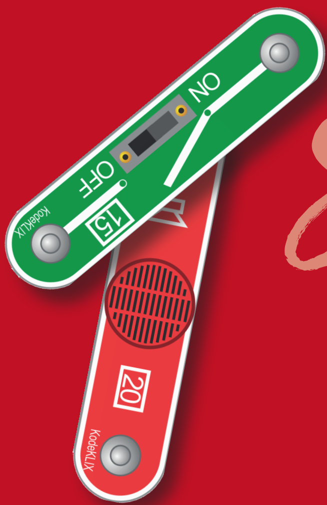
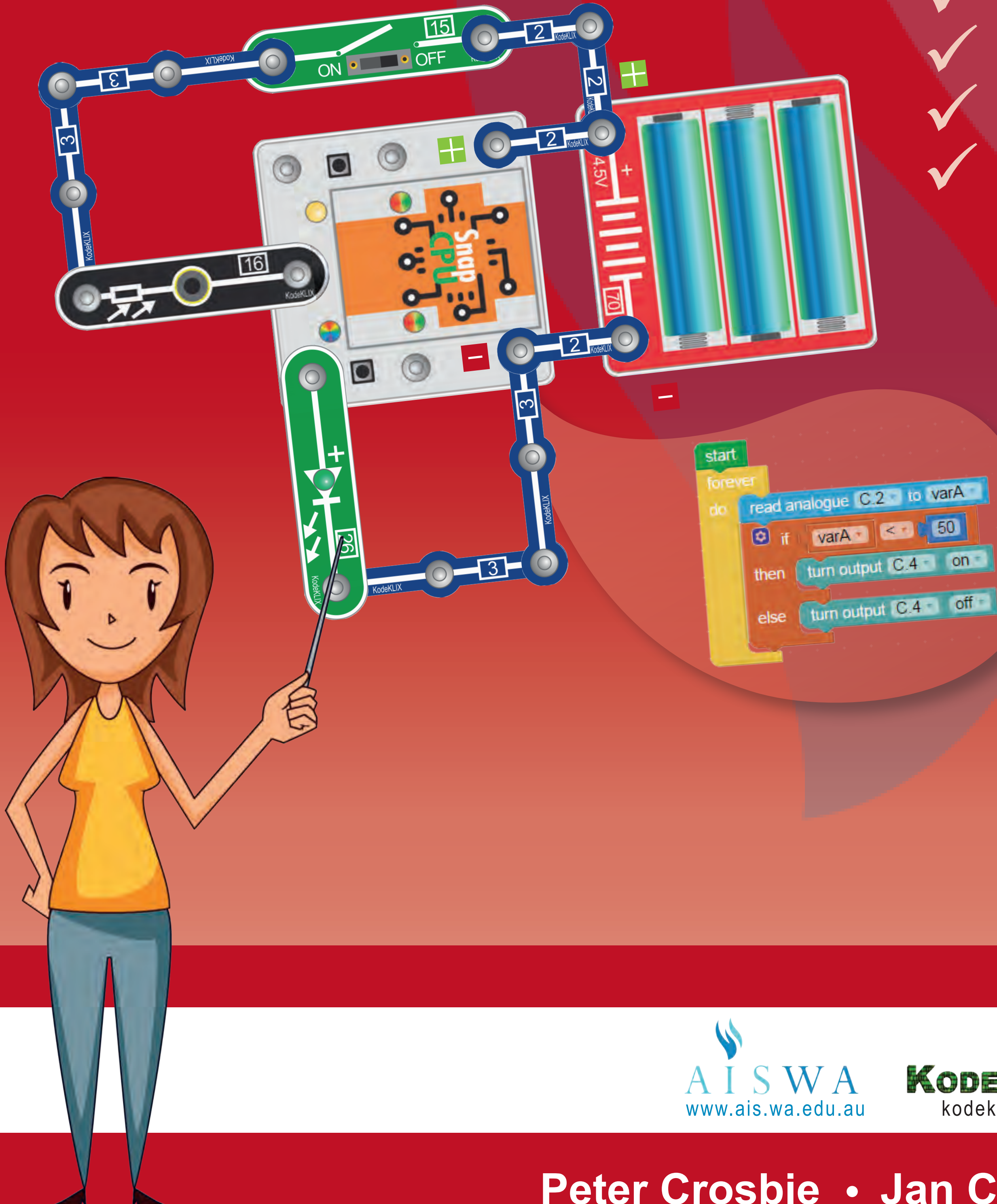
TEACHER RESOURCES

