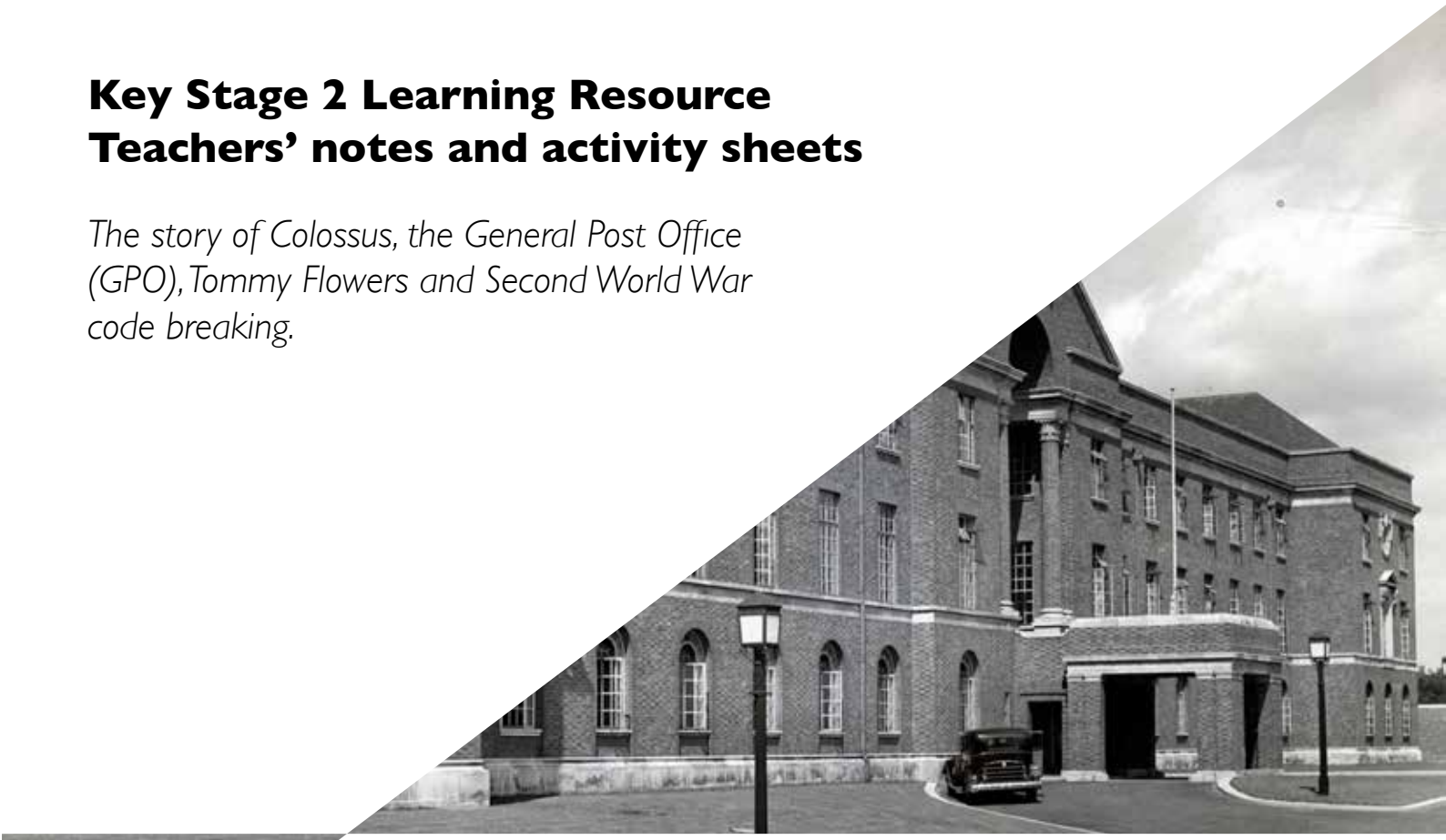
Cracking Code Breakers

Key Stage 2 Learning Resource
Teachers' notes and activity sheets

The story of Colossus, the General Post Office (GPO), Tommy Flowers and Second World War code breaking.



Teachers' notes and activity sheets can be photocopied

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Cracking Code Breakers – Activity Overview

01 – The General Post Office – The Heart of Communication

General Post Office (GPO) engineers worked hard to build Colossus, a code breaking machine in the Second World War. Students work in teams to decide what skills are needed to be an engineer, apply for the job of an engineer and make their own Dollis Hill ID card.

02 – Tommy Who?

CREST SuperStar Challenge

Take inspiration from Tommy Flowers and Colossus to design a new machine to fix a problem. Students will write a class questionnaire and analyse this data to identify a need. They will sketch their design and consider what resources are needed to make their creative idea a reality.

03 – Building Colossus

CREST SuperStar Challenge

Tommy Flowers tore up the original blueprint of Colossus for his team of engineers. Students will work in teams to make a scale drawing from a blueprint. They will investigate maps and plans to discuss why Dollis Hill was chosen as the location for a research station.

04 – Cryptic Messages

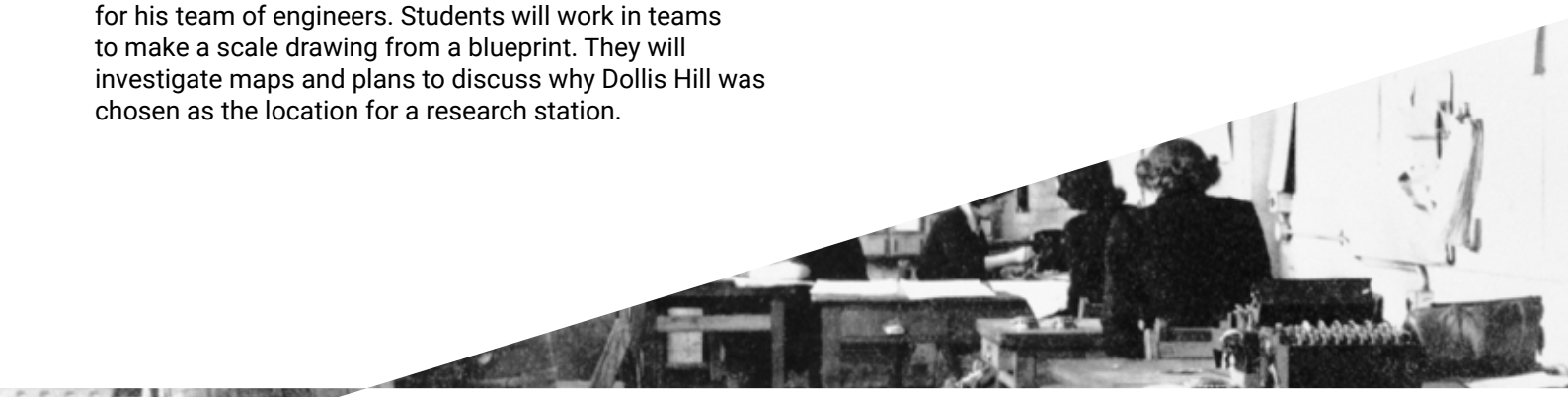
Learn how the Germans used the Lorenz machine (the Tunny) to send secret messages using a binary code and tapes. Students will use a key to create their own binary codes, make a cipher wheel and write a coded message for a partner.

05 – Cracking the Code

Find out how British cryptographers deciphered the German messages. Learn different techniques to decipher code, and translate a message from German. Work as a team, against the clock, to find and decode secret messages in your school.

06 – Digital Security

Digital security is an important issue in today's world. Students will discuss how we can protect our data, investigate what makes a weak or strong password, and use top tips to write a password to protect their rucksack.



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Cracking Code Breakers – Curriculum Links

Teachers' Notes

Cracking Code Breakers KS2 learning resource reveals the lesser known story of Colossus, the General Post Office (GPO), Tommy Flowers and Second World War code breaking in your classroom.

This flexible resource includes six key topics to support teaching across the curriculum with a focus on History, Computing and STEM.

Each topic includes a short film clip, PowerPoint presentation, Teachers' Notes and Student Activity Cards. Activities can be differentiated for Upper KS2 learners aged 9 – 11.

01 – The General Post Office (GPO) - The Heart of Communication (1 - 2 hours)

Curriculum links

- English (Literacy, speaking and listening, role play)
- History (Enquiry, chronological study, local history)
- Art & Design (Drawing)

02 – Tommy Who? (1 - 2 hours)

Curriculum links

- Art and Design (Invent, draw)
- Maths (Data collection, data analysis, graphs)
- English (Presentation, spoken language)

CREST SuperStar Challenge

- This CREST SuperStar activity is accredited by the British Science Association.
- Run the activity and download Cracking Code Breakers CREST SuperStar stickers for your students: www.postalmuseum.org/learning

03 – Building Colossus (1 - 2 hours)

Curriculum links

- Maths (Measurement, estimation, geometry)
- Geography (Human and physical geography, fieldwork)
- Art & Design (Drawing)

CREST SuperStar Challenge

- 'Design a Secret Research Station for your school' is a CREST SuperStar Challenge accredited by the British Science Association.
- Run the activity and download Cracking Code Breakers CREST SuperStar stickers for your students: www.postalmuseum.org/learning

04 – Cryptic Messages (1 - 2 hours)

Curriculum links

- Maths (Binary calculations)
- Computing (Sequence, selection, repetition in programs, logical reasoning)
- Art and Design (Craft)

05 – Cracking the Code (1 - 2 hours)

Curriculum links

- Maths (Code breaking, problem solving)
- Computing (Sequence, selection, repetition in programs, logical reasoning)
- Languages (Written, translation from German)

06 – Digital Security (1 - 2 hours)

Curriculum links

- Maths (Calculations)
- Computing (Digital safeguarding, sequence, selection, repetition in programs, logical reasoning)
- English (Vocabulary)

CREST SuperStar Challenges

Activity 02 and Activity 03 (Design a secret research station for your school) are CREST SuperStar Challenges accredited by the British Science Association.

Run the Challenges and download CREST SuperStar stickers for your students: www.postalmuseum.org/learning

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01 – The General Post Office (GPO) – The Heart of Communication

Teachers' Notes

What does it take to be an engineer?

General Post Office (GPO) engineers worked hard to build Colossus, a code-breaking machine in the Second World War. Students work in teams to decide what skills are needed to be an engineer, apply for the job of an engineer and make their own Dollis Hill ID card.

