Year 5 Design and Technology: Systems – Block B
How can we keep ourselves safe on the road?

- This block combines pupils' knowledge from Science, Computing and DT knowledge acquired so far in KS2.
- The outline and structure of the block is as follows:

Lesson 1	Lesson 2	Lesson 3
Understanding and selecting materials	Using fixings and fastenings	Using knowledge of programming to control a product

Emily Brooke
Inventor of the *Laserlight* bike light projector

At the end of this block, pupils will …	
Know:	**Be able to:**
Technology can be used to program and control a product	Combine elements of their design knowledge to fulfil a brief

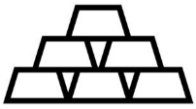
In this block, pupils will draw on the knowledge they have learnt so far to design and make a road safety belt. Pupils will write a simple program for a micro:bit and evaluate their outcome against the design brief.

CUSP Design & Technology Long term sequence	Block A	Block B	Block C	Block D	Block E	Block F
Year 1	Mechanisms	Structures	Food and Nutrition	Understanding Materials	Textiles	Food and Nutrition
Year 2	Textiles	Food and Nutrition	Mechanisms	Understanding Materials	Food and Nutrition	Structures
Year 3	Textiles	Food and Nutrition	Mechanisms	Food and Nutrition	Systems	Structures
Year 4	Food and Nutrition	Mechanisms	Textiles	Structures	Electrical Systems	Food and Nutrition
Year 5	Food and Nutrition	Systems	Textiles	Mechanisms	Structures	Food and Nutrition
Year 6	Food and Nutrition	Mechanisms	Food and Nutrition	Structures	Electrical Systems	Textiles

Point of reference:
Y5 Systems – Block B

Pupils will be able to:

- describe the properties of materials
- identify and attach fastenings



Prior Learning

- understand and use simple algorithms
- design and debug simple programs

Design or Technology History:

Emily Brooke (born 1985)
Emily Sophie Hastings Brooke (MBE) is a British inventor, industrial designer and entrepreneur who is best known for developing the Beryl (formerly Blaze) laser bike light projector which helps to protect cyclists caught in the blind spot of drivers. It does this be projecting the symbol of a bike onto the road in front of the cyclist. Emily developed the laser as part of a project in her final year at university. After graduating, she developed the project further and gained the attention of Transport for London. Her firm was then successful in securing support from Santander who now uses the lights on all of the bikes within the Santander Cycles rental scheme. Emily was appointed MBE in the 2017 Birthday Honours List for her services to the economy and transport. Her company (Beryl) sells the *Laserlight* and other cycle lights and also operates dockless cycle-sharing schemes in several cities around the UK.

Links to Literature:

Inventors by Robert Winston
Grace Hopper: Queen of Computer Code by Laurie Wallmark
Road Safety Week website

Materials:

BBC micro:bits and MakeCode Editor websites
Range of fabric swatches, roll of fluorescent fabrics, reflective tape, range of fixings and fastenings (see Year 4 Block C), basic sewing equipment

Health and Safety:

This block requires pupils to use: basic sewing equipment. Teachers should ensure that they follow their own school's risk assessments and policies for using the necessary materials and equipment. Pupils should be taught about how to use equipment and materials safely and responsibly as part of these lessons.

Working as a Designer

Design	Make	Evaluate	Apply
The art or process of deciding how something will look or work.	Create something by combining materials or putting parts together.	Form an opinion of the value or quality of something after careful thought.	Use something or make something work in a particular situation.

Product Design Brief

Road safety has become a leading issue for young people in the UK. With more cars on the road and more children walking to school, it is essential for us to find innovative solutions to help keep people safe. One of the most important things that we can do as pedestrians is to make sure that we are clearly visible to cars and other vehicles, in any weather and at any time of the day. But school uniforms aren't always easy to spot, particularly early in the morning or late in the evening.

There are a number of products available on the market that help in some regards: high-visibility vests, reflective patches on bags and key rings with a flashing light. However, we'd like to challenge you to combine these elements to create a new all-in-one road safety belt. Your design must fulfil the brief below.

Your all-in-one road safety belt must:

- ❑ be clearly seen in the day
- ❑ be clearly seen at night
- ❑ use at least two types of fabric or material
- ❑ be easy to attach over school uniform, using at least one fastening
- ❑ stay securely on while walking, cycling or scooting
- ❑ draw attention to the wearer
- ❑ be weatherproof, including against wind and rain
- ❑ have one feature that automatically activates if the light fades.

