

HOW TO ESCAPE

7 doors, each a puzzle in its own right – several have more than one part.

1. Work every part of a door on this pack and build its code.
2. Type the code into the terminal to open the door.
3. Write down the key digit it gives you.
4. Combine all 7 key digits into the master override and escape.

TEAM NAME

TERMINAL

🔒 DOOR 1 PERIODIC TABLE

GROUPS 1 & 7

Part 1. Halogens (IDs only) were added to solutions of the others' salts. ✓ = displacement, ✗ = none, · = not tested.

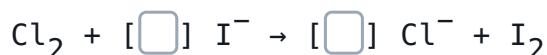
added ↓	1	2	5	8
1	—	✗	✗	✗
2	✓	—	·	✗
5	✓	·	—	✗
8	✓	✓	✓	—

Clue: halogen **5** is more reactive than halogen **2**.

Put the IDs in order most → least reactive.

Part 2. When potassium reacts with water, a gas is given off. Give the M_r of that gas.

Part 3. Balance the ionic equation, then say whether the bromide/iodide ions are oxidised or reduced (oxidised = 1 · reduced = 2).



The halide ions are

Door code = the reactivity IDs, then the M_r , then the coefficients, then the redox digit.

DOOR
CODE

KEY
DIGIT

Five unknown gases were tested. Identify each and read its code digit.

hydrogen = 3 · oxygen = 7 · carbon dioxide = 1 · chlorine = 9 · ammonia = 5

GAS 1

Damp red litmus paper turns blue.

code

GAS 2

It relights a glowing splint.

code

GAS 3

It bleaches damp litmus paper.

code

GAS 4

A lit splint gives a squeaky pop.

code

GAS 5

It turns limewater milky.

code

Precipitates. Each solution gives a coloured precipitate with sodium hydroxide. Identify the metal ion from its colour, then write its **charge** as the digit.

A red-brown precipitate

A blue precipitate

A green precipitate

Door code = the gas digits, then the precipitate charges, in order.

DOOR
CODE

KEY
DIGIT

For each salt, choose the correct **preparation method** and write its number. Use the solubility rules.

Methods: 1 = excess solid (metal / insoluble base / carbonate) + acid, then filter · 2 = titration (soluble alkali + acid) · 3 = precipitation (mix two solutions, filter)

Lead(II) sulfate

Magnesium chloride

Potassium nitrate

Iron(II) sulfate

Silver chloride

Sodium sulfate

Neutralisation. Complete the ionic equation for making water: $\text{H}^+ + \text{OH}^- \rightarrow ?$ then write the **number of hydrogen atoms** in the product.

Strength. Is ethanoic acid a strong or weak acid? (strong = 1 · weak = 2)

Reactive-metal soluble salt → titration; other soluble salt → excess; insoluble → precipitation. Door code = the method numbers, the H count, the strength digit, in order.

DOOR
CODE

KEY
DIGIT

Work out each answer and write it in the box.

$A_r: \text{Cu} = 64 \cdot \text{O} = 16$

1 Work out the M_r of copper(II) oxide, CuO.

2 Work out the % by mass of copper in CuO.

3 $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$. What mass of CuO forms from 128 g of copper?

4 How many moles are in 160 g of CuO?

Door code = the answers in order (numbers only, no units).

DOOR
CODE

KEY
DIGIT

Part 1. Classify each molecule as an alkane or an alkene from its formula. alkane = 1 · alkene = 2

C_2H_4

C_4H_{10}

C_3H_6

C_6H_{14}

Part 2. How many hydrogen atoms are in a molecule of C_6H_{14} ?

Isomers. How many structural isomers does C_5H_{12} have?

Combustion. Balance this complete-combustion equation and read the coefficients.



Alkanes fit C_nH_{2n+2} ; alkenes fit C_nH_{2n} . Door code = the classifications, then the Part 2 answer, the isomer count, the coefficients.