Background information

- The General Post Office (GPO) employed engineers in the Research Station at Dollis Hill in North London.
- During the Second World War the Germans sent messages using teleprinters. The messages were disguised with codes to keep them top secret.
- Teleprinters used a 5-bit code – 5 "on" and "off" pulses that represented letters and numbers.
- In an effort to win the war, Britain worked hard to intercept secret messages from the Germans.
- In 1940, a new German code was discovered. Tommy Flowers, a GPO engineer, was tasked with building a machine to crack the code.

Historical context

- Over 60 million people died during the Second World War.
- Britain was part of the 'Allies' and Germany was part of the 'Axis'.

Key words

Engineer | Teleprinter | Encrypted

Learning outcomes

- To discuss the skills needed to be an engineer and apply for an engineering job at the Research Station at Dollis Hill.

Prepare for the activity

- Print student activity cards.
- Download classroom PowerPoint.
- Prepare film clip.
- Divide students into groups.
- Have scissors and glue at the ready.

Run the activity

- Show the film clip.
- Use the PowerPoint to introduce key words, describe a Research Facility, discuss engineering skills and explain Colossus was 'Top Secret'.
- In groups, ask students to use the skills sheet to discuss engineering skills.
- Ask students to fill out the job application form.
- Explain students have been successful. They must make their own Dollis Hill ID card.
- Top tip: Take photos to stick on the card, or ask them to draw their face.

Extension activities

- Role play – ask students to interview each other for the job of a General Post Office engineer.
- Class discussion about engineers – do they think it is a job for boys or girls?

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01 – The General Post Office (GPO) – The Heart of Communication

Recruit

Tommy Flowers needs to recruit a team of engineers to help him build the Colossus machine – but who should he choose?

It's essential to get it right; time is tight and we need to win the war! Can you help?

What skills do you need to be an engineer? Write them in the six boxes. Use the skills cards to help you.

Engineering Skills Card

Apply

Imagine you are applying to be a General Post Office engineer at Dollis Hill. Fill in the job application form below.

Application Form

Name

_____

What job are you applying for? (Tick one)

Sportsperson **Driver** **Engineer**

☐ *Tick this box if you agree to sign the Official Secrets Act*

Your skills

_____ _____

_____ _____

_____ _____

Why do you want to work at the GPO Research Station at Dollis Hill?

It's interesting because _____

_____

_____

01 – The General Post Office (GPO) – The Heart of Communication

Engineering Skills Sheet - Student Activity Card 02

What skills do you need to be an engineer?

Cut out the six skills you think are most important.
Stick them onto the Engineering Skills Card.

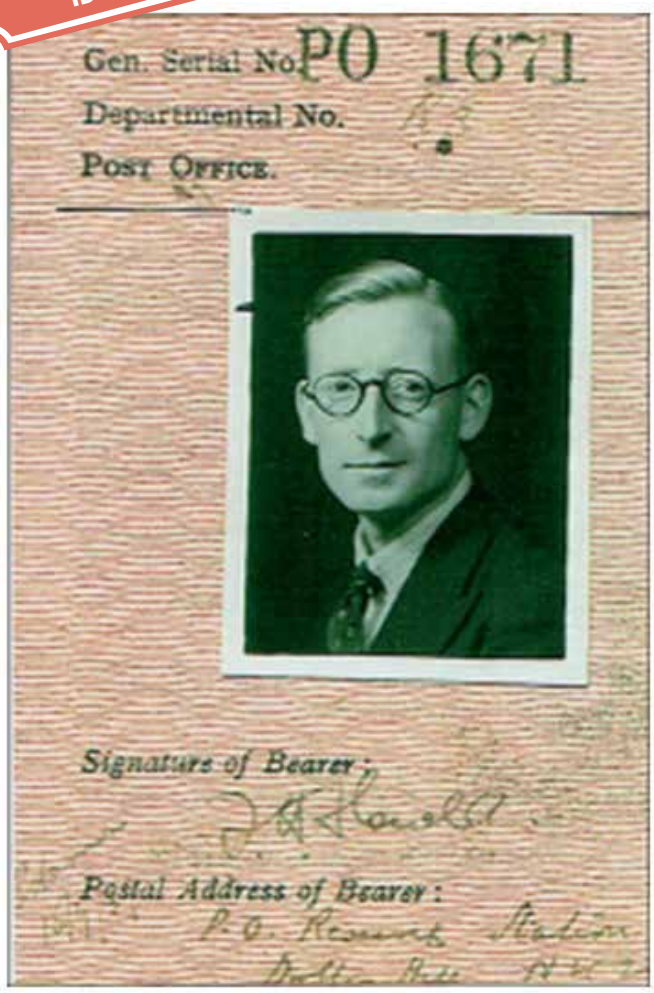
Listening	Creativity	Physics	Painting
Enthusiasm	Confidence	Persistence	Inspiring
Juggling	Maths	Drawing	Flying
Languages	Inquisitive	Communication	Football
Problem solving	Singing	Running	Teamwork
Organising	Technology	Learning	Investigation
Finances (money)	Training	Chemistry	Managing

Can you think of any extra engineering skills? Write them in the empty boxes.

Congratulations!

Top Secret! Tommy Flowers has given you a job at the GPO Research Station at Dollis Hill. You need to make an ID card.

Tommy Flowers ID Card



Name _____

ID Number _____

Department _____

Image

Signature _____

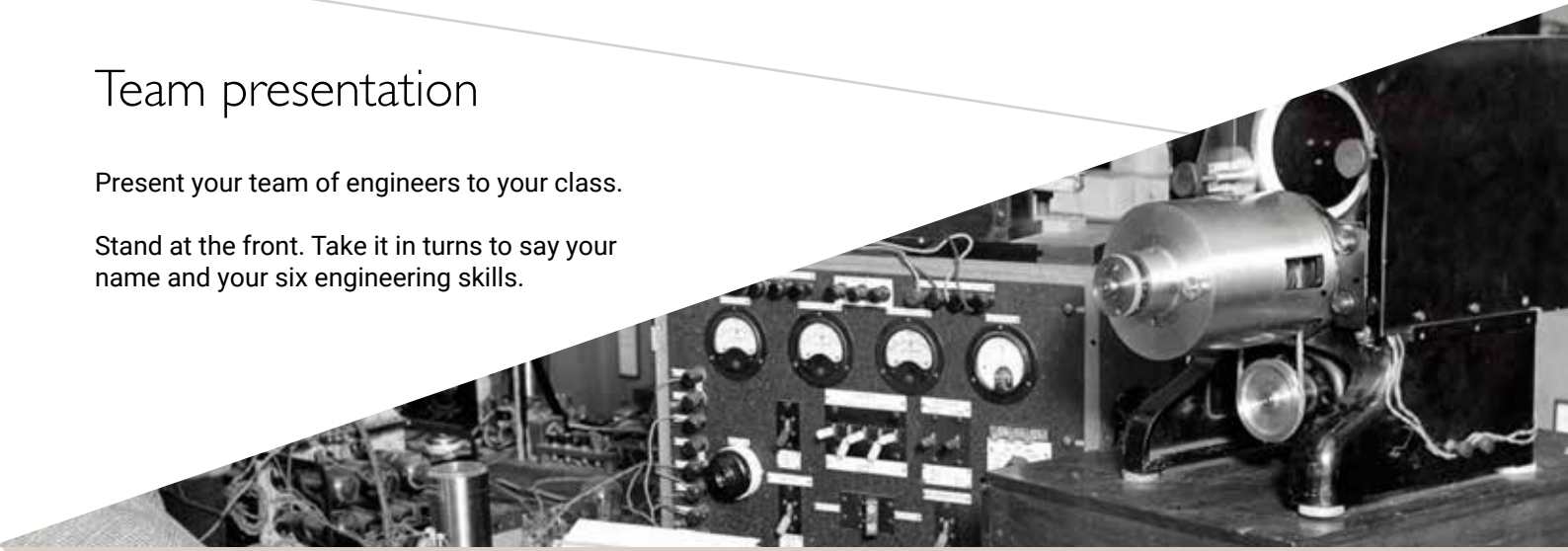
Address _____

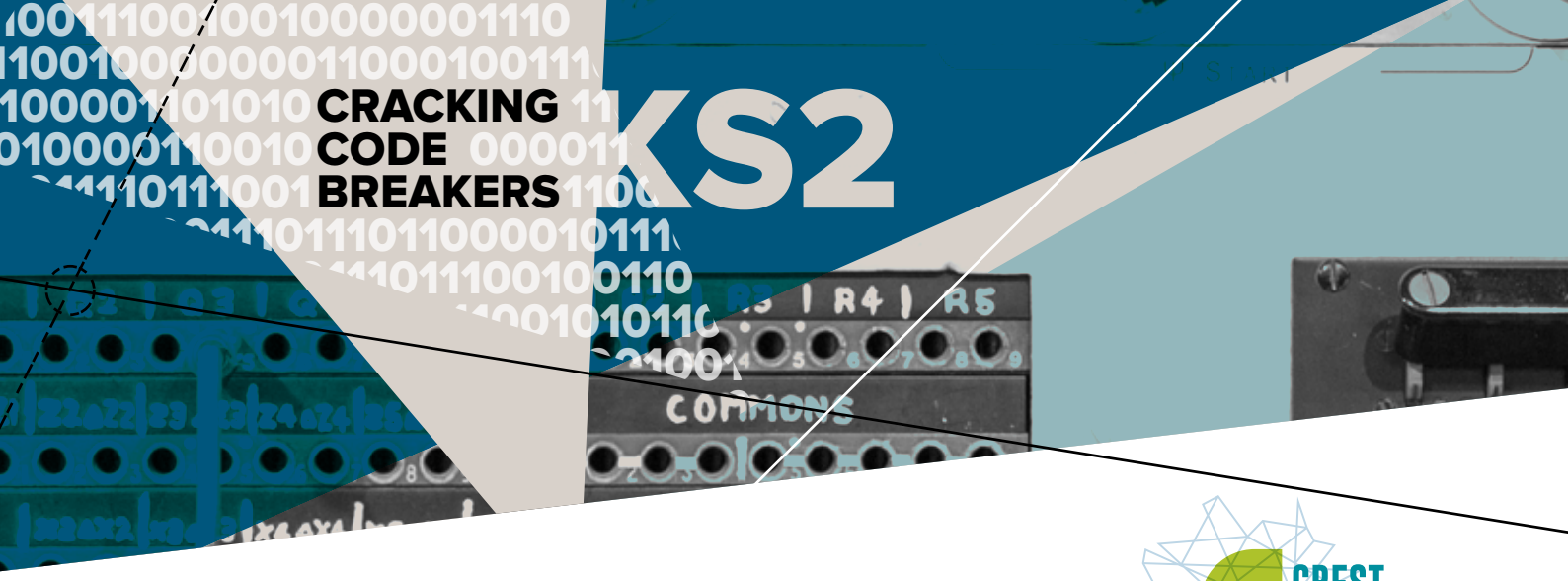
_____

Team presentation

Present your team of engineers to your class.

