

The Smallpeice Trust  
**ENGINEERING  
@HOME**

08

# The Encryption Challenge

#EngineeringAtHome

Suitable  
for ages:

7+

Time  
needed:

1hr



smallpeice   
Dare to imagine

Curriculum links: **Maths** – numbers, sequences, measurement; **Science** – cyber security, encryption and codes ; **D&T** – design, make, evaluate

Skills learnt: **Design, building, testing, evaluation**



Since our Smallpeice team can't visit schools, we've decided to challenge each other to try some different methods of encryption and send some secret messages.



## Learning Objectives

Create a purposeful, functional and appealing design

Select from a wide range of materials and use tools to perform practical tasks

Learn different means of encryption and use these to encrypt information

Evaluate your ideas and products

## Topics Covered

**CRYPTOGRAPHY**

<https://bit.ly/2X17kz8>

**CRACKING CODE**

<https://bit.ly/35ZHCPB>

**ONLINE COURSE ABOUT CRYPTOGRAPHY**

<https://bit.ly/3cuGBBu>

# Activity **01**

## Invisible Ink

### WHAT MATERIALS TO USE

You can use anything you can find at home.

Try looking in your recycling box.

#### HERE'S WHAT WE USED:

1. **LEMON JUICE**
2. **COTTON BUDS**
3. **PAPER**
4. **IRON** (AND IRONING BOARD)



# Activity 01

## Invisible Ink

### INSTRUCTIONS

- 1 Pour plenty of lemon juice into a bowl or egg cup.
- 2 Dip your cotton bud into the lemon juice, making sure it's got plenty on.
- 3 Write your message in lemon juice on a plain piece of paper.
- 4 Leave your message to completely dry out.
- 5 **WITH ADULT SUPERVISION** turn your iron onto maximum heat (make sure steam settings are off) and heat your message using the iron.
- 6 Read your secret message!



# Activity 02

## Substitution Cypher

### WHAT MATERIALS TO USE

You can use anything you can find at home.

Try looking in your recycling box.

#### HERE'S WHAT WE USED:

1. PEN/PENCIL
2. PAPER



# Activity 02

## Substitution Cypher

### INSTRUCTIONS

- 1 Write out the alphabet A-Z with some space underneath
- 2 Underneath each letter place a number, counting up from 1 to 26.

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
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

- 3 Solve the message below using this code...

MESSAGE ONE

▶ 3 1 14 25 15 21 19 15 12 22 5 20 8 9 19 3 15 4 5?

# Activity 02

## Substitution Cypher

4 Solve these messages, but beware the code changes for each message!

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
3	6		12	15	18			27	30			39	42		48	51	54	57		63	66	69	72		

MESSAGE TWO

▶ 69 24 3 60 3 6 45 63 60 60 24 27 57 24 3 54 12 15 54 45 42 15?

.....

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
200	195	190			175	170	165	160		150				130	125	120	115								

MESSAGE THREE

▶ 165 130 90 200 195 130 100 105 135 130 90?

.....

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
28		62	79		113	130	147		181		215	232	249	266		300		334			385	402	419		

MESSAGE FOUR

▶ 62 266 249 130 317 28 351 368 215 28 351 164 266 249 334  
436 266 368 334 266 215 385 96 79 351 147 96 232 28 215 215

.....

