

HOW TO ESCAPE

6 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 6 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 ↓	3	5	8
3	—	✗	✗
5	✓	—	✓
8	✓	✗	—

Put the IDs in order most → least reactive.

Part 2. (increases = 1 · decreases = 2) going **down** Group 1, reactivity and going **down** Group 7, reactivity .

Part 3. When potassium reacts with water, a gas is given off. Give the M_r of that gas.

Door code = the reactivity IDs, then the trend digits, then the M_r

DOOR
CODE

KEY
DIGIT

Four 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

A lit splint gives a squeaky pop.

code

GAS 3

It turns limewater milky.

code

GAS 4

It relights a glowing splint.

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 green precipitate

A blue 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)

Magnesium sulfate

Potassium nitrate

Silver chloride

Copper(II) nitrate

Barium sulfate

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

DOOR
CODE

KEY
DIGIT

Work out each answer and write it in the box.

A_r : Ca = 40 · C = 12 · O = 16

1 Work out the M_r of calcium carbonate, CaCO_3 .

2 Work out the % by mass of calcium in CaCO_3 .

3 $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$. What mass of CaO forms from 100 g of CaCO_3 ?

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_4H_{10}

C_2H_4

C_5H_{12}

C_3H_6

Part 2. How many carbon atoms are in a molecule of C_5H_{12} ?

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

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

DOOR
CODE

KEY
DIGIT

🔒 DOOR 6 TITRATION

READ THE BURETTE

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	26.10	
1	0.00	23.20	
2	0.10	23.35	
3	0.00	23.15	

Mean titre (cm³), then × 100

Ignore the rough run and any non-concordant titre. Door code = the mean titre × 100.

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.

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

1. A Group 1 metal
2. A Group 2 metal
3. A transition metal
4. A Group 7 element (a halogen)

CODE 1 2 3 4

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

MASTER OVERRIDE

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

DOOR 1

DOOR 2

DOOR 3