STEM in Practice

with KodeKLIX®



- ✓ Define
- ✓ Plan
- ✓ Model
- ✓ Test
- ✓ Reflect
- ✓ Improve



AISWA www.ais.wa.edu.au

KodeKLIX kodeklix.com

Peter Crosbie • Jan Clarke

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SECTION 1: TEACHER RESOURCES FOR STEM IN PRACTICE

Manage it! Pedagogy, curriculum and practical ideas for classroom management

ONLINE RESOURCES

Sample resources, the certificate and interactive resource documents can be downloaded from:
https://www.ais.wa.edu.au/stem-practice

Copies of the printed resources
http://store.ais.wa.edu.au/

Materials specific to the KodeKLIX® STEM kits can be downloaded at this link
http://www.kodeklix.com/snapcpu4stem.html

Order KodeKLIX® STEM kits
http://www.kodeklix.com/shop.html

A PRODUCTIVE COLLABORATION

*The **STEM in Practice*** materials are the result of a productive industry-education collaboration between the Association of Independent Schools of Western Australia (***AISWA***) and ***KodeKLIX®***. Combining the resources of ***Australian engineering and education professionals***, the electronics kits and teaching materials have been specifically designed for Years 4-7 to enhance learning (by both students and teachers) in Science, Technologies, Engineering and Mathematics.

They support:

- student engagement with STEM subjects;
- differentiation, through a variety of activities;
- promotion of iSTEM (integrated STEM);
- awareness of computational, systems, design and futures thinking;
- student collaboration;
- developing project management skills;
- growth of problem solving strategies, building curiosity, resilience and persistence;
- quality teaching in physical science, systems technologies and computer science; and
- activities that promote general capabilities.

The collaborative project grew from a shared belief that primary school aged students would significantly benefit from knowing more about how their ***designed and built environment*** works, particularly in a digital, electronics-centric world. The recognisable needs and interests of the generation – as well as the curriculum demands – were a catalyst. The intention was to support Year 4-7 teachers with useful background information, hands-on experience and class-ready materials, with a view to help them introduce less familiar science and technologies topics to their students.

Making the activities manageable, and the materials affordable, were conscious decisions by AISWA and KodeKLIX®.

STEM and iSTEM EDUCATION

The Australian national agenda reflects global trends by encouraging innovation that will improve STEM education and STEM initiatives in commerce and industry. This collaboration sought to address both.

There are various definitions of STEM education.

The STEM in Practice materials support the provision of integrated STEM, or iSTEM. Topics or projects that integrate curriculum content from various subjects have long been commonplace in primary schools. If students are learning in engaging contexts with meaningful narratives and exciting goals or elements of curiosity and adventure, then they have more fun and make more connections – both personal and conceptual – while learning. The investment of extra time and energy into planning and organisation for such positive outcomes is always considered worthwhile by teachers. This was our philosophy too.

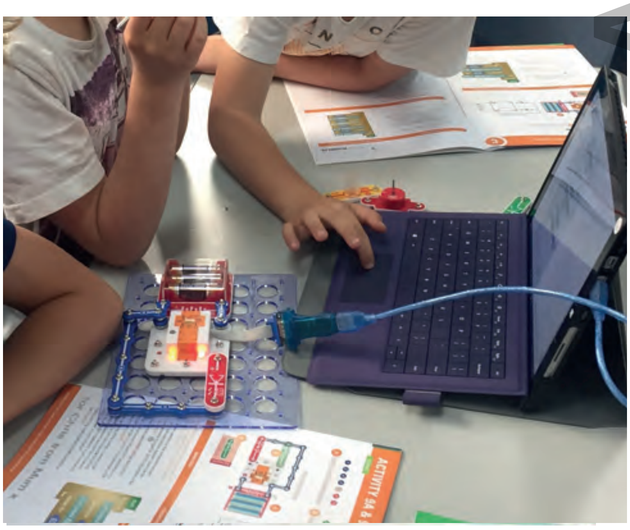
In the STEM in Practice curriculum mapping documents, the following subject delineations have been used:

S Science

T Technologies (Digital Technologies)

E Engineering (Design & Technologies)

M Mathematics



The materials have a ***strong Technologies focus***.

The various materials are designed to support investigative work, collaborative learning and the kinds of thinking required in Technologies, being:

- systems thinking;
- design thinking;
- computational thinking; and
- futures thinking.

Ideally student materials would be used for pair work, ***engaging students in collaboration***.