# Activity 03

## Caesar Cypher

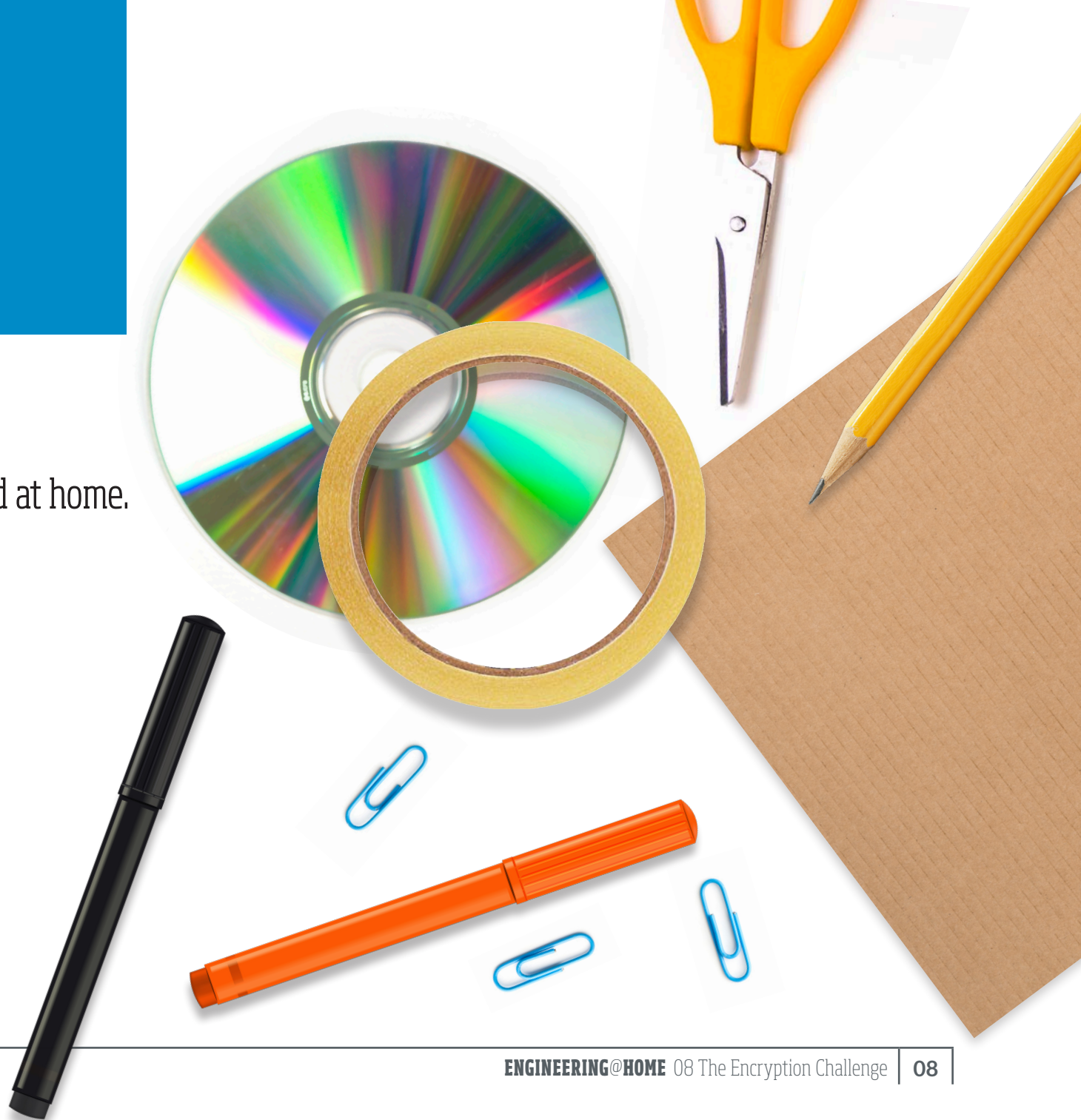
### WHAT MATERIALS TO USE

You can use anything you can find at home.

Try looking in your recycling box.

#### HERE'S WHAT WE USED:

1. PENCIL
2. FELT TIPS
3. CARDBOARD
4. SCISSORS
5. PAPERCLIP
6. CD/SELLOTAPE TO TRACE

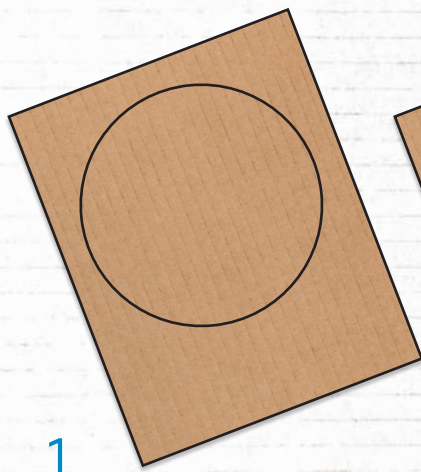




# Activity 03

## Caesar Cypher

### INSTRUCTIONS



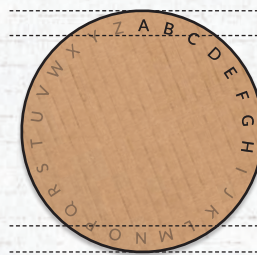
1.

Draw a large circle on a piece of cardboard. You can trace around a CD (or a mug or anything else to make a large circle).



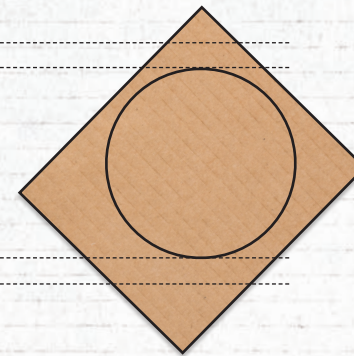
2.

Cut out the large circle or make one large cardboard disc.



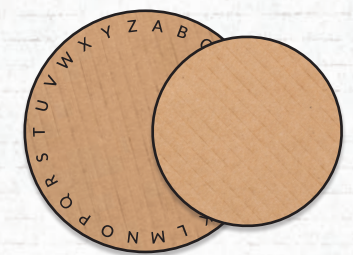
3.