Stand at the front. Take it in turns to say your name and your six engineering skills.





02 – Tommy Who?

Teachers' Notes – CREST SuperStar Challenge

Tommy Flowers the inventor

Take inspiration from Tommy Flowers and Colossus to design a new machine to fix a problem. Students will write a class questionnaire and analyse this data to identify a need. They will sketch their design and consider what resources are needed to make their creative idea a reality.

Background information

- Tommy Flowers was an engineer at the GPO Research Station at Dollis Hill.
- Tommy is not a famous figure from the Second World War. However, his invention played a vital role, helping to shorten the length of the war by months, saving many lives.
- Tommy initially struggled to gain support and funding to build the first Colossus.
- Colossus dramatically increased the speed and accuracy of breaking coded messages between Hitler and his generals.

Learning outcomes

- Use research, data collection and analysis to identify a problem.
- Use teamwork, problem solving skills and creativity to design a machine-based invention.

CREST SuperStar

- This CREST SuperStar Challenge is accredited by the British Science Association.

Key words

Apprentice | Invention | Colossus

Prepare for the activity

- Download classroom PowerPoint.
- Prepare film clip.
- Print student challenge cards.

Run the challenge

- Show the film clip.
- Use the PowerPoint to introduce key words and Colossus, to explain the task and provide inspiration for invention ideas.
- Students write their questionnaire, ask classmates to fill it in and analyse the results (homework idea: ask family and friends).
- Students sketch their design and choose a catchy name.
- Top tip: If students need inspiration, allow them to work as a team to discuss and share their ideas.

Extension activities

- Develop machine designs into prototype models using craft materials e.g. tin foil, pipe cleaners, coloured paper, wool and felt.
- Pitch designs to the class. Select a group of students to be Chief Engineers (like Tommy) and sit them in row like Dragons' Den to listen to pitches.
- Encourage the Chief Engineers to ask questions like: Has the machine been tested? Is it safe? Who is it for? Does it come in different colours?
- Top tip: Ask the students to swap roles to take turns to make a pitch.

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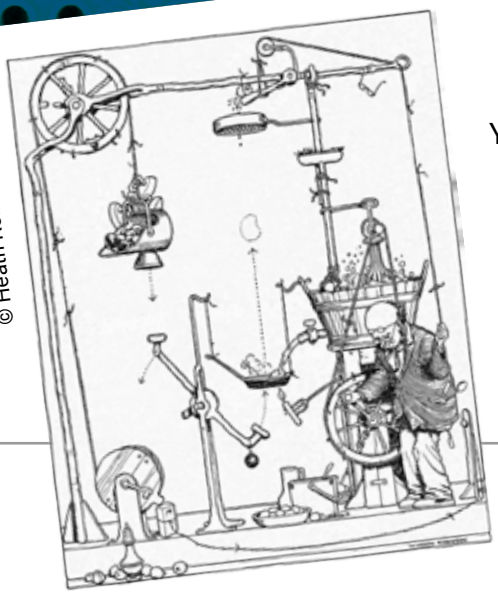
02 – Tommy Who?

Student Activity Card 01 – CREST SuperStar Challenge



Your task is to design a new machine to impress Tommy Flowers.

It doesn't need to be about coding but it must solve a problem. No idea is too wacky!

It could be a machine to tidy your room, make your breakfast or even tie your shoelaces!

Wacky invention questionnaire!

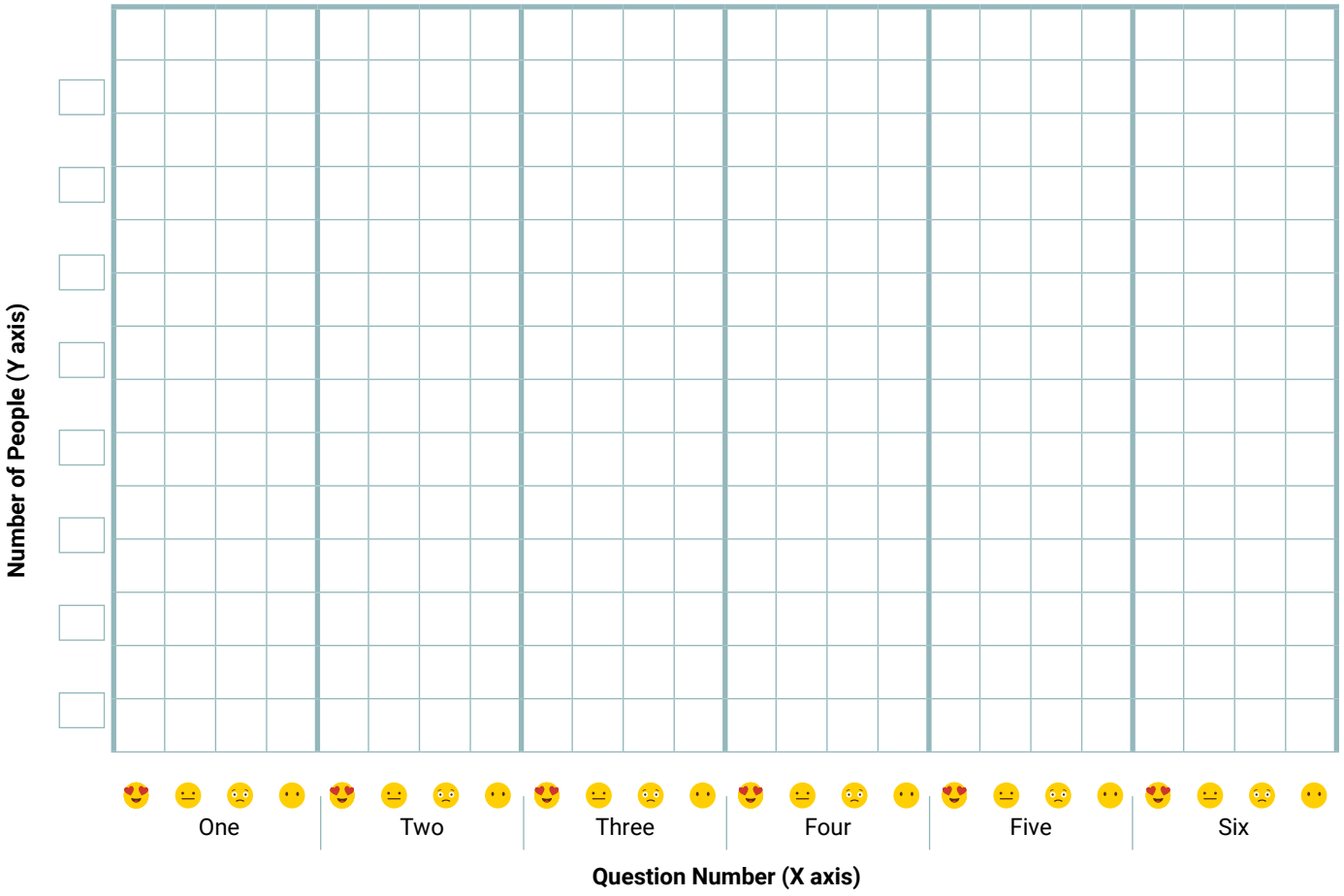
Do you agree or disagree with the following statements?

	Question	Agree 😍	Not Sure 😐	Disagree 😳	Not Applicable 😶
1	I like tidying my room.				
2	I like making my breakfast.				
3	I like tying my shoelaces.				
4					
5					
6					

Add three more questions. Use the questionnaire to find out what problem needs solving.
Ask as many people as possible. Use a **tally chart** to keep score.

The results

Use the grid to make a bar chart of your questionnaire results.
Label the Y axis with the number of people. Use pencils to colour in each column.



Decision time

Discuss the results of your questionnaire and decide what machine you are going to design.

Answer the following questions:

What problem will your machine solve?

What will you call it? It needs a catchy name like Colossus!

Your design

Use the box below to draw a rough sketch of your machine.
Fill in the boxes to describe what your machine is for, what it is made from, and any special features.

This machine is for:

It is made from:

Its special feature is:

The pitch

Tommy had to persuade his managers that Colossus could crack the German code.

Write down three things to convince people that your machine is a good idea.

1

2

3

03 – Building Colossus

Teachers' Notes – CREST SuperStar Challenge

Introducing Colossus

Tommy Flowers tore up the original blueprint of Colossus for his team of engineers. Students will work in teams to make a scale drawing from a blueprint. They will investigate maps and plans to discuss why Dollis Hill was chosen as the location for a research station.

Background information

- Ten Colossi were built in total. The machines were operated by Wrens (Women's Royal Naval Service).
- The first Colossus was built at Dollis Hill in North London.
- Dollis Hill was chosen as the site for an engineering research station because it was close to the General Post Office headquarters in London, but away from the busy city.
- During the war, a giant camouflage net covered Dollis Hill to hide it from German bomber planes.

Historical context

Colossus helped the Allies on D-Day, a major turning point in the war. A German message, decoded by Colossus, revealed German tanks at the chosen location for a US parachute division. The site was changed to secure D-Day success.

Key words

Prototype | Blueprint | Valve

Learning outcomes

- Develop an understanding of blueprints, size, scale and teamwork.
- Read maps and interpret and analyse information.
- Make decisions about the development of a new research station.

Prepare for the activity

- Download PowerPoint and prepare film clip.
- Print student activity/challenge cards.
- Print the grid sheet onto A4 or A3 paper.
- Arrange the class into five teams.

CREST SuperStar Challenge

Activity Card 04/05: 'Design a secret research station for your school' is a CREST SuperStar Challenge accredited by the British Science Association.
The Challenge asks students to work in teams to locate and design a research station in the school.

Equipment list

Ruler, coloured pencils, A4 or A3 paper for large blueprint.

Run the activity

- Show the film clip.
- Use the PowerPoint to introduce key words, provide knowledge about Colossus and explain valves, blueprints and maps.
- Use the valve activity to introduce concepts of scale.
- See teacher instructions for the 'Scale Up!' activity.
- Top tip: Point out the rural setting. Lead a class discussion about location of Dollis Hill.
- Encourage the students to engage in creative problem solving for 'Activity Card 04 & 05'. They should work in teams for the discussion tasks.