A STEM in Practice class set includes:

KodeKLIX materials

- KodeKLIX® STEM CORE KIT
  for use 1:2 students, basic components
  CPU and download cable provided
  use with Blockly+KK app

- KodeKLIX® TEACHER CORE KIT
  a STEM Core Kit for teacher use

- KodeKLIX® EXTENSION KIT
  more advanced components,

- KodeKLIX® SPARES KIT
  the most common parts for replacement

AISWA print materials

- TEACHER RESOURCE BOOK
  support materials, curriculum mapping

- STUDENT ACTIVITY BOOK
  core electronics and coding activities

- STUDENT STEM WORKBOOK
  designed to be consumable, 1:1
  complements core activities
  reinforces learning and reflection

- EXTENSION ACTIVITY BOOK
  investigations using extension kit parts
  use for able students
  1:4 (for half the class number)

As an integrated learning system, the materials could be easily used in educationally rich and rewarding ways.

See the example on the following page.

The following pages provide an overview of the alignment of the ***STEM in Practice*** materials with Western Australian STEM subject curriculum for Years 4-7. The strongest alignment is found in Year 6, where 'electricity' is a physical science topic supported by the engineering context of 'electrical energy and forces' in Design and Technologies. However, significant alignment is obvious at all year levels. Digital Technologies and the Design and Technologies contexts of materials and electronics engineering have ubiquitous application, especially when students engage with prototyping project work. Additionally, the capabilities of literacy, numeracy, critical and creative thinking and interpersonal skills are very well represented throughout.

Notes (in colour) have been added to the curriculum overviews to reference some extra links, content and contexts.

🟢 Year 4
🟡 Year 5
🔴 Year 6
🔵 Year 7
⊕ Year 7-10

STEM subject curriculum alignment

		S			T			E				M			
		SCIENCE			DIGITAL TECHNOLOGIES			DESIGN AND TECHNOLOGIES				MATHEMATICS			CC
	STRANDS →	HE	SU	SIS	KU	PPS	TP	Soc	Eng	Mat	TP	NA	MG	SP	X
CORE ACTIVITY BOOK and STUDENT STEM WORKBOOK															
CORE COMPONENTS															
1a	Materials, equipment and safety with electricity	🟢	🟢 ⊕	Experimenting with physical science and properties of materials in an Engineering investigation context rather than controlled experiments.			The TechPro-related skills most used would be investigation, implementation and evaluation as students test coding in given models.	🔴🔵		🟢🟡 🔴🔵	The TechPro-related skills most used would be investigation, implementation and evaluation as students engineer and test electronics models.	🟡	🟢🟡	🔴	
1b	Conductors, insulators and resistance	🟢🟡 🔴🔵	🔴🔵		🟢🟡 🔴🔵			🟢🟡 🔴🔵	🟢 🔴	🟢🟡 🔴🔵		🟢 🔵	🟢🟡 🔴	🟢🟡 🔴🔵	
2a, 2b	Blockly app, coding and computational thinking				🟢🟡 🔴🔵	🟢🟡 🔴		🟡 🔴				🟢 🔵	🟢🟡	🟢 🔴	Games
3a	Inputs for controlling circuits	🟢🟡	🟢🟡 🔴		🔴			🟢🟡	🟢🟡 🔴🔵	🟢🟡 🔴🔵			🟡 🔴	🔴	
3b, 3c, 3d	Coding to control inputs	🟢🟡 🔴	🟡 🔴		🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴	🟢🟡 🔴🔵	🟡 🔵		🟢 🔴🔵	🟢🟡 🔴🔵	🟢🟡 🔴	HASS
4a	Outputs in a circuit	🟢🟡 🔴	🟢🟡 🔴⊕					🟢	🟢🟡 🔴🔵	🟢 🔴🔵			🟡 🔴	🔴	
4b, 4c	Coding to control outputs	🟢🟡 🔴	🟢🟡 🔴		🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴	🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢 🔴🔵	🟢🟡 🔴	🟢 🔴	
5a	Circuits in series	🟢🟡 🔴	🟢🟡 🔴⊕					🟢🟡 🔴	🟢🟡 🔴🔵	🟢🟡 🔵		🟢🟡 🔴	🟡	🟡 🔴	
5b	Circuits in parallel	🟢🟡 🔴	🟢🟡 🔴⊕					🔴	🟢🟡 🔴🔵	🟢🟡 🔴🔵			🟡	🔴	Reading Comp'n
SENSORS															
6a	Heat sensing circuit	🟢🟡 🔴	🟢 🔴⊕	Significant opportunities for collecting and analysing data.	🟢🟡 🔴🔵		Significant opportunities for collecting and analysing data.	🟢🟡 🔴	🟢 🔴🔵	🟢 🔴🔵	Opportunities for investigating semiconductor material.		🟢🟡	🟢🟡 🔴	
6b	Coding a heat sensing circuit	🟢🟡 🔴	🔴⊕		🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟡 🔴🔵	🟢🟡	🟢🟡 🔴🔵	Reading Comp'n
7a, 7b	Light sensing circuits	🟢 🔴	🟡 🔴⊕		🟡 🔴🔵	🟡 🔴		🟢🟡 🔴	🟢🟡 🔴	🟢🟡 🔴🔵		🟢	🟢🟡	🟢 🔴	
7c, 7d	Coding a light sensing circuit	🟢🟡 🔴	🟡 🔴⊕		🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴	🟢🟡 🔴🔵		🟢 🔴🔵	🟢🟡	🟢🟡 🔴🔵	
ADVANCED															
8a, 8b, 8c	Sound/music coding circuit	🟢🟡 🔴	🔴⊕	SCIENTIFIC INQUIRY	🟢🟡 🔴🔵	🟢🟡 🔴🔵	TECHNOLOGY PROCESS	🟢🟡 🔴	🟢🟡 🔴	🟢🟡 🔴🔵	TECHNOLOGY PROCESS	🟢🟡 🔴🔵	🟢🟡 🔵	🟢🟡 🔴🔵	Music
9a, 9b, 9c	Controlling a servo motor	🟢🟡 🔴	🟢 🔴⊕		🟢🟡 🔴	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢 🔵	🟢🟡 🔵	🟢 🔴🔵	
GLOSSARY															
Terms	Engineering, science, CT, coding, systems, design, futures, mathematics	🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴🔵	🟢🟡 🔴🔵		🟢🟡 🔴🔵	🟢🟡 🔴🔵	🟢🟡 🔴🔵	

