



Lesson Plan – Design a Light



Level – Years 3-6

Time taken – 2 hours planning (2-3 weeks in advance), 4 hours making and testing

Pupils to work individually or in pairs

Additional adult help is recommended

Expectations – to complete working lights

Associated resources:

PowerPoint: Lighting it up – planning session

PowerPoint: Lighting it up – make and test session

Worksheet

Blog 'How to make a flashlight'

Blog 'How to make a lighthouse'

STEM Links

- Science: electrical circuits, everyday materials, light and shadows
- Technology: design products, use materials and components, electrical systems
- Engineering: product design and implementation, how a torch works
- Mathematics: measuring lengths and angles, drawing graphs

Curriculum Learning Objectives – it is recommended to cover as many of these topics as possible prior to the exercise so that the pupils are reinforcing their knowledge and understanding, rather than meeting the topics for the first time.

Science: Electricity

Pupils should be taught to:

- recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit
- use their circuits to create simple devices
- represent a simple circuit in a diagram using recognised symbols
- pupils should be taught about precautions for working safely with electricity

Science: Materials

Pupils should be taught to:

- think about unusual and creative uses for everyday materials

Science: Light

Pupils should be taught to:

- recognise that shadows are formed when the light from a light source is blocked by an opaque object
- find patterns in the way that the size of shadows change

Design and Technology

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making.

When designing and making, pupils should be taught to:

Design and Technology: Design

- design innovative, functional, appealing products that are fit for purpose

Design and Technology: Make

- use a range of tools and equipment to perform practical tasks (for example cutting, shaping, joining and finishing)

- select from and use a range of materials and components according to their functional properties and aesthetic qualities

Design and Technology: 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

Design and Technology: Technical knowledge

- understand and use electrical systems in their products (for example series circuits incorporating switches and bulbs)

Mathematics: Measurement

Pupils should be taught to:

- measure and compare lengths
- measure angles in degrees
- solve comparison problems using a line graph

Vocabulary list

Cell – a device which produces electrical energy from stored chemical energy

Battery – two or more cells connected together to produce electrical energy

Bulb – a component which emits light when a current is passed through it

Reflect – turn back light (or heat or sound) from a surface

Transparent – easily seen through

Opaque – doesn't allow light to pass through

Toggle switch – an electrical switch which uses a rotating arm to make and break the circuit

Slide switch - an electrical switch which uses a linear slider to make and break the circuit

Push to make switch – an electrical switch in which a button is pressed to make the circuit and released to break it

Parts included in class kit:

- Assorted coloured cardboard craft rolls (60)
- Card wheels (100)
- Bulb holders (30)
- Bulbs 1.5V (50)
- Crocodile leads (90)
- Battery holders 1xAA (30)
- Push switches (5)
- Toggle switches (15)
- Slide switches (10)

Check you have received the correct contents in your class kit. Please let TTS know if there are any problems as soon as possible.

Tools and consumables needed:

- Rulers
- Pencils
- Felt tip pens
- A4 white paper
- Graph paper
- Protractors or 30° and 45° set squares
- Large scissors
- Pointed nail scissors (use under adult supervision only)
- Double sided foam tape
- Transparent sticky tape
- Low melt glue guns and glue sticks (use under adult supervision only). **Note: High melt temperature glue guns should not be used by pupils, as they can cause nasty burns.**
- Hand drills and vices (optional)
- Ramp
- A dark room where you can investigate shadows

Preparation needed

Conduct the planning exercise at least two weeks before making and testing the products. This is to give the pupils time to collect any additional recycled household objects they need for their design, encouraging them to think of creative uses for everyday materials. You could also collect recycled materials such as plastic pâté pots, yogurt pots, foil trays etc for the children who forget to bring anything in.

If possible bring a torch along to the planning session. Don't bring any mains operated lights unless they have been electrical safety (PAT) tested.

Build a sample flashlight and/or lighthouse to show the children the kind of things they could realistically make.

Risk assessment

Conduct a risk assessment before undertaking the activity. Some suggestions for inclusion are given below:

Hazard: Pupils burning themselves with the glue guns.

Ways to reduce the risk: Warn the pupils of the dangers; don't switch them on until after the safety briefing; have a responsible adult supervising the glue guns; only use low melt temperature glue guns.

Hazard: Pupils cutting themselves with the scissors.

Ways to reduce the risk: make the pupils aware of the dangers; explain how to use the scissors safely.

Hazard: Pupils short circuiting their batteries and burning their fingers.

Ways to reduce the risk: explain how to avoid short circuiting the battery; use zinc chloride batteries (not alkaline or rechargeable ones) so they don't get so hot; if the batteries get hot ask an adult to disconnect them immediately.

Hazard: Pupils cutting their fingers on aluminium.

Ways to reduce the risk: use aluminium foil trays or similar; do not use aluminium drinks cans

Extension activities

On a sunny day you can ask children to work in pairs to measure the length of each other's shadows at different times throughout the school day and plot a graph of shadow length against time. This would contribute to the class discussion as to why shadows change in length over the course of a day.

If any pupils have made a lighthouse you could connect up a Crumble Controller (not included in the kit) and use it to make the lighthouse flash on and off, and programme different flashing patterns. You could ask the class to discuss why lighthouses have different designs and flashing characteristics (to help sailors identify which lighthouse it is and work out where they are).