Write the alphabet out evenly along the outside of this large disc.



4.

Draw a smaller circle on cardboard (this must fit inside the alphabet so check its size).



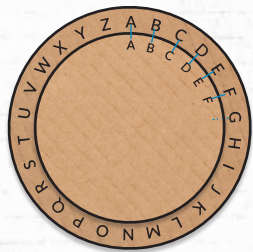
5.

Cut out the smaller circle and put on top of the large disc.

# Activity 03

## Caesar Cypher

### INSTRUCTIONS



6.

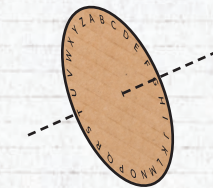
**Write the alphabet out again on the small disc making sure the letters line up.**

*If you have access to a printer you can print the next page of the handout and stick this to your discs.*



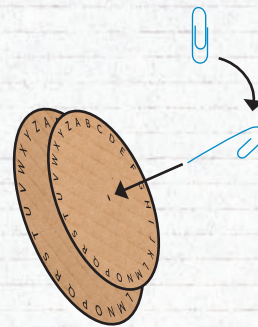
7.

**Find the middle of both discs and mark a small dot.**



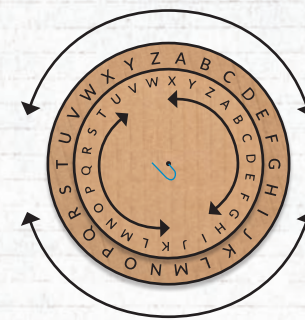
8.

**Carefully use a paperclip or scissors to punch a small hole in the exact centre of both discs.**



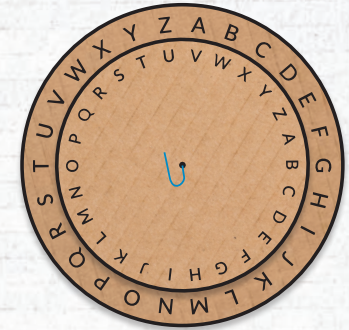
9.

**Join both discs together using a paperclip or paper fastener.**



10.