HE- Human Endeavour, SU – Science Understanding, SIS – Science Inquiry Skills, KU – Knowledge & Understanding, PPS – Processes & Production Skills, TP – Technology Process, Soc - Technologies in Society, Eng – Engineering, Mat – Materials Specialisations, NA – Number & Algebra, MG – Measurement & Geometry, SP - Statistics & Probability, CCX – Cross-curricular, CT – Computational Thinking

S-SCIENCE	Year 6
Science as a human endeavour	
Nature and development of science	Science involves testing predictions by **gathering data** and **using evidence** to develop **explanations** of events and phenomena and reflects **historical and cultural contributions**. * level of scientific understanding impacts on explanations about events
Use and influence of science	**Scientific knowledge** is used to solve problems and **inform decisions** (personal and community). * having knowledge of the science behind how things in the community work
Science understanding	
Physical sciences content (with relevant elaborations)	**Electrical energy** can be **transferred and transformed** in electrical **circuits** and generated from a range of sources. • recognising a complete circuit allows the flow of electricity • investigating different electrical conductors and insulators • exploring features of electrical devices (e.g. switches, light globes) * conversion of energy from one form to another, types of energy, measurement of electrical energy and resistance, components, types of circuits, potential, current, transistors, resistors, sensors, etc.
Science inquiry skills	
Questioning and predicting	With guidance, pose **clarifying questions** and **make predictions** about scientific investigations. * using logical thinking, investigating problems
Planning and conducting	**Identify, plan and apply** the elements of scientific investigations to answer questions and solve problems **using equipment and materials** safely and identifying **potential risks**. *using logical thinking, knowing materials Decide **variables** to be changed and measured in fair tests, and observe, measure and record data with accuracy using digital technologies as appropriate. * aligns with concepts of using variables in coding
Processing and analysing data and information	Construct and use a range of **representations, including tables and graphs**, to represent and describe observations, **patterns or relationships in data** using **digital technologies** as appropriate. **Compare data with predictions**; use as evidence in developing explanations.
Evaluating	Reflect on and **suggest improvements** to scientific investigations. * aligns with debugging and the evaluation stage of the Tech Process
Communicating	**Communicate** ideas, explanations and **processes** using scientific representations in a variety of ways, including multi-modal texts.

