. The sheet includes questions about how their circuit might be used in a product. Questions for assessment Can children suggest some problems with using traditional, incandescent bulbs in products? • Can children suggest some aesthetic and practical reasons for using LEDs instead? • Can children construct a circuit with an LED?	
Design Lesson 3	1 hours	To develop ideas for a decorative illuminated sign.	What do we use signs for? Challenge children to decide the purpose of each of the three signs shown. • Apart from signs for information, instructions or advertising, can you think of any other purposes of signs? Briefly discuss, then explain that lots of people like to have decorative signs in their homes. Some are illuminated, too. • Explain that today we are going to design decorative, illuminated lights for someone's home. Show some questions for children to consider and discuss, relating to the product's audience and purpose. Optionally, note some ideas on the space provided on the slide. • Show children various electrical components that they may use in their design. Which of these would you want to 'hide'	Plan Bee lesson 3 Slides Resources Worksheets 3A/3B/3C Cuboid Cards 1-4 Teacher's Notes FSD...? activity only: CAD software/website, e.g. tinkercad.com Challenge Card 3

			in your product? Which would you want to show? Why? Discuss. • Explain that children must design a 'light box' light, i.e. a cuboid shape with the light source inside it. Allow time for children to read the design criteria listed on the slide and ask any relevant questions. • Show some examples of ways in which light boxes may be constructed. Ask children to consider where they might fit electrical components inside these types of light box, and how they might include text in their design. For example, some children may realise that they could include 'silhouette' text by placing dark lettering on the translucent surface of a light box, so light shines around the letters. Others may suggest putting lettering inside a light box, with bulbs or LEDs illuminating its interior. • Show some more specific questions about designing light box signs for children to discuss. Activity Worksheet 3B includes spaces for children to draw, label and describe their design. Questions for assessment Can children identify potential audiences and purposes for a product design? • Can children make practical considerations about how to fit essential components in/on a product? • Can children consider tools and techniques they may need to use when constructing a product of their own design?	

Make Lesson 4	1 hour	To select and use tools, equipment, materials and components to make the enclosure of a decorative illuminated sign.	Today we will be making the enclosure for a decorative, illuminated light box sign. If you have taught the previous lesson in this Complete Series, instruct children to get out their designs. • Show the slides challenging children to consider and discuss how either scrap materials or 'new' materials may be used to construct a light box sign. • Depending on your design, your light box frame will also need 'cladding' on some of its sides. What materials could you use to cover your frame? Discuss, then show three examples: card, foam board and balsa wood. Take a minute to discuss some pros and cons of each material. • Depending on your design, your light box will have text or lettering on the inside or outside. The slide shows questions about adding text for children to discuss. You may wish to define the words 'transparent', 'translucent' and 'opaque'. • How can we work safely? No additional information is given on the last slide, as you will have to explain how to work safely with the resources you have, or select, for use with your class. • If you are doing the Main Activity, below, demonstrate techniques for measuring, marking, cutting and glueing wooden box section to make a frame. Stop periodically during the making session to demonstrate additional techniques such as painting the inside of the box white to reflect light. Refer to the Teacher's Notes for advice on this. Activity Worksheet 4B children are to redraw their design from the previous lesson, adapting it as required according to the	Plan Bee lesson 4 Slides Resources Worksheets 4A/4B/4C Teacher's Notes Lightbox construction tools and materials (refer to Teacher's Notes) Scrap Art/DT materials (FSD...? activity only)

			limitations of the materials and methods you choose for them to use. They must also write a short set of instructions for a logical sequence for constructing their design Questions for assessment Can children identify ways in which their existing designs could be adapted for the materials available? • Can children select appropriate tools and materials for construction of their design? • Can children identify ways in which they can work safely while constructing their design?	
Make Lesson 5	1 hour	To construct a working circuit with one or more lights, and fit it in a decorative illuminated sign.	Show images of electrical components. Can you draw a quick picture to show a working circuit with a light? Give children a minute to draw on scrap paper or mini whiteboards. Show images of two different circuits. Was your drawing similar to either of these? • Give groups some electrical components (wires, battery packs, bulbs, switches etc.). Instruct them to make and test the circuits they have just drawn. • Some of your components may be designed to 'snap' or fix together. Others, such as wires with crocodile clips, are only meant for temporary electrical connections. They are not ideal for permanent connections in a circuit inside a product. The slides show how insulated wire may be stripped, twisted and taped to ensure there is a reasonably effective electrical connection. • Show the slide explaining how adults might use a soldering iron to make a stronger, permanent connection between wires and electrical components.	Plan Bee lesson 5 Slides Resources Worksheet 5A/5B Invention Cards 5A Challenge Cards 5A (FSD? activity only) Worksheet 5C (FSD? activity only)

			• (Skip if not doing Main Activity, below) Show the slide titled 'Light Box Signs'. Ask children to briefly discuss the questions shown about how they might fit their light box signs with electrical components. • (Optionally, skip this if you are not doing the FSD...? activity below, or do not have time for children to make and incorporate improvised switches in their light box signs) Show the slide titled 'Making Switches'. Again, allow children time to think and discuss how they might make a switch. Activity Give children Worksheets 3B and 4B from previous lessons, plus their lightbox designs. Instruct them to finish their designs by fitting electrical components. Questions for assessment Can children recall how to create a simple series circuit with a light? • Can children select and use appropriate tools, materials and components to construct a circuit? • Can children decide on an appropriate way to fit electrical components inside their designs?	
Evaluate Lesson 6	1 hour	To investigate ways in which computers can be used to program and control lights in a product.	If you have a set of fairy lights with a controller that switches through various settings, show children these. Alternatively, show the video (link on slide). How do you think these lights work? Discuss. • Explain that these lights have microcontrollers inside them, which are small electronic components that are programmed on a computer, then fitted into electronic products.	Resources Worksheet 6A/6B/6C (plus blank, customisable versions) Teacher's Notes Programmable microcomputers/microcontrollers e.g. Raspberry Pis and electronic components (see Teacher's Notes) Challenge Card 6

			• Can you think of other products that might have microcontrollers? Think, pair, share, writing ideas on a mini whiteboard/scrap paper. Show some examples. • We can program microcontrollers and microcomputers to control products, too. The slides show examples of LEGO, Raspberry Pi, BBC micro:bit and Arduino microcontrollers/microcomputers. • Show a set of simplified coding 'blocks' for a program which turns a single LED on and off when keys are pressed on a keyboard. Challenge children to suggest a correct order for the code blocks. • Show another set of code blocks. Can you draw these in the correct order to make an LED 'blink'? • Explain that today we will be programming and controlling lights using coding software and, depending on which activity below you choose, physical electronic components Activity Provide Worksheet 6B and the components listed on the top of the sheet. Following the guidance on the sheet, children are challenged to connect the components and create a simple Scratch program which makes it 'blink' repeatedly as specified. Questions for assessment Can children identify products which contain microcontrollers which control lights? • Can children make algorithms with simple sets of instructions which describe how a flashing LED is controlled? • Can children write or edit programs to control an LED?	(FSD...? activity only) Internet access (FSD...? activity only)