Extension activities

- Activity Card 03: Pace out the size of 'Block A' on your school field. Show a large stride is equal to about 1 metre. Use field markers to help you.
- Activity Card 05: Build the new school research station design out of Lego.

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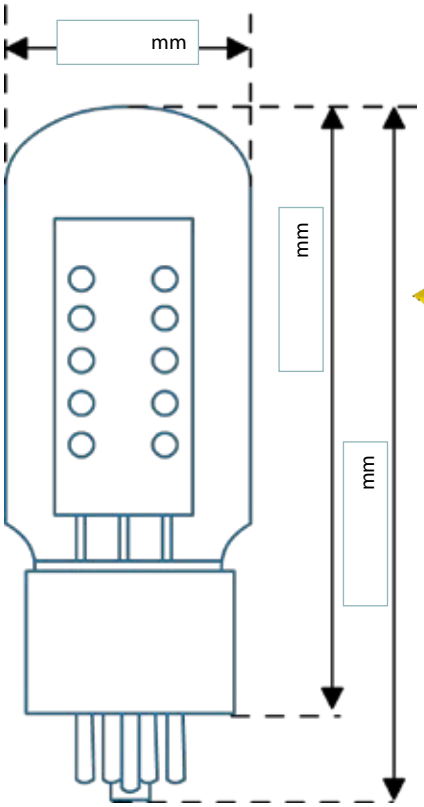
03 – Building Colossus
Student Activity Card 01



The Colossus prototype, built at Dollis Hill, contained 1,500 valves.

This is a valve drawn at actual size, also known as a scale of **1:1**.

1mm on the drawing is equal to 1mm in real life.

Fill in the three missing measurements on the drawing.

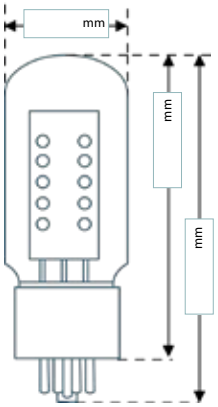
To keep the design of Colossus top secret, Tommy Flowers ripped up his blueprint into five pieces. After the war the blueprint was completely destroyed!

Colossus was around the size of a classroom.
We know that it was **2.3 metres tall**.

Estimate how wide it was:

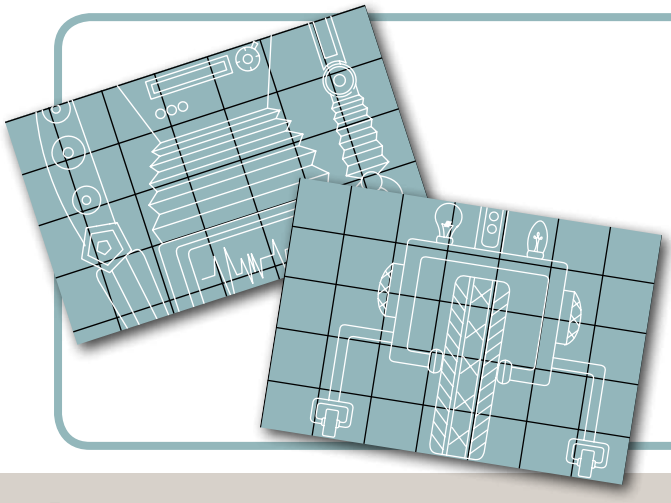
Blueprints are drawn to scale to fit more information onto a piece of paper. The scale **ratio** tells us how many units in real life are equal to **one** unit on the drawing.

This is a drawing of the same valve but at a smaller size.



Tick the correct scale ratio that this valve has been drawn to.
(Measure the height of the small valve and compare the measurement to the full size drawing)

1:2 ☐ 1:5 ☐ 1:8 ☐



Scale up!

Imagine that Tommy designed a secret robot.

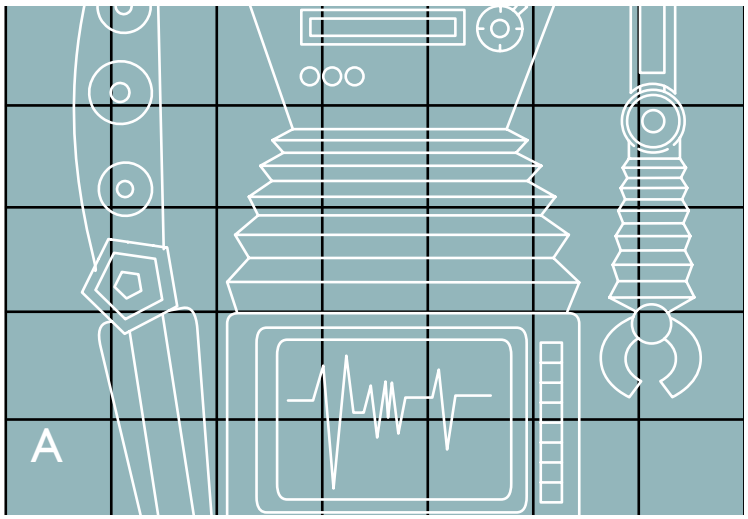
You will be given a piece of the robot blueprint.

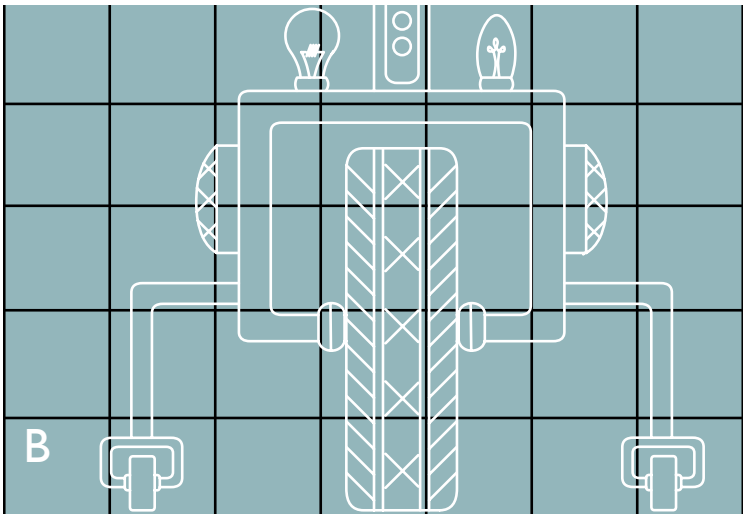
Your challenge is to draw the blueprint at full scale on a grid sheet.

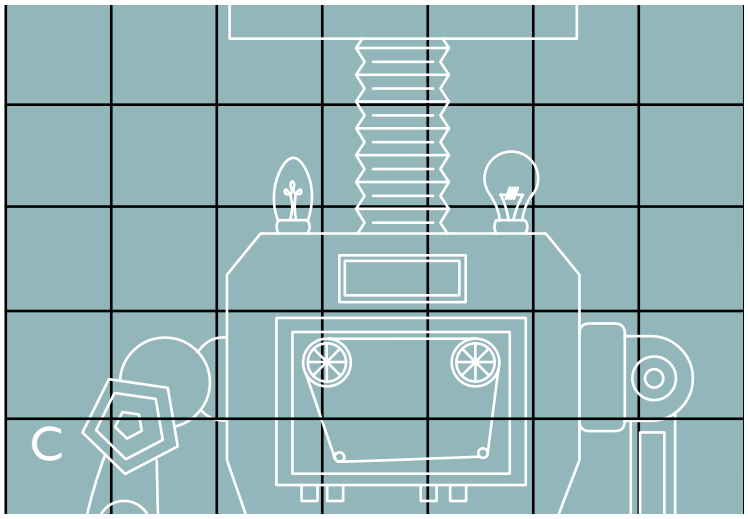
In your team, fit together your blueprint drawings to see the full size robot.

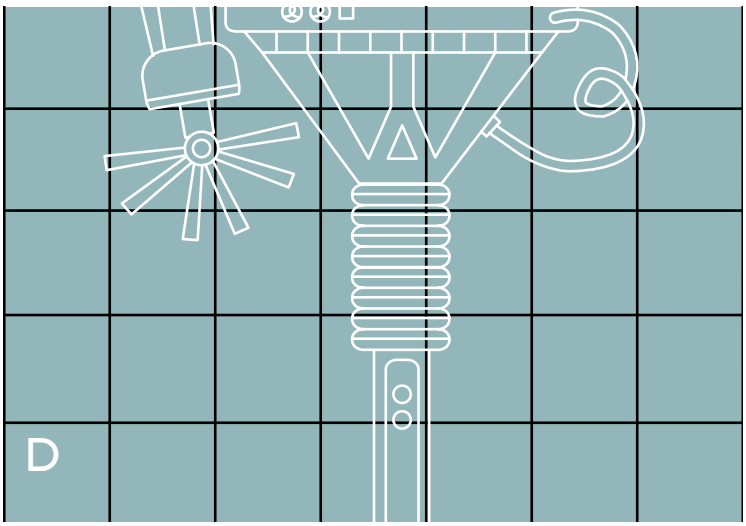
Teacher instructions – Scale up!

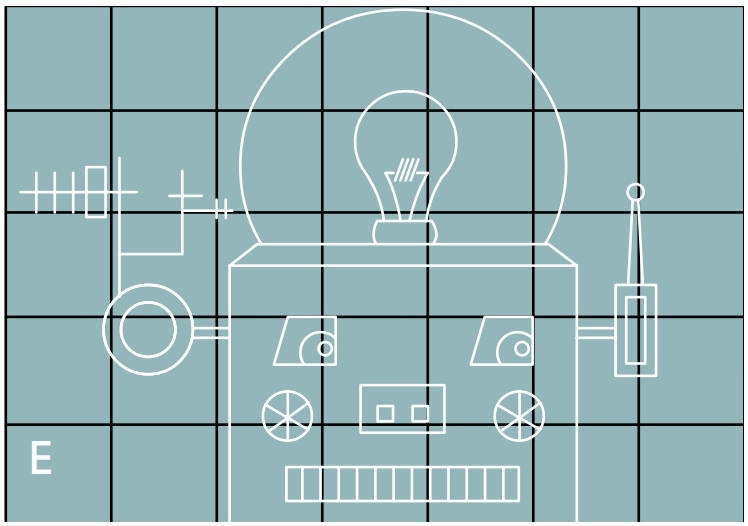
- Divide the class into teams of five.
- Photocopy this page the required number of times (e.g. six times for a class of 30).
- Cut out the blueprint pieces (A-E).
- Give each student a piece of blueprint and a grid sheet in A4 or A3 for a larger drawing.
- Ask students to draw their piece of blueprint onto the grid sheet to create the 'full scale' drawing.
- Ask students to focus on a square at a time to transfer the blue print to a bigger scale.
- In teams, fit together the five parts to reveal the robot.
- Top tip: Use a roll of wallpaper or large paper to draw a giant grid. Give each team one piece of blueprint to work together and draw a class robot.