T-DIGITECH	Year 6
Knowledge and understanding	
Digital systems	Digital **systems have components** with basic **functions** and **interactions** that may be connected together to form **networks** that transmit different **types of data**.
Representations of data	Whole **numbers are used to represent data** in a digital system. * binary counting activities, data streams, variables, analogue sensors and real-time data
Processes and production skills	
Collect, manage and analyse data	Collect, sort, interpret and **visually present** different types of data using software to **manipulate data** for a range of purposes.
Digital implementation	Design, modify, follow and represent both diagrammatically, and in written text, simple **algorithms** (sequence of steps) involving **branching** (decisions) and **iteration** (repetition). * including flowcharts and process diagrams Implement and use **simple visual programming** environments that include **branching** (decisions), **iteration** (repetition) and **user input**. * count blocks, repeated loops, modules and procedure, sensors to input data to the system, nested loops, conditional statements Manage the **creation and communication of information**, including online **collaborative projects**, using agreed social, ethical and technical protocols.
Using the Technology Process, students create solutions to problems through activities and experiences that guide them to…	
Investigating and defining	Define a problem and a set of **sequenced steps**; users make decisions to **create a solution** for a given task. **Identify resources** available.
Designing	Design, modify, follow and represent, both diagrammatically, and in written text, **alternative solutions** using a **range of techniques**, appropriate **technical terms** and technologies.
Producing and implementing	Select and apply **safe** procedures when using a variety of **components and equipment** to make solutions.
Evaluating	Develop collaborative **criteria to evaluate** and **justify design processes** and solutions.
Collaborating and managing	Work collaboratively, considering resources and safety to **plan, publish** and **manage projects**, including sequenced steps.

Have a comprehensive discussion about safety.

Please begin by having a discussion with the class about SAFETY and electricity.

Perhaps undertaking the first Activity as a whole class would be a time to have these important conversations. This is, quite simply, ‘duty of care’. The KIT IS ABSOLUTELY SAFE and has been designed for use by children. However, as students explore the world of electronics and electricity in class they will start exploring it in the real world too!

Help students work to capacity

With the younger students, we would not expect that they undertake ALL of the activities in the Core Activity book or the Student STEM Workbook, nor do so independently. Many of the activities lend themselves to class discussions or focused lessons in their own right. The reading difficulty is appropriate but abilities vary and so do confidence and the ability to self-manage. Able students enjoy the independence of working at their own pace and sorting out their own problems.

Expand It! (Part 2 of this teacher resource book) contains activities for enrichment and extension. Teachers in the trial found that students enjoyed working with materials from this section if they finished their other work ahead of the rest of the class and had some spare time or an interest in exploring other contexts. These may be good activities to use in other cross-curricular ways, like comprehension activities, vocabulary puzzles, cultural investigations, applied geography skills or insights into history.

Teachers who work with digital technologies often find it is prudent to have a ‘plan B’. These materials could serve as useful as sets of ‘unplugged’ reserve materials.

The Extension Activities (circuit building) book is full of more advanced, interesting electronics projects. The parts required are found in the KodeKLIX® extension kit. Not all students will have the capacity to use these extension kits and their more sophisticated electronics components and coding activities, but they will be an added bonus to engage the students who have a natural inclination for the subject.

Expect students to take responsibility.

Expect that students learn to care for the materials and use them purposefully. Make the development of project-management skills and practices part of explicit teaching. Assist the students to develop a method for auditing their kit contents on a regular basis – a way of ‘counting in and counting out’ the parts and documenting and replacing broken or lost components. Technologies is one of the few subjects

Examples of the variety of activities in the Expand IT! Section.

USE MATHS for SAFETY AWARENESS

3. Use mental maths ESTIMATION skills to find the numbers that make the sentences **true**.
Use a maths strategy your teacher has shown you.
CIRCLE them.

House power is very dangerous if you are not an electrician! It is a lot stronger than batteries.

In Australia, house power is about **2.4** **24** **240** **24000** volts.

An AA battery pushes out **1.5v** of power.

House power is about **10x** **100x** **150x** **500x** **1000 x** more powerful than the AA cell.

A MOTORBIKE battery generates **6v** of power. A CAR battery generates **12v** of power.
A TRUCK battery generates **24v** of power.

A CAR battery makes ⅙ ¼ ⅓ ½ as much power as a TRUCK battery

A MOTORBIKE battery makes ⅙ ¼ ⅓ ½ as much power as a TRUCK battery.

A TRUCK battery makes **1/10** **1/100** **1/1000** **1/10000** as much as HOUSE power.

Insulated safety clothing

Information from: www.mybootprint.com (SteelBlue boots)

Sparkie says:

This SYMBOL is used on safety boots for ELECTRICIANS and LINESMEN (people who work on power lines). It shows that the soles give electrical protection.

The rubber soles will resists the current and the electricity will not be able to follow the path through the person's body to the ground. It cannot complete the circuit.