Night sensor algorithm examples for a micro:bit

Simple night sensor algorithm:

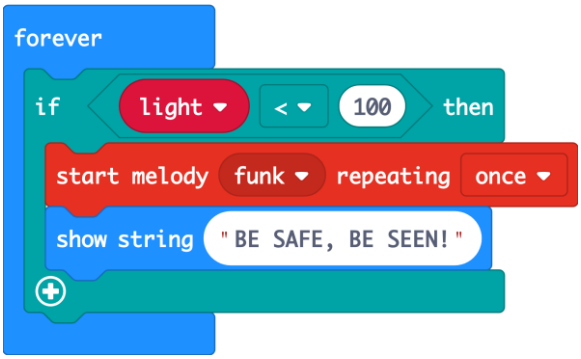
- START
- INPUT sense darkness level
  - ➢ IF dark then
    - ○ OUTPUT musical audio for 5 seconds
    - ○ OUTPUT visual display 'Look out!'
    - ○ STOP
  - ➢ ELSE, REPEAT

Night sensor with stop-start buttons algorithm:

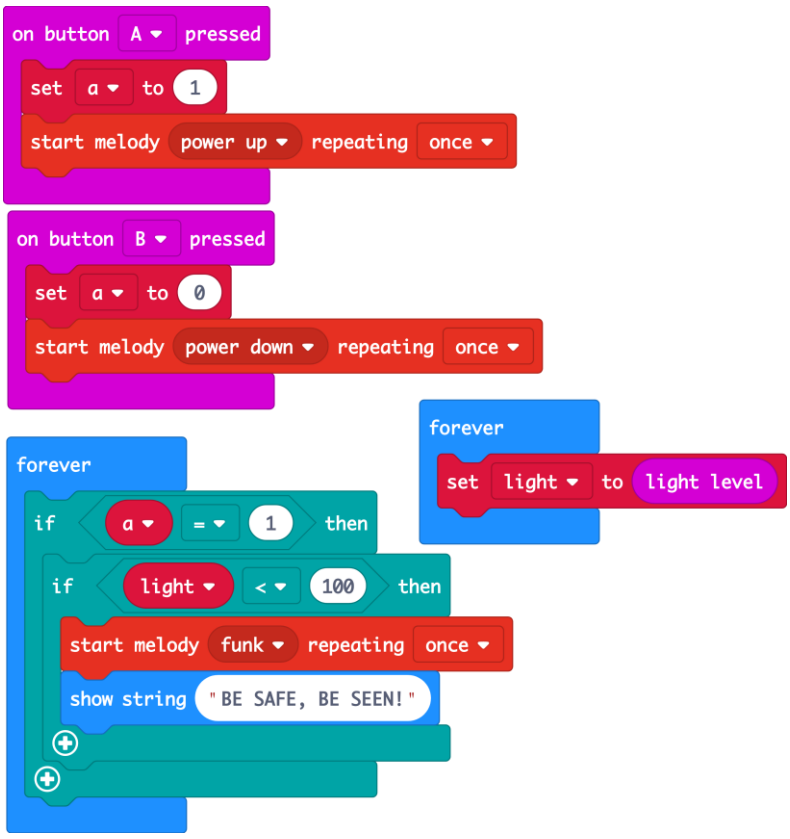
- When START button pressed
  - ➢ OUTPUT 'on' audio sound
  - ➢ INPUT sense IF dark
    - ○ IF dark then
      - ❖ OUTPUT musical audio for 5 seconds
      - ❖ OUTPUT visual display 'Look out!'
    - ○ ELSE, do nothing
- When STOP button pressed
  - ➢ OUTPUT 'off' sound
  - ➢ STOP

Night sensor program examples for a micro:bit

Simple night sensor program:



Night sensor with stop-start buttons:



Point of explanation:
Y5 Systems – Block B

Core Knowledge	Explanation
properties	Properties are the qualities or characteristics that a material has, such as flexibility, elasticity, etc.
fastener	A fastener is a button, zip or other device used for temporarily joining together the parts of items such as clothes.
algorithm	An algorithm is a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

Technical Vocabulary	Definition
fluorescent	appearing very bright when light shines on it; that can be seen in the dark
reflective	capable of throwing back light, heat or sound from a surface
attachment point	the point at which one thing joins to another
debug	to look for and remove faults in a computer program
programming	writing and testing computer programs

Link to Video: https://vimeo.com/742588097/da671e9c77

- Explanation and demonstration of taught content
- Lesson by lesson guidance
- Exemplification of techniques and outcomes