**Make sure both discs can spin freely, you may need to make the hole larger if it does not spin.**

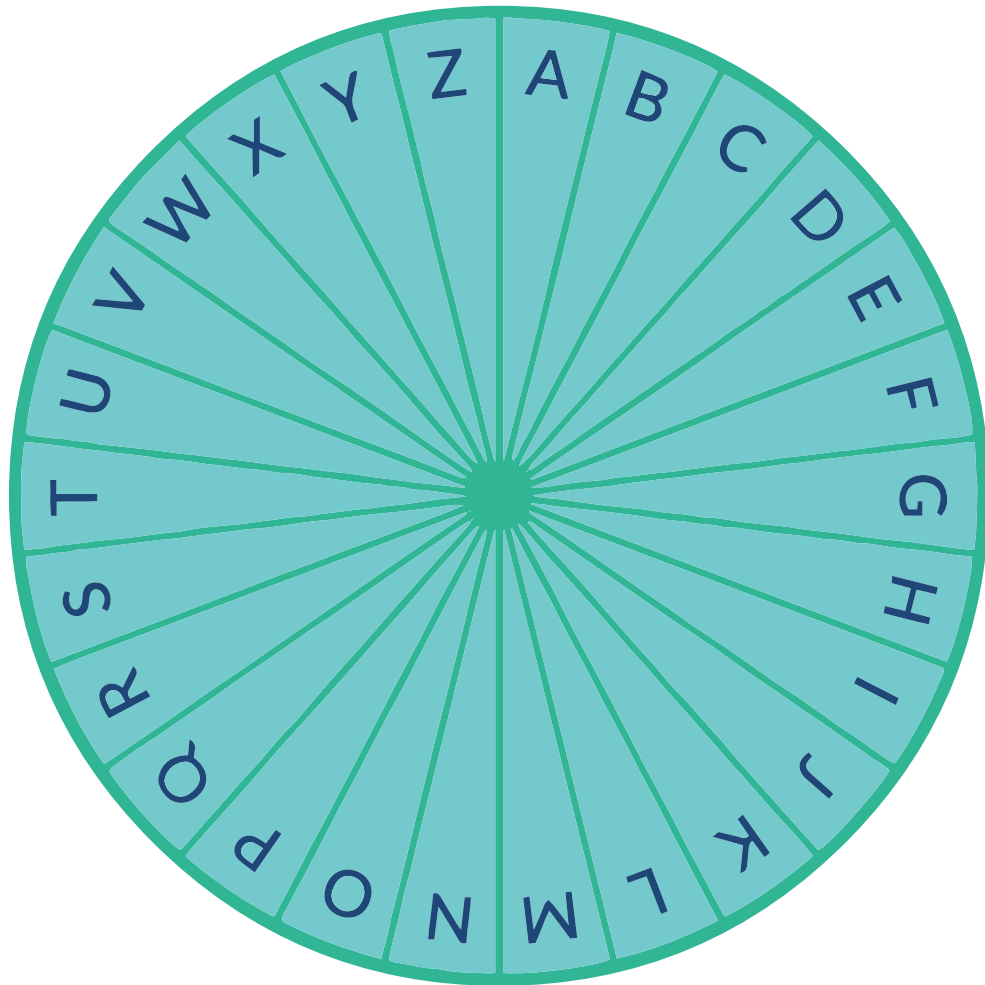


11.

**USE YOUR CAESAR WHEEL TO WRITE/ SOLVE A CAESAR CYPHER!**

H = C  
E = Z  
L = G  
L = G  
O = J

**CZGGJ**



## NEED A CHALLENGE?

If you complete all the activities and want to challenge yourself further:

1. Try to learn some new codes, what about a vigenere cypher? (look it up!)
2. Make your own code completely from scratch!
3. Share your code with someone else in your house and send each other messages.
4. Write a letter in secret code and post it to a friend (make sure you tell them how to solve it first!)

ANSWERS to questions on pages 6 & 7:  
MESSAGE ONE - Can you solve this code?  
MESSAGE TWO - What about this harder one?  
MESSAGE THREE - How about now?  
MESSAGE FOUR - Congratulations you solved them all

Once you've got your secret messages, share with us on:



[www.facebook.com/TheSmallpeiceTrust](https://www.facebook.com/TheSmallpeiceTrust)

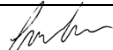


[www.twitter.com/SmallpeiceTrust](https://www.twitter.com/SmallpeiceTrust)  
Use the hashtag **#EngineeringAtHome**



[www.instagram.com/TheSmallpeiceTrust](https://www.instagram.com/TheSmallpeiceTrust)

## STEM Day Risk Assessment

<b>Risk Assessment for</b>	<b>Engineering at Home Projects</b>
<b>Assessment undertaken on</b>	31/03/2020
<b>Assessment undertaken by</b>	Jessica Lee
<b>Signed</b>	

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
1	General Activity and Workspace	<b>Slips, trips and falls:</b> Injury due to tripping over items	Students and adults	Activity supervised by adult supervisor. Deliverer reminds students about safety in video introduction.	M	Students and adults
2	Use of Materials: paper/card, plastic containers	<b>Injuries:</b> Injury due to paper cuts, cuts from sharp edges <b>Injuries:</b> Injury due to misuse	Students and adults	Activity supervised by adult supervisor.	L	Students and adults
3	Use of materials: elastic bands, sellotape, glue stick, blu-tack, small toys, paper fasteners, LEGO pieces, nuts & bolts or equivalent.	<b>Injuries:</b> Injury due to use as a missile <b>Slips, trips and falls:</b> Injury due to slipping on dropped items <b>Injuries:</b> Ingestion risk of choking.	Students and adults Students and adults Students and adults	Activity supervised by adult supervisor. Activity supervised by adult supervisor. Activity supervised by adult supervisor.	L	Students and adults
4	Use of materials: plastic, corrugated cardboard	<b>Injuries:</b> Cuts from sharp edges	Students and adults	Activity supervised by adult supervisor.	L	Students and adults

No.	Activity/area being assessed	Associated risk	Who is at risk?	Existing control measures in place?	Level of risk (low, medium, high)	Responsibility
5	Use of sharp tools: Scissors, craft knives	<p><b>Injuries:</b> Cut to self</p> <p><b>Behaviour:</b> Cut to others</p> <p><b>Behaviour:</b> Vandalism of property</p>	<p>Students</p> <p>Students and adults</p> <p>School or home</p>	<p>Activity supervised by adult supervisor.</p> <p>Activity supervised by adult supervisor.</p> <p>Activity supervised by adult supervisor.</p>	<p>M</p> <p>L</p> <p>L</p>	<p>Students and adults</p> <p>Students and adults</p> <p>Students and adults</p>
6	Testing of projects: bathtub, drop from height, items on floor	<p><b>Spillage of water on floor:</b> damage and injury due to slip</p> <p><b>Slip, trip or fall:</b> Injury due to falling from testing area, tripping over items in testing space</p>	<p>Students and adults</p> <p>Students and adults</p>	<p>Activity supervised by adult supervisor.</p> <p>Activity supervised by adult supervisor.</p>	<p>L</p> <p>L</p>	<p>Students and adults</p> <p>Students and adults</p>