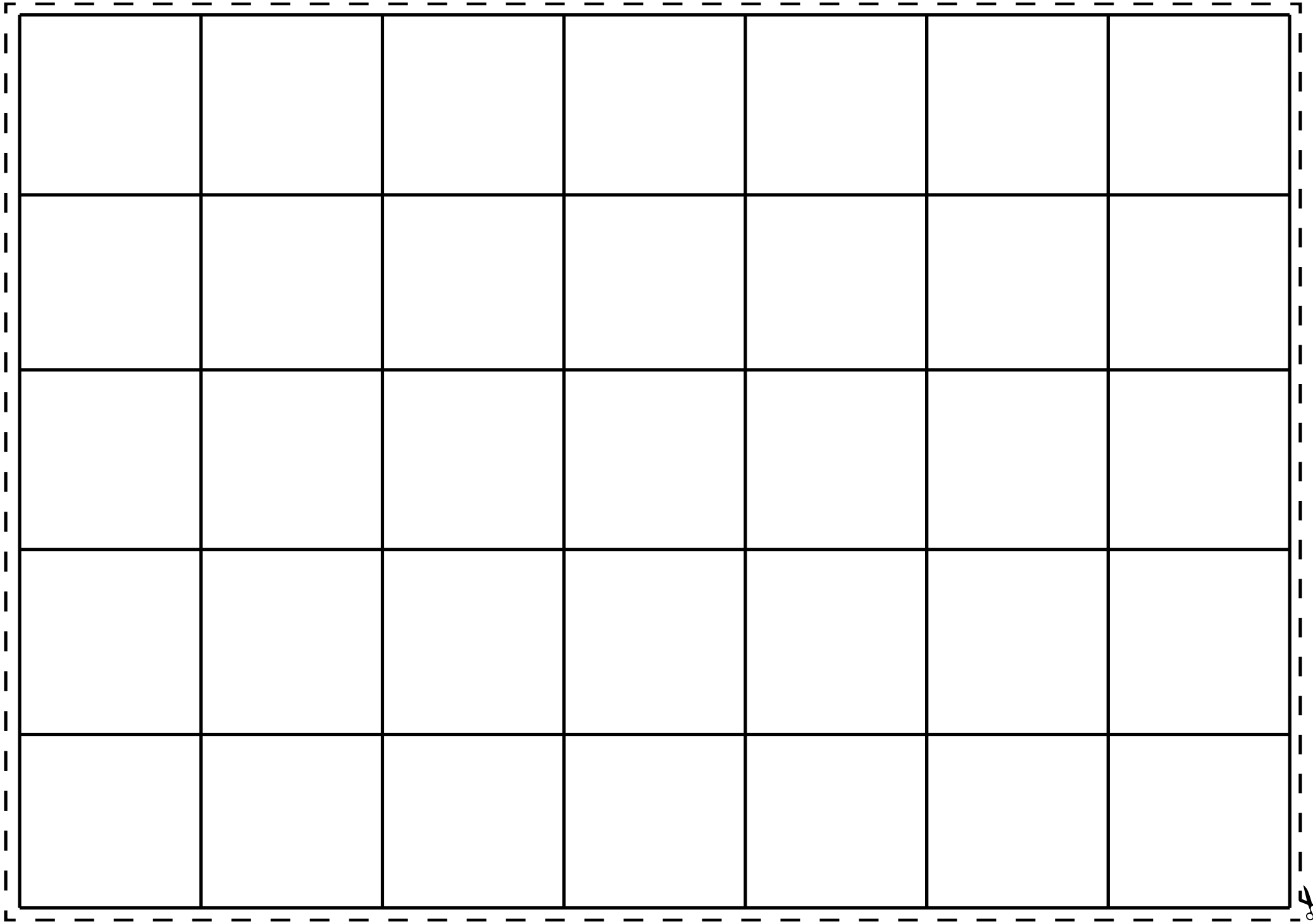




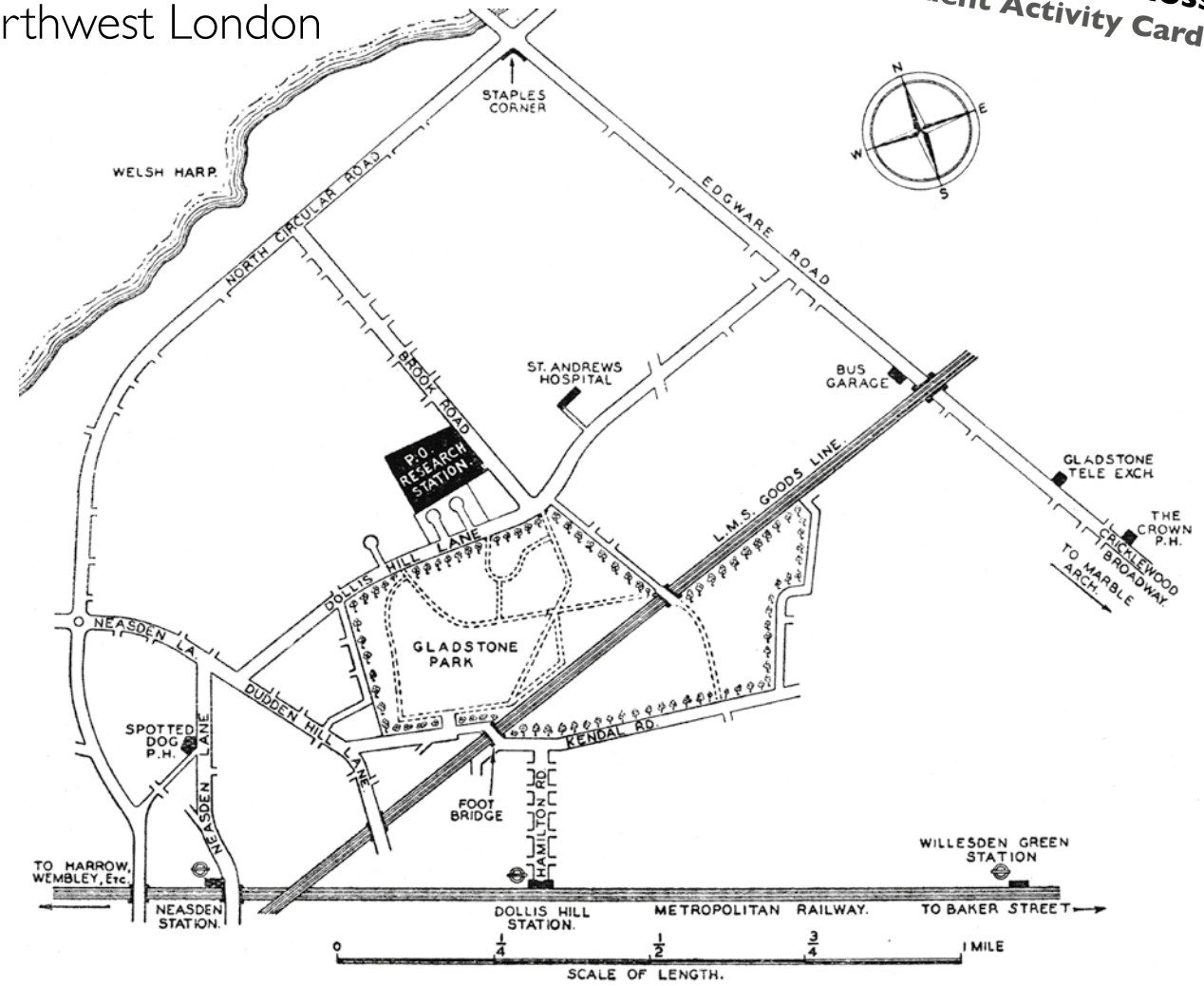




03 – Building Colossus – Student Activity Card 01 – Grid Sheet



Map – Dollis Hill, Northwest London



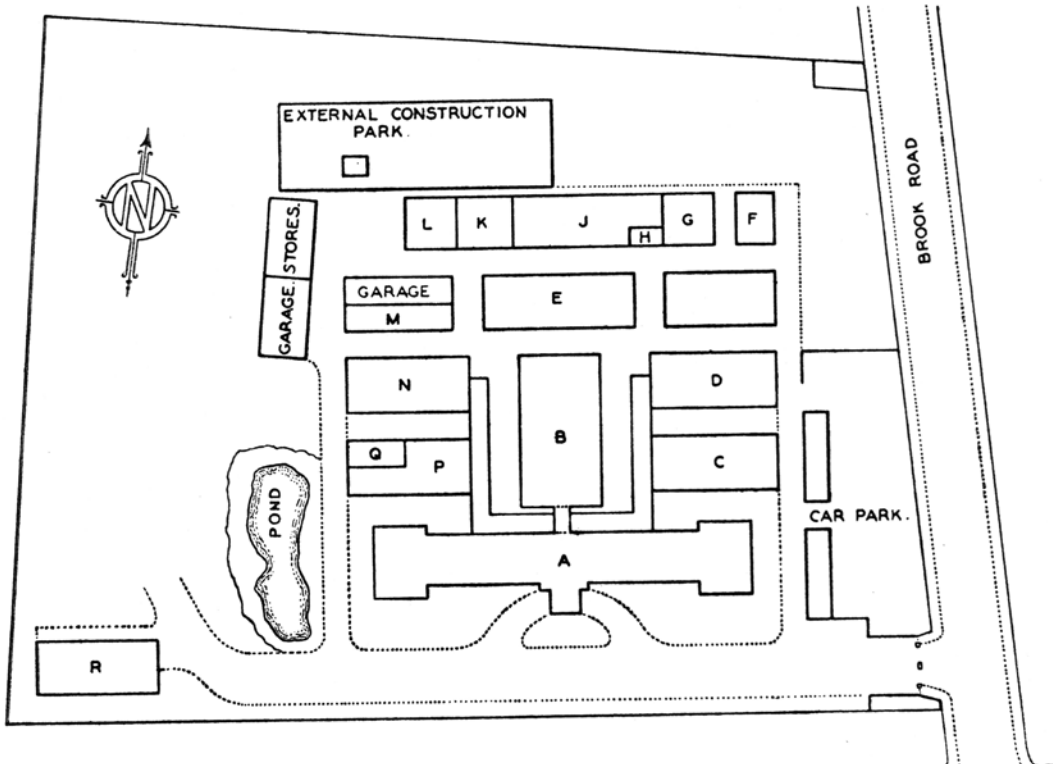
1. Circle the **P.O. RESEARCH STATION** on the map.
2. Colour the railway lines red, the roads blue and the footpaths green.
3. Imagine you have just arrived at Dollis Hill Station. Mark the route you would take from Dollis Hill Station to the P.O. RESEARCH STATION.