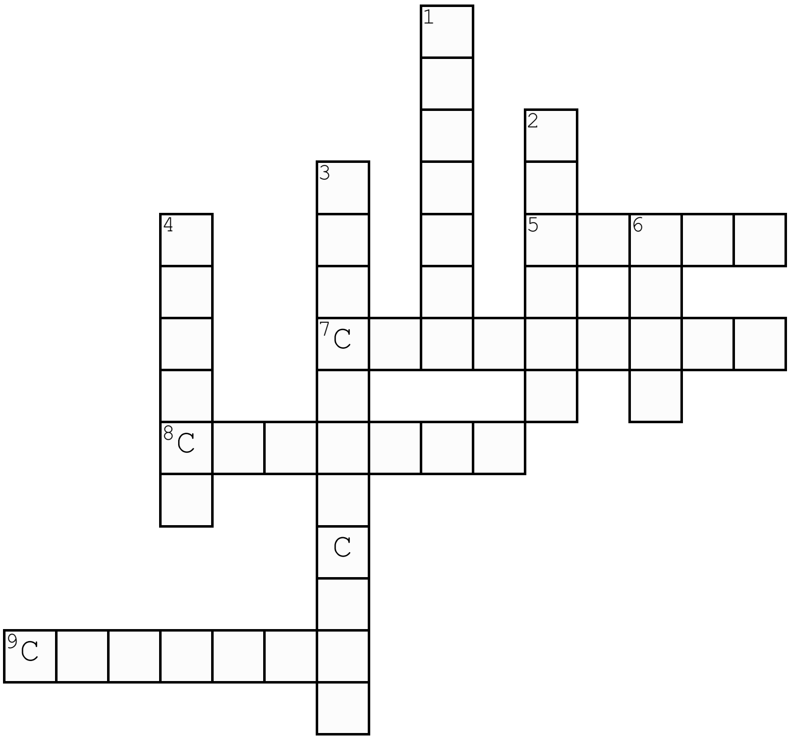
The boots have been designed and tested to withstand 18,000v for 1 minute with NO current flow in dry test conditions! Wow!

Read the text information.

4. Why do you think that symbol was chosen?____

5. What might happen AFTER 1 minute? ____

1. SOLVE the word puzzle about **inputs**.



Created with TheTeachersCorner.net Crossword Puzzle Generator

ACROSS:
5. the surname of the man who invented a code that works by switching current on and off (to make sounds or flash lights)
7. the name for any part that is part of a circuit
8. the name for the 'flow of electricity'
9. the 'circle pathway' for electricity

DOWN:
1. a special type of picture that uses symbols. Engineers, scientists and mathematicians use them.
2. a very simple little picture that shows a main idea about something
3. the kind of energy made when electrons are quickly flowing
4. an input component that can stop or start the flow of electricity
6. the type of switch controlled by a magnet

ASCII Code: Changing keyboard characters to binary code

A	0100	0001	a	0110	0001
B	0100	0010	b	0110	0010
C	0100	0011	c	0110	0011
D	0100	0100	d	0110	0100
E	0100	0101	e	0110	0101
F	0100	0110	f	0110	0110
G	0100	0111	g	0110	0111
H	0100	1000	h	0110	1000
I	0100	1001	i	0110	1001
J	0100	1010	j	0110	1010
K	0100	1011	k	0110	1011
L	0100	1100	l	0110	1100
M	0100	1101	m	0110	1101
N	0100	1110	n	0110	1110
O	0100	1111	o	0110	1111
P	0101	0000	p	0111	0000
Q	0101	0001	q	0111	0001
R	0101	0010	r	0111	0010
S	0101	0011	s	0111	0011
T	0101	0100	t	0111	0100
U	0101	0101	u	0111	0101
V	0101	0110	v	0111	0110
W	0101	0111	w	0111	0111
X	0101	1000	x	0111	1000
Y	0101	1001	y	0111	1001
Z	0101	1010	z	0111	1010

ASCII – the code of keyboard input.

2. WRITE your name in **ASCII.**

Each keyboard **key** has its own **8-bit binary code** (as 0s and 1s). It's called ASCII.

When a person presses the keys to input data, the code from every key press is added to the computer's memory.

Usually it immediately shows on the screen as **pixels** of printed data. Then it can be used in other ways and probably changed to some other form of data, such as printed out on paper.

Imagine how hard a computer works with a person who types fast!