Point of delivery:
Y5 Systems – Block B

Revisiting prior learning	Taught content	Point of practice	Point of reflection
1. Revisit properties of materials, such as water resistance, flexibility, durability, etc.	Understand the importance of road safety Select materials based on their properties Combine materials to fulfil a design brief	Introduce pupils to the *Be Safe, Be Seen* campaign (this could be tied in with National Road Safety Week 16 – 21 November 2022). Explore the problem of road safety and the associated challenges of this, particularly in the autumn and winter. Show pupils images of high-visibility vests / belts, bike reflectors and small flashing lights. Discuss how these can help keep children safe on the road in the daytime and at night. Pose the key question for this block: **How can we keep ourselves safe on the roads?** Explain that pupils are going to design a belt that combines three elements: high-visibility, reflectors and an aspect of technology. Share and discuss the requirements set out in the design brief. Introduce the Knowledge Note and teach the words *fluorescent* and *reflective* using the first vocabulary task. Discuss the properties that this product would need to have, encouraging pupils to use technical language to explain their thinking. Give pupils a range of fabric swatches to examine. Ask them to evaluate their suitability for the base fabric of their product. Explore the principle of combining fluorescent and reflective fabrics (e.g. to be seen in the daytime and at night). Share images of different configurations of high-visibility clothing (e.g. vest, belt, rucksack cover, full jacket, hat, etc.). Discuss the benefits and merits of these. Give pupils time to work in pairs or groups of three to develop their belt design, explaining how it meets each element of the design brief. Encourage pupils to generate and develop ideas, modelling each stage of the design process and posing the question 'What if …?' to prompt their thinking.	Can identify specific properties of materials and describe them using appropriate technical language Can develop a design to a specific brief, giving and responding to feedback

Questions for assessment

What do the words *durable*, *flexible* and *water-resistant* mean?

Why is *reflective* material suitable for clothing designed to be worn at night?

What does the word *fluorescent* mean?

Which materials are most visible during the day / at night?

Why is *durability* and *flexibility* important?

Point of delivery:
Y5 Systems – Block B

Revisiting prior learning	Taught content	Point of practice	Point of reflection
2. Revisit different types of fastening (Year 4 Block C), such as zips, buttons, hook and loop, press studs, buckles, etc.	Different fastenings are appropriate for different purposes Measure and cut a paper template Apply basic stitching skills Explain how a product meets a design brief	Return to the design problem: **How can we keep ourselves safe on the road?** Revisit pupils' designs from Lesson 1. Model how to make a basic paper template for their product. This should include taking simple measurements and drawing these out. (One possible starting point for this is to ask a pupil to stand in front of a whiteboard so that you can draw around their torso.) Give pupils time to make their own paper templates and then cut out the component fabric pieces for their design. Ask pupils to identify positions where they will need to fix this (either to itself or to the wearer). Revisit examples of the fixings and fastenings that pupils learnt about in Year 4 Block C. Encourage pupils to discuss a range of fastening mechanisms and their potential uses. Discuss the need for ease of attachment. Ask pupils to identify attachment points for their products and suggest a type of fastener, explaining which fastening they have chosen and why. Once pupils have the component parts and any fastenings that they have chosen, remind them of the basic stitches that they have learnt and give them time to stitch the parts together to form their belt. Pupils may choose to stitch or tape the reflective elements to their design. Revisit the design brief and ask pupils to evaluate their product against the criteria listed. Which elements do their belts now meet? Which elements have not yet been met? Encourage pupils to reflect on how close their product is to their own original design and if any changes were made, why they were made.	Can accurately measure and cut fabric using a paper template Can use basic stitching confidently to join pieces of fabric Can select and attach an appropriate fastening for a purpose

Questions for assessment

What is a template? **Why** is a template necessary?

How did you decide on the attachment points for your belt?

Which type of fastener did you select and **why**?

Why is ease of attachment important?

Which reflective elements have you included?
How are these attached to the main garment?

How close is your product to the original design?
What changes did you have to make and **why**?