I chose this route because:

4. Suggest three reasons why Dollis Hill was a good location for a research station.

General Post Office Research Station, Dollis Hill, plan and key

A	Main Block - Library - Exchange Signalling - Line Transmission
B	Central Block - Films - Mechanical Tests
C	Plant Machinery
D	Tea Room
E	Staff Training
F	Spraying Workshop
G	Assembly Workshop
H	Coil Winding Room
J	Machine Workshop
K	Carpenters Workshop
L	Forge
M	Testing Laboratory
N	Radio Laboratory
P	Chemical Laboratory
Q	Acoustical Laboratory
R	Radio Laboratory



On the plan, the scale is 1:10000. This means 1 centimetre on the map is equal to 100 metres in real life.

1. Which is the largest block on the plan?

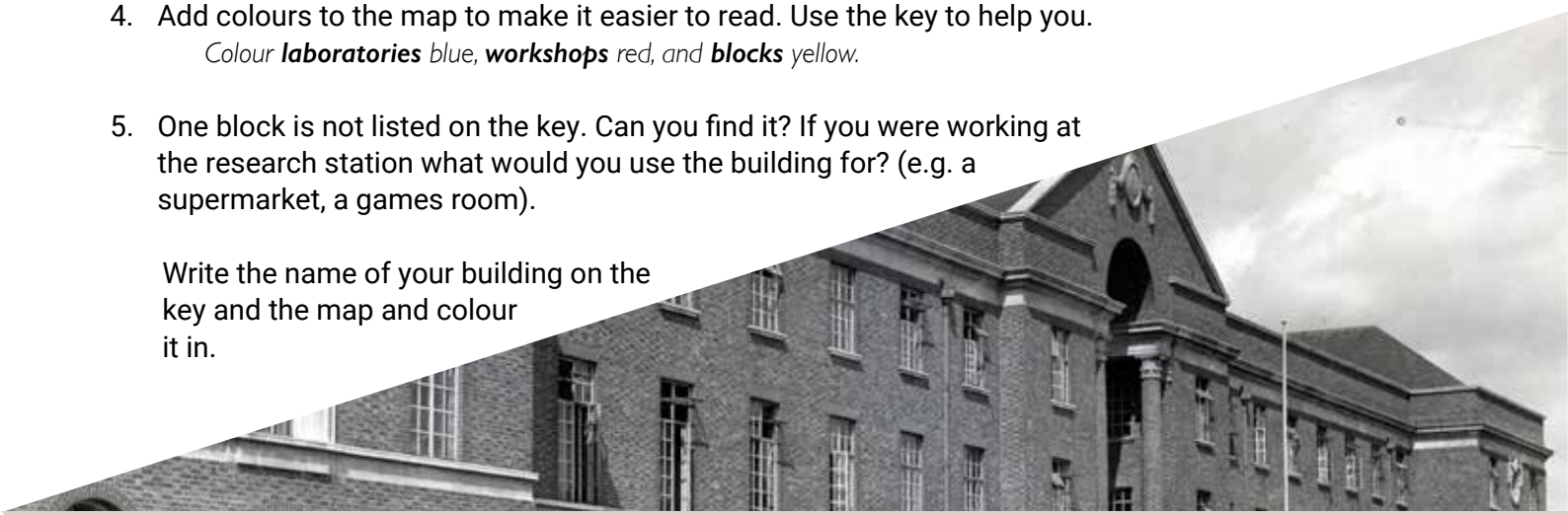
2. The scaled length of the largest block is: cm

3. The actual length of the largest block is: m

4. Add colours to the map to make it easier to read. Use the key to help you.
   *Colour **laboratories** blue, **workshops** red, and **blocks** yellow.*

5. One block is not listed on the key. Can you find it? If you were working at the research station what would you use the building for? (e.g. a supermarket, a games room).

   Write the name of your building on the key and the map and colour it in.



Design a secret research station for your school

Your school has been chosen as the site for a new, **secret** research station!

Discuss

Why do you think your school and the local area would make a good location for a research station?

Team ideas:

What sort of buildings do you think the new research station should have?
List your ideas in the box.

Team ideas:

Write down the three best building ideas in the boxes below.

1	2	3

Branding

Think of an **exciting** name for the research station.

The new research station will be called:

Design a logo for the research station in the circular space provided.

A grand plan

Take a walk around your school grounds. Where do you think the secret research station should be built?

The GPO Research Station at Dollis Hill was covered in a giant camouflage net to keep it from being discovered by the enemy.

How will you help to keep the school research station **Top Secret**?

Draw a plan of the research station on the grid below. Design your own colour coded **key** to help you to label each of the buildings.

Key

CRACKING CODE BREAKERS KS2

04 – Cryptic Messages

Teachers' Notes

How were messages made secret?

Learn how the Germans used the Lorenz machine (the Tunny) to send secret messages using a binary code and tapes. Students will use a key to create their own binary codes, make a cipher wheel and write a coded message for a partner.

Background information

The Tunny code used five-bit binary numbers. Binary code is either on '1' or off '0'. This code is still used in computers today.

Each letter has a five-digit code made up of 0's and 1's.
A = 11000 B =10011 C=01110

To create the Tunny code, another binary letter (the key) was added to the original letter to create a new sequence of 0's and 1's.

Binary addition works like this:
0+0=0 1+0=1 0+1=1 1+1=0

To encipher the plain text letter A with the letter key B would give a code: 01011 and letter G

A	11000
+ B	10011
= G	01011

Key words

Cryptography | Binary | Cipher

Learning outcomes

- Learn how ciphers are made.
- Develop a basic understanding of binary code.
- Understand how machines help to make and break codes.

Prepare for the activity

- Download classroom PowerPoint.
- Prepare film clip.
- Print cipher wheels onto thick paper or card.

Equipment list

Card/thick paper, pencils, split pins, scissors.

Run the activity

- Show the film clip.
- Use the PowerPoint to introduce key words, binary code and the German Lorenz machine (the Tunny).
- Ask students to create their own key to show a simple letter-grid encryption process.
- Use the Cipher Wheel to show how to change settings.
- The binary message is '**Move tanks North**'.

Extension activities

- Students may be able to create longer words and messages.
- Try other methods to send a secret message. Which technique works best?
- Represent binary with Lego, lights, noises etc.

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04 – Cryptic Messages
Student Activity Card 01

Create your own key

Make a simple cipher process based on the Tunny.

Use the key grid. Give each letter of the alphabet a new letter.
(**a**, **b** and **c** in for you.)

Original letter –	a	b	c	d	e	f	g	h	i	j	k	l	m
Code letter –			a										

Original letter –	n	o	p	q	r	s	t	u	v	w	x	y	z
Code letter –							b						c

This is your '**key**'. It is like the chart used to control the settings for the German Lorenz machine (the Tunny).

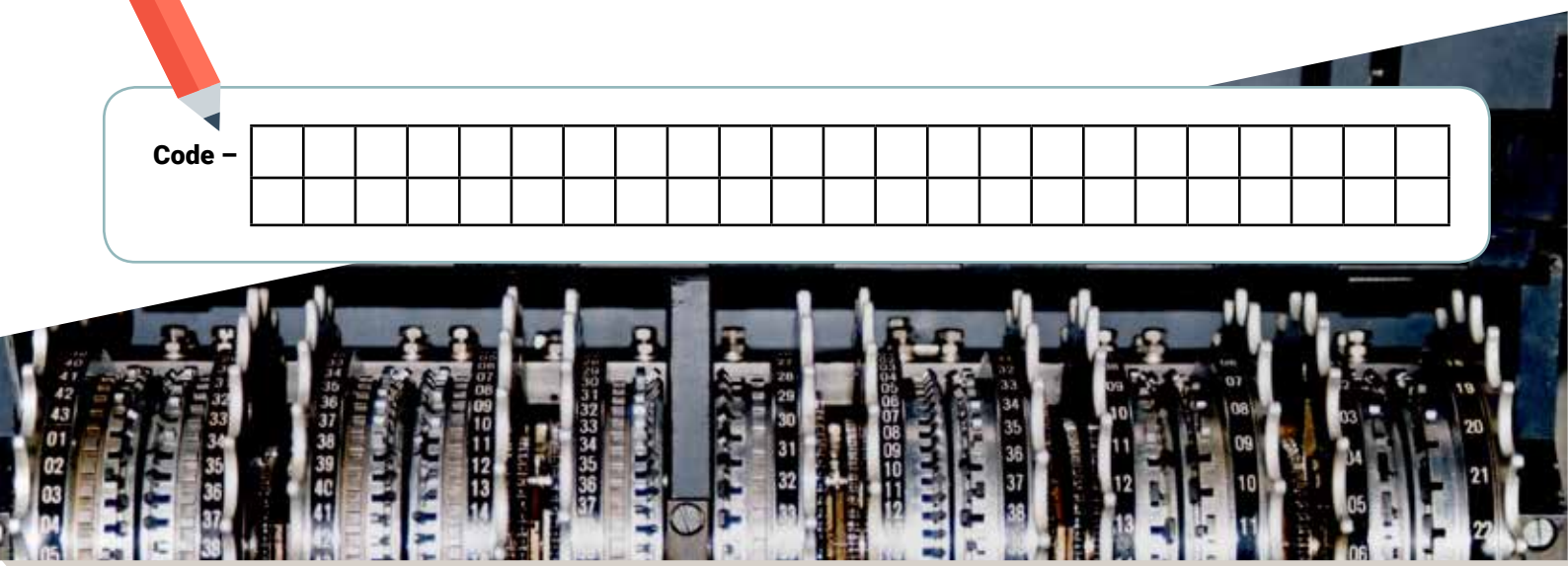
In the top row of the grid write a short message (something like "send more troops").
In the bottom row write your code letter from the **key** grid above.

Original message –	s	e	n	d		m	o	r	e		t	r	o	o	p	s			
Coded message –																			

Well done. You have created an encrypted message!

Use your key to write a **coded** message on the top line of the grid below.
Swap your sheet with a partner. They will work as a cryptographer and use your **key** to reveal the mystery message.