DOOR
CODE

KEY
DIGIT

Work out each **titre** (final – initial), pick the **concordant** results (within 0.10 cm³), then find their **mean titre**.

Run	Initial / cm ³	Final / cm ³	Titre / cm ³
Rough	0.00	22.50	
1	0.00	21.40	
2	0.30	21.75	
3	0.00	21.35	

Mean titre (cm³), then × 100

Method order. These steps are jumbled. Put them in the correct order and read their numbers.

4 Add a few drops of indicator to the acid.

7 Pipette 25.0 cm³ of acid into a conical flask.

3 Run alkali in until the colour changes.

9 Record the final burette reading.

Ignore the rough run and any non-concordant titre. Door code = the mean titre × 100, then the step numbers in order.

DOOR
CODE

KEY
DIGIT

Part 1. Classify each molecule as an alcohol or a carboxylic acid. alcohol = 1 · carboxylic acid = 2

CH₃OH

C₂H₅COOH

C₄H₉OH

CH₃COOH

Part 2. How many carbon atoms are in propanoic acid, C₂H₅COOH?

Esters. How many oxygen atoms are in the ester group -COO-?

Alcohols contain -OH; carboxylic acids contain -COOH. Door code = the classifications, then the Part 2 answer, the ester answer.

DOOR
CODE

KEY
DIGIT

Each clue gives only a **type** of element. Exactly one element of that type is hidden in the grid – **find it**, then write the **chemical symbol** of each element (find iron → write **Fe**). Enter them in order 1–4 for the code.

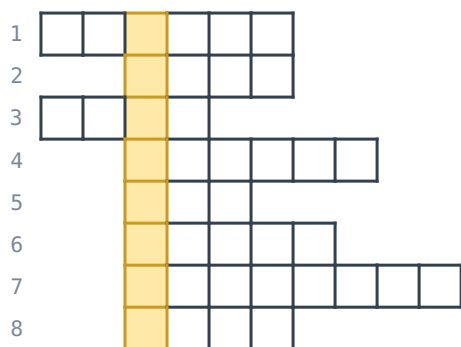
V	K	D	B	Z	S	F	D	D	H	A	R	V
C	K	S	O	D	I	U	M	R	H	W	M	C
A	O	Z	V	A	R	K	F	O	Y	S	A	I
D	H	P	U	Y	Z	G	I	M	Z	I	A	E
D	N	M	P	X	E	H	C	J	M	Y	J	F
U	N	X	I	E	P	E	F	B	J	T	H	U
M	T	R	H	G	R	Y	K	S	X	L	N	P
U	N	V	I	A	E	N	I	R	O	L	H	C
I	A	I	W	J	U	G	I	Y	D	T	V	S
C	M	U	H	R	Y	D	M	L	D	V	X	D
L	I	A	L	O	L	D	G	U	E	Z	E	B
A	D	N	L	J	B	Q	T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

1. An alkali metal
2. An alkaline earth metal
3. A transition metal
4. A halogen

CODE

The clue only tells you the group – the grid tells you which element it is.

Solve the clues, one letter per box. The **shaded column**, top to bottom, spells the vault password.



1. The alkane with two carbon atoms (6)
2. A substance with a pH below 7 (4)
3. Formed when an acid neutralises a base (4)
4. Gas that relights a glowing splint (6)
5. The state of matter that fills its container (3)
6. Sweet-smelling product of an alcohol + acid (5)
7. Makes up about 78% of the air (8)
8. Sodium chloride is common ____ (4)

Every answer crosses the shaded column at one letter.

DOOR
CODE

MASTER OVERRIDE

Every door green? Write your key digits in order, then enter the master code to escape.

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DOOR 1 DOOR 2 DOOR 3 DOOR 4 DOOR 5 DOOR 6 DOOR 7

MELTDOWN OVERRIDE: enter your key digits REVERSED - last door first.

Enter codes at: _____