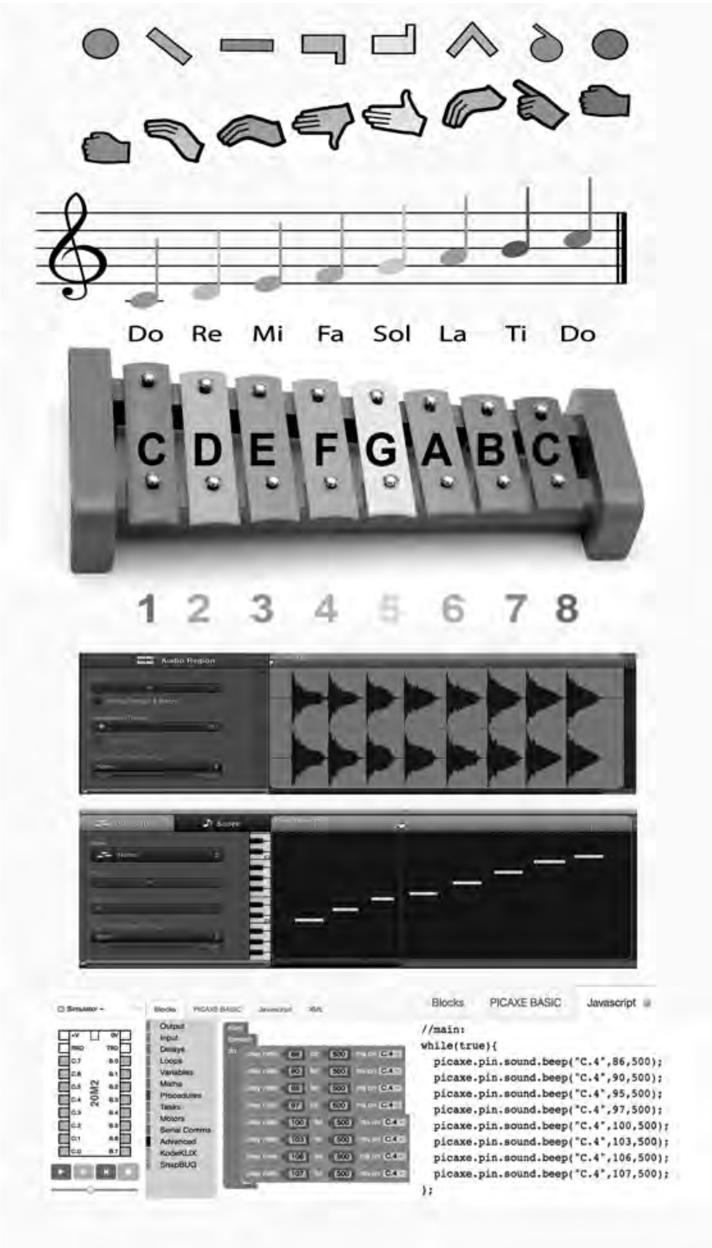
Create a tune by solving a coding problem.

Even if you don't know how to read music or play an instrument you can have a go at making a tune through investigating code and electronics.

Music has many **patterns and rules**, just like STEM subjects and programming languages.

For example, you can code the **frequency** of the note (make the pitch), the **duration** (the length of the note) and the **sequence** of notes. You can code repeated section as **loops**. That's enough to get started.

Really beautiful music needs to have many other qualities that cannot be created with simple electronics but this activity will be good for learning some basics of music and coding.



1. Use a basic circuit that has a Snap CPU, a battery and a **speaker** for outputting the sound.

2. STUDY the picture (left) to see how a music **scale** is represented in these different ways:

   - symbols
   - hand signs
   - notes on staff
   - musician naming
   - letters
   - instrument bars
   - numbers
   - sound waves
   - digital samples
   - code

   They all give the same information if people know how to understand the different codes.

3. Work out which notes on the **staff** (lines with music notes) match with the **note names** (on the xylophone).

   For example, the 2nd note on the staff can be called **D** (its staff name) or **Re** (its sound name) or the numbers **2** (its place in the scale sequence) or **90** (its Snap CPU frequency value).

TEACHER RESOURCE 3

APPLY IT!

Ideas and support materials for extended practical problem solving through prototyping and project work

A

SECTION 3:
PROJECTS CHALLENGES - STEM IN PRACTICE

***A review of the practical, conceptual and collaborative skills** that students use when they problem solve on a technical task is included in the materials, as well as an overview of the 'technology process' (or called the 'engineering design process' when prototyping and modelling is included). The page has been designed with the intention of sharing it with students to develop their understanding of the importance to design, systems and futures thinking.*

***The TechPro black-line masters** (technology process scaffold templates at 3 levels of detail) may be useful for assessments in the Technologies subjects. The completed examples of student work could be shared with students so that they understand what documentation of the process looks like. While 3 options are provided, it may be entirely appropriate to simply cut and paste any of the templates to better suit the needs of a class.*

***The projects** match up with the Core Activities. They are intentionally written as narratives so that students need to unpack the information to find the essence of the design brief and sort out how to decompose the problem. If students have no experience with project work it would be advisable to approach a first attempt as a whole class and model the process.*

PROJECT TITLE: ____________________

I'm working with: ______________________________ *(partner's name)*

Using the Technology Process…

STAGE 1: INVESTIGATE and DEFINE

The problem to solve

____

____

The design brief

What system will you need to make?