Code –



A cipher wheel

1. Cut out the circles at the bottom of the page.
2. Make a hole in the centre of each circle.
3. Use a split pin to fasten the circles together.

The numbers on the cipher wheel are your **setting numbers**.

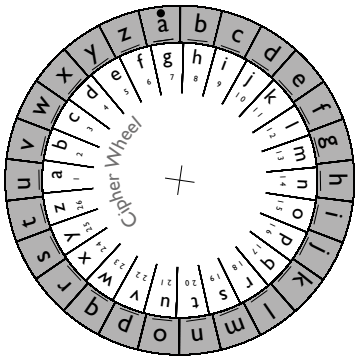
Just like the Germans you are going to change the **settings**.

When the wheels are set to **1** all the numbers line up and there is no encryption.

Turn the top wheel to a new setting and the letters will be mixed up

Example

This cipher wheel is on setting 7.



The word 'hello' now becomes:
7nkrru

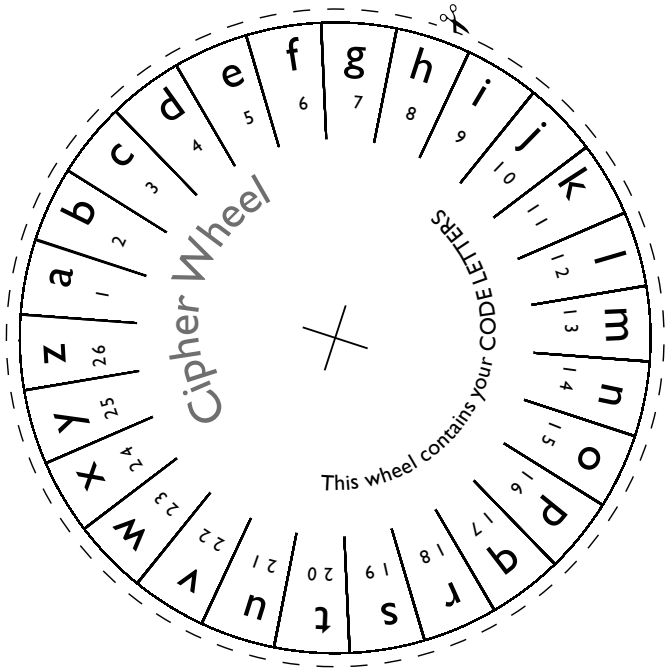
Pick a number (1 – 26). Line your number up with the letter '**a**' on the big grey letter wheel.

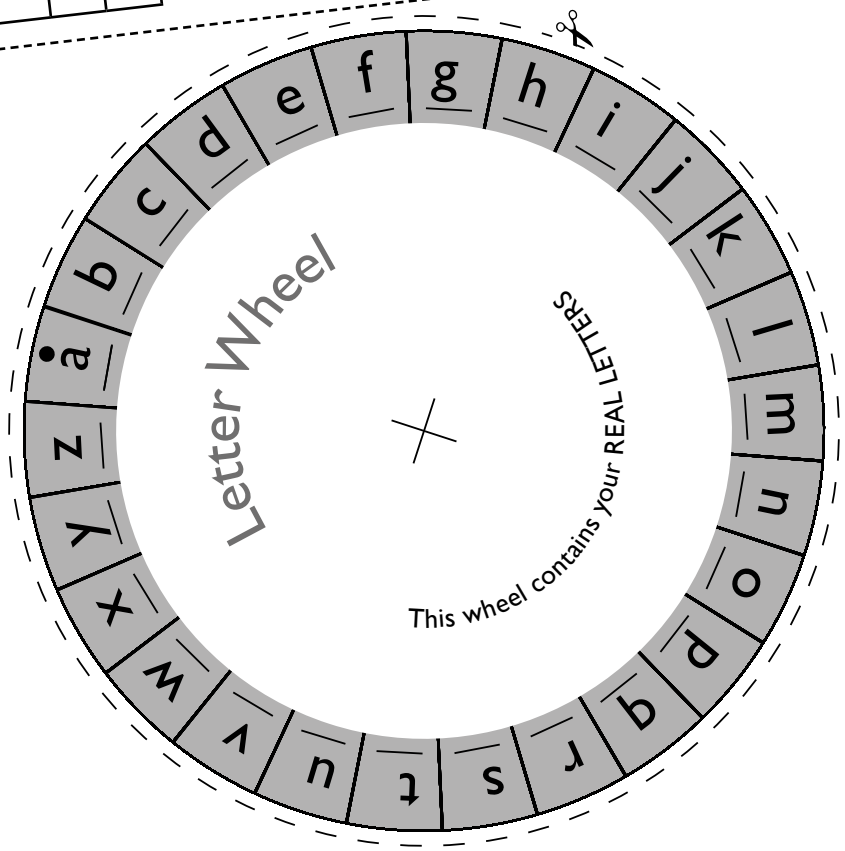
Encrypt a word using your wheel. Pass the encrypted word to a partner but make sure your word starts with your setting number.

For example: **9abwx** means **stop**

Setting number

How quickly can you decipher each other's word?





Binary code

To send messages as radio signals, the Germans changed alphabetic letters into five-bit binary code.

Each digit or letter has its own binary code.

Letters		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Code Elements	1	o	o		o	o	o				o	o						o		o		o		o	o	o	o
	2	o		o				o		o	o	o	o				o	o	o			o	o	o			
	3			o			o		o	o		o		o	o		o	o		o		o	o		o	o	
	4		o	o	o		o	o			o	o		o	o	o			o				o		o		
	5		o					o	o				o	o		o	o	o			o		o	o	o	o	o

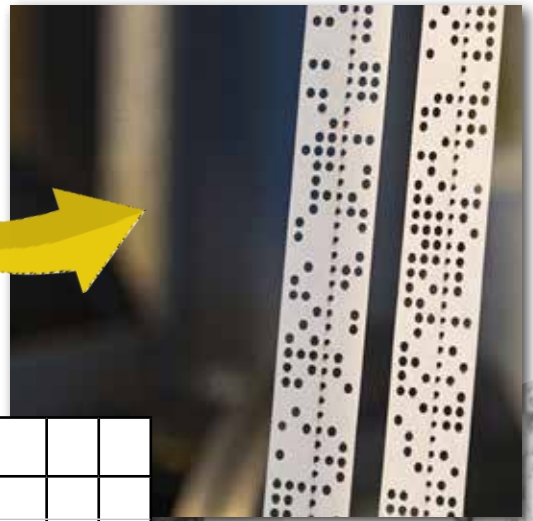
Use the grid below to spell out your name. Write each letter in a box on the top row.

Below each letter, mark on the correct binary code.

Letters																											
Code Elements	1																										
	2																										
	3																										
	4																										
	5																										

Punched tapes

Binary codes are punched onto tapes. The Colossus machine read the tapes to work out the settings of the German Lorenz cipher machine.



Can you work out the binary message in the grid below?
Write the plain text letters in the top row of the grid.

Letters																		
Code Elements	1				o			o		o	o							
	2			o				o		o					o			
	3	o		o					o	o	o		o				o	
	4	o	o	o					o	o			o	o	o			
	5	o	o	o			o							o		o	o	

05 – Cracking the Code

Teachers' Notes

What techniques do code breakers use?

Find out how British cryptographers deciphered the German messages. Learn different techniques to decipher code, and translate a message from German. Work as a team, against the clock, to find and decode secret messages in your school.

Background information

- Colossus was fast but humans were needed to operate the machines and finish the deciphering process.
- The British noticed that important messages sometimes started or ended with the same words e.g. "Adolf Hitler, Führer". This provided clues to work out the rest of the message.
- Other clues include letter frequency, looking for letter patterns and double letters.

Learning outcomes

- Use different techniques to decipher code.
- Appreciate time pressure by racing to crack the code.
- Understand that encrypted messages were translated from German.

Key words

Intercept | Decipher | Translate

Prepare for the activity

- Prepare film clip.
- Download classroom PowerPoint.
- Print activity sheets.
- Read Teachers' Clue Sheet to prepare the team challenge.

Run the activity

- Show the film clip.
- Use the PowerPoint to introduce key words, describe code-breaking techniques and explain messages were translated from German.
- Give the students time to do Activity 01 and crack the code.
- The encoded message translates to: "**I am wounded I need help**".

Secret decoder team challenge

- Read the Teachers' Clue Sheet.
- Follow the instructions to set up the Decoder challenge.
- Remind students this is a Top Secret operation.
- The four mystery words are: **Engineer**, **Dollis Hill**, **Colossus** and **Lorenz**.
- Top tip: Start each team with a clue for a different location.

Extension activities

- Use a stop watch to time how long it takes each team to complete the task.
- Use the key to write more difficult clues or help students to write their own.

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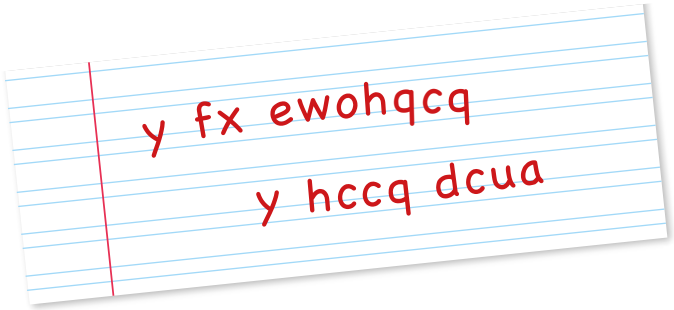
Quick!

A secret message has just arrived.

We've figured out some of the letters. Can you work out the rest?

CLUE! We think that the last word might be **help**.



Code breaking tips

The letter **e** is a common letter in English.

Single letter words are usually **I** or **a**.

Some common two letter words are: **of**, **am** and **to**.

Some common pairs of letters are **ee**, **oo** and **ss**.

Single letter words

A two letter word

A pair of letters

y		f	x		e	w	o	h	q	c	q		y		h	c	c	q		d	c	u	a
					w				d		d							d					

Don't forget. The messages Colossus helped to decode were in German.

Use the mini dictionary to translate the secret message above into German.

Write your translation in the box:

Challenge sheet

Your teacher will give your team an encrypted clue!
Your challenge is to use the key to decipher the clue and find the hidden **decoder** as fast as possible.