Point of delivery:
Y5 Systems – Block B

Revisiting prior learning	Taught content	Point of practice	Point of reflection
3. Revisit micro:bit basics, such as input, output, simple coding and programming and the MakeCode function. ***Note for teachers:*** *this lesson includes the use of micro:bits. If schools are not following the suggested Computing curriculum in the CUSP long-term sequence, they may choose to use an alternative programming tool.* *For schools that are not yet using micro:bits as part of their Computing curriculum, more information can be found here:* Introduction | micro:bit (microbit.org) Microsoft MakeCode for micro:bit (microbit.org)	Technology can be used to control, program and monitor products Develop an algorithm Write and test a simple program using coding knowledge Evaluate a product against a design brief	Revisit the design brief. Explore the increased risk on roads if it is dark or becoming dark. Show pupils an example of a bicycle light with different speed settings and colours for its flash. Ask pupils why this is important (to attract attention and to differentiate a person from a car or other vehicle). Pose the question: **How can technology help us to draw attention to ourselves on the roads?** Ask pupils to generate ideas using technology that they are familiar with. Give pupils a micro:bit (pupils following the CUSP sequence may have met this in Computing in the Autumn term) and ask them how this could help solve the problem. Revisit the MakeCode Editor and model using iteration, selection and variables, as appropriate to the experience of the class. Introduce pupils to the night sensor program and give them time to explore this. Discuss how this could be useful, particularly for those pupils who have a visual or hearing impairment. Give pupils time to write a pseudocode algorithm for a night sensor program in their pairs / groups. Ask them to test and debug their algorithm, noting any changes that they have made. (See examples in the teacher notes.) Give pupils time to develop their night sensor programs. This can include flashing lights, sounds or messages (e.g. Be Safe, Be Seen!). Remind pupils to test and debug their program before downloading it to their micro:bit. Agree how the micro:bit will be attached to their design (this could include by using clips, transparent pockets or hanging loops) and give pupils time to assemble the final part of their design. Pupils should work in groups to present their design to the class, explaining their design choices and taking feedback. Use the second vocabulary task to support this.	Can use their knowledge of computing to control a product they have designed Can present a design prototype, explaining how it works and how it fulfils a brief

Questions for assessment

What is an *algorithm*?

What does *debug* mean?

What does *programming* mean?

How does your night sensor program work?
How does the micro:bit attach to the main garment?

How does your garment draw attention to the wearer? (lights, sound, messages) Explain the choices you have made.

Oracy and Vocabulary: Y5 Systems – Block B

Task 1: Use a thesaurus or dictionary to help you sort these words according to whether they are connected with the word *fluorescent* or *reflective*.

rebound return luminous incandescent phosphorescent radiant illuminated reverberate echo	fluorescent 	reflective 

Exploration:

The word *reflective* refers to the property of a material that allows it to throw back light.

1. Is this an accurate definition of the word *reflective*?
2. Could you improve on this definition?
3. Share your definition with a partner.

Task 2: Present your road safety prototype to the class.
Use these prompts and questions to help you structure your presentation.
Make sure everyone in your group has a role and gets the opportunity to speak.

Demonstrate and describe your prototype.	**Consider these questions in your presentation.** • Which fastenings did you use and why? • Are the fastenings secure? Are they durable? • Which combination of fabrics did you use and why? • Are the materials you have chosen durable, flexible, weatherproof? • Is the product easy to attach and comfortable to wear?
Explain how your product makes the wearer visible at night.	• How does your night sensor program work? • How does it draw attention to the wearer? • How is it attached to the main product?
Explain how your design fulfils the specifications of the brief.	• Are there any aspects of your product that do not fulfil the brief? What could be done about this? • Which aspects of your product are you most satisfied with and why?
Explain what makes your product unique and how the design could be further enhanced.	

Vocabulary: Y5 Systems – Block B

OWN-it — Analyse

Write the root of *reflective*.

_____

Change this noun to a verb.

attachment

_____

Tick the correct meaning of the prefix *de–* in the word *debug*.

- ❑ do the opposite
- ❑ repeat
- ❑ add

KNOW-it — Define

Write two words that mean the opposite of *fasten*.

_____

_____

True or false?

Reflective means the same as *fluorescent*.

true ☐ false ☐

Write a definition of the word *algorithm*.

LINK-it — Connect

Write a word is derived from the word *idle*.

Write two words associated with the word *fluorescent*.

Tick the synonyms of the word *reflect*.

return receive rebound

USE-it — Use in context

Write two different meanings of the word *programming*.

1. _____
2. _____

Use the word *properties* in a sentence.

Tick the sentence if the word *fluorescent* has been used correctly. Then, write your own sentence using this word.

- ❑ The *fluorescent* algae could be seen from some distance away.

Knowledge Note:
Y5 Systems – Block B

Year 5: Systems
How can we keep ourselves safe on the road?

Core content:
Design and make a road safety belt.
Fulfil a design brief.
Write a simple program for a micro:bit.

Technical vocabulary:

Properties – qualities or characteristics that something has.

Fastener – a button, zip or other device used for temporarily joining together parts of items.

Algorithm – a process or set of rules to be followed in operations, especially by a computer.

Fluorescent – appearing very bright and can be seen in the dark.

Reflective – capable of throwing back light, heat or sound from a surface.

Attachment point – the point which one thing joins to another.

Debug – to look for and remove faults in a computer program.

Programming – writing and testing computer programs.

Connections:

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bike light projector

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