____

____

____

The parts of the project

What are the main parts of the project? Who will be in charge of each part?

[____________________] *Name the whole system*

The *(This is made from electronics components)*	The *(This is made from an algorithm of instructions)*	The *(This is the special name for a working model)*

TechPro Designer | GIGAWATT ENGINEERING DESIGN PROCESS GW

PROJECT TITLE: The Safe Chip Chopping Machine

My partner is: Scott M. (by Chris M.)

Using the Technology Process...

STAGE 1: INVESTIGATE and DEFINE

The project challenge

Draw a sketch that describes the problem.
Describe the problem in words.

The factory has a chip chopping machine which is not safe so it needs a warning system when it is going. It goes on and off.

The design brief

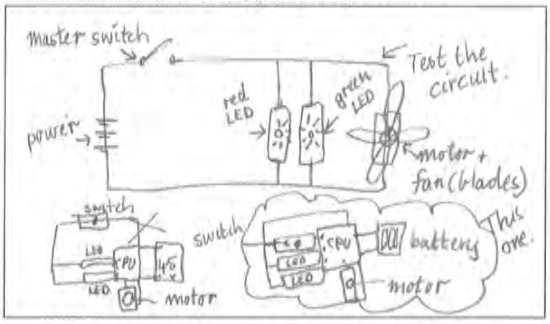
These are the things to think about so you can plan well.

Our aim is to build a... *What is its purpose?*	warning system that will make the machine safer
We are going to... *What is your plan?*	build an automatic control system with warning lights that flash in red and green

STAGE 2: DESIGN

Design for the circuit

Draw the circuit diagram for your first idea. Add any changes in a different colour later.



Design for the code

Sequence the main steps of instructions to control the circuit (the algorithm).
Are there any patterns that can be repeated? Could a loop or procedure be used?

- safety switch on/off ← if switch on
- motor off for 10 secs
- green LED on for 6
- red LED flash for 4
- motor on for 10 secs
- red LED on for 10

REPEATING

REPEAT

then do forever
- turn motor off
- g.LED on, wait 6, off
- r LED on/off. wait 4.
- turn motor on
- red LED on, wait 10, off

maybe procedure

We are building it for... *Who are the users?*	the boss so he is not in trouble for not being a good boss and the workers so they are safer.
They need it because... *What special needs do users have?*	the boss doesn't want to go to jail and the people want to have 2 hands each for ever.
Our timeframe is... *How long do you have to make it?*	5 lessons and we don't want to do homework. But we might need to do some
We know it's good if it... *What main features must it have?*	has lights that go on at the right time which is in time with the motor and it doesn't fall apart
We will share the jobs by... *How will you share the workload?*	Chris will do electronics + model. Scott will do Blockly + model. We will both do our own diary.

Decomposing a big project (problem)

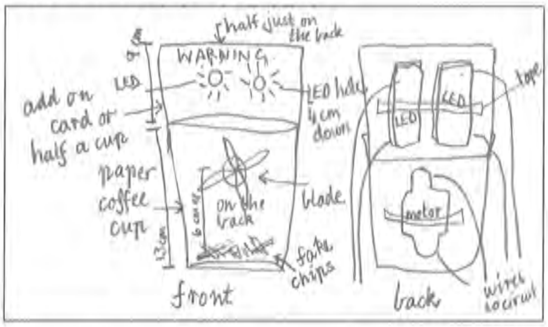
Finish the TREE DIAGRAM to show the parts of the project.

A Chip Machine Warning System

The circuit components	The code algorithm	The prototype model
Build a circuit that... has · red LED - warns · green LED - safe · motor with blade · switch · CPU for code · power	Build an algorithm that... · will turn the motor on + off · will match the LEDs on + off with the motor · keeps repeating	Build a model that... · won't fall apart · looks like a chip chopper · can be connected to the circuit · demonstrates it

Diagram your prototype idea

Show your working model.
Label the materials and show some measurements.



Materials and tools list

List the materials and tools you need to build a prototype (working model).

MATERIALS and TOOLS	
recycled cups (card)	red LED + green LED
~~toilet rolls~~, boxes	motor + fan (blades)
scissors, ~~lacky bands~~	connectors
tape, paper	batteries, CPU
pretend potato chips	slide switch, cables

Safety consideration

Identify any equipment or materials you need to be careful with.

1. careful not to cut wires with the scissors
2. sharp pins for poking things threw
3. eyes if the bits are getting whacked around