The Key

a	b	c	d	e	f	g	h	i	j	k	l	m
c	e	n	o	r	w	x	y	u	p	j	k	g

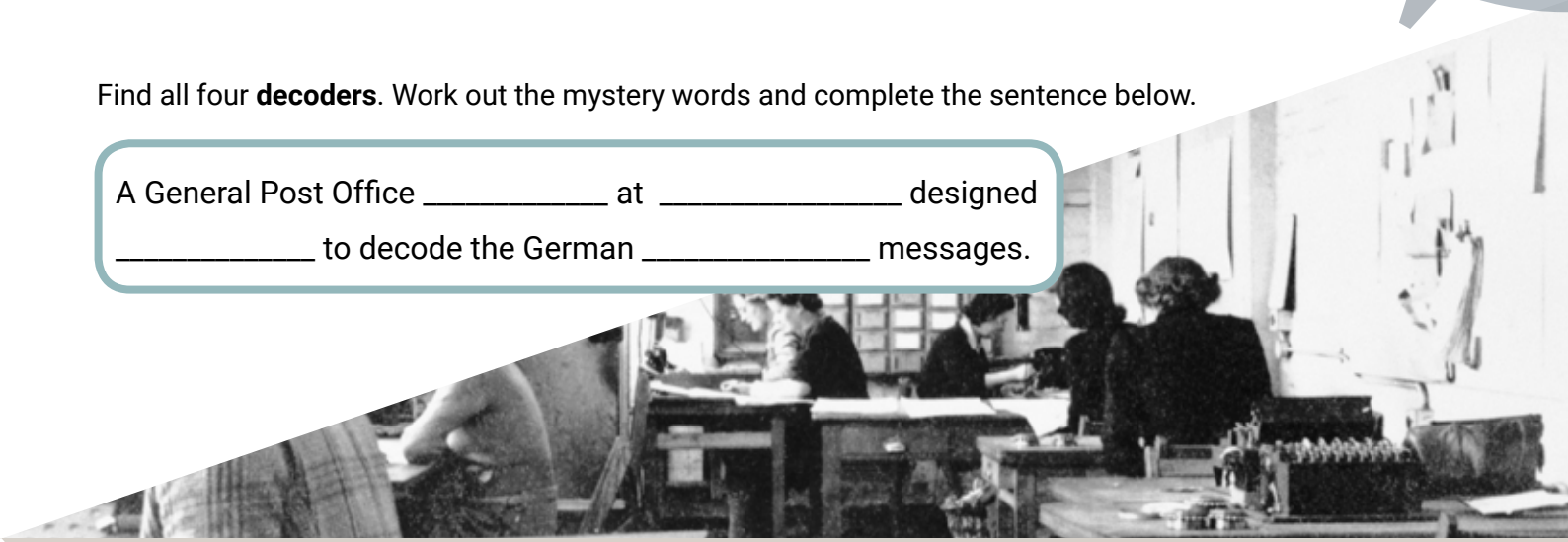
n	o	p	q	r	s	t	u	v	w	x	y	z
b	f	m	s	d	q	z	v	t	l	i	h	a

Follow the dotted line and cut out the **decoder**. Place it on the letter grid below. This will reveal the letters of a mystery word.

A	K	B	R	P	J	T	Q	B	A	Y	S
E	N	S	A	L	W	F	A	Y	Q	H	I
D	O	I	K	M	N	A	U	T	P	A	R
A	O	U	G	A	K	I	T	L	Y	S	U
L	A	U	A	F	P	L	G	A	K	S	N
C	O	A	D	W	H	K	A	U	A	L	L
L	L	I	R	I	F	Z	O	F	B	E	N
F	D	N	A	Q	O	C	M	S	H	A	Q
G	J	L	B	A	R	H	B	A	L	O	S
I	Y	F	A	O	D	A	T	W	E	E	R
S	A	I	Y	F	J	A	P	U	Q	D	A
O	R	Q	P	L	H	G	I	F	Y	H	Z

Find all four **decoders**. Work out the mystery words and complete the sentence below.

A General Post Office _____ at _____ designed _____ to decode the German _____ messages.



05 – Cracking the Code

Teachers' Clue Sheet (Teacher eyes only!)

Students take on a 'Top Secret' operation in teams. Their challenge is to decipher cryptic clues and find four decoders hidden around the school to reveal a secret message.

Set up the Decoder Challenge

- Divide the students into teams (four - six teams for an average class of 30).
- Copy this sheet for each team and cut out the cryptic clues.
- Make a copy of the decoder sheets for each team.
- Cut the decoder sheets in half and put copies of the same decoder into each envelope.
- Hide the decoders in position. Do not cut along the dotted line – allow students to do this.
- E.g. 'Clue 1' will lead to 'Envelope 1' hidden near the piano.
- Put a Challenge Sheet with letter grid on each team table.
- Give each team the four clues.

Run the Decoder Challenge

- Start each team in a different order.
- Explain that the classroom is their Research Station and they must bring each decoder back and use the letter grid on the 'Challenge sheet' to reveal the secret word.
- Encourage students to work together – and fast – to beat the clock!

1. Near the piano

1

brcd zyr mucbf

2. By the goal posts

2

eh zyr xfck mfqzq

3. By the bike rack

3

eh zyr eujr dcnj

4. Outside bench

4

fvzquor erbny

TOP SECRET DECODER

1

TOP SECRET DECODER

Great work! Take this decoder back to the Research Station.

Cut along the dotted lines. Place the decoder over the letter grid on the 'Challenge sheet' to reveal the mixed up letters.

Rearrange the letters to reveal the mystery word.

TOP SECRET DECODER

TOP SECRET DECODER

2

TOP SECRET DECODER

Great work! Take this decoder back to the Research Station.

Cut along the dotted lines. Place the decoder over the letter grid on the 'Challenge sheet' to reveal the mixed up letters.

Rearrange the letters to reveal the mystery word.

TOP SECRET DECODER

TOP SECRET DECODER

TOP SECRET DECODER

3

TOP SECRET DECODER

Great work! Take this decoder back to the Research Station.

Cut along the dotted lines. Place the decoder over the letter grid on the 'Challenge sheet' to reveal the mixed up letters.

Rearrange the letters to reveal the mystery word.

TOP SECRET DECODER

TOP SECRET DECODER

4

TOP SECRET DECODER

Great work! Take this decoder back to the Research Station.

Cut along the dotted lines. Place the decoder over the letter grid on the 'Challenge sheet' to reveal the mixed up letters.

Rearrange the letters to reveal the mystery word.

TOP SECRET DECODER

06 – Digital Security

Teachers' Notes

How can we protect our data?

Digital security is an important issue in today's world. Students will discuss how we can protect our data, investigate what makes a weak or strong password, and use top tips to write a password to protect their rucksack.

Rules to protect passwords

- Do not use the same password for everything.
- Do not use personal information. It makes it too easy to guess.
- Passwords should be at least twelve characters long.
- Passwords should use a mixture of letters, numbers and symbols.
- Use upper- and lower-case numbers
- Use a 'pass-phrase' with a random mixture of words such as: 'black76SometimeSugar&Shoe'
- Top tip: Remind students not to write their passwords down. Instead they should create rules to help remember them.

Learning outcomes

- Understand it is easy to crack a password that uses personal information.
- Identify what makes a weak or strong password.
- Discuss how to make passwords safer.
- Learn how to make passwords more secure.

Key words

Secure | Password | Character

Prepare for the activity

- Prepare film clip.
- Download classroom PowerPoint.
- Print student activity cards.

Run the activity

- Show the film clip.
- Use the PowerPoint to introduce Key words, explain what makes a strong password and set up a class discussion about passwords in real life.
- Students complete Activity Card 01.
- Put students into teams of five or six (or their table group).
- Assign each team a person - Winston or Tommy.
- Teams must work together and use three elements of the character profile information to create a password.
- Pair teams with different people together.
- Teams take it in turns to guess the three parts of the password and the correct order.
- Swap teams over to guess other passwords.

Extension activities

- Work as a class to create a secure password for the school. Encourage students use rules to help them to work out a system for remembering passwords.

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Oops! The password protecting Hitler's battle plans has been discovered!

a	d	o	l	f	1	8	8	9

Write three things that are wrong with Hitler's password in the boxes.

1

2

3

Passwords should be at least 12 characters long.
Imagine you could password protect your rucksack. What set of characters would you use?

How have you made this a strong password?

It's strong because

Discuss

Can you think of three things in your school or at home that need to be protected with strong passwords.

Write them in the boxes.

1

2

3

Second World War character profiles

First Name:	Winston
Surname:	Churchill
Year of Birth:	1874
Nickname:	Winnie

First Name:	Thomas
Surname:	Flowers
Year of Birth:	1905
Nickname:	Tommy

Your teacher will tell your team to create a password for Winston or Tommy.

The password must use three elements of their profile.

Write down the password but keep it secret from other teams.

Take it in turns to guess other teams' passwords.

Using personal information in your password makes it **VULNERABLE**. This means it is easy to break.

Passwords need to be easy for you to remember but hard for another person to guess.

Favourite food:

Favourite colour:

Name of first pet or toy:

Fill in the boxes. Use your answers to help you create a secure, memorable password.

Don't forget to add special characters like £ ?] and use a mix of capital and lower-case letters.

Write your password here:

Try not to write your real passwords down. Instead create a rule to help you to remember.

This example uses the second word of three nursery rhymes and a favourite number.

Example

Dumpty&Mary&Blind+127

Use this box to write down the rules to remember your password.

Cracking Code Breakers

Cracking Code Breakers is sponsored by John Cass Foundation and Royal Mail Group Ltd.

www.sirjohncassfoundation.com
Sir John Cass's Foundation is one of London's oldest and largest education charities. Founded in 1748, it supports education for young people in London through its grant programmes for individuals, schools and organisations, and its support for a number of institutions bearing Sir John Cass's name.
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www.royalmailgroup.com
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Although today, Royal Mail and Post Office Ltd are separate companies, they once formed a single organisation. For much of its history the standard organisational name used was 'Post Office'. Post Office buildings existed in almost every town. In the principal cities of London, Edinburgh and Dublin there was a main post office known as a General Post Office (GPO). For many this became the official name of the organisation. Throughout this learning resource the terms 'Post Office' and 'General Post Office' are used in their historical context'.

Cracking Code Breakers was developed with support from TNMoC

www.tnmoc.org
The National Museum of Computing, located on Bletchley Park, is an independent charity housing the world's largest collection of functional historic computers, including the rebuilt Colossus, the world's first electronic computer designed by Tommy Flowers. The museum enables visitors to follow the development of computing from the ultra-secret pioneering efforts of the 1940s through the large systems and mainframes of the 1950s, 60s and 70s, and the rise of personal computing in the 1980s and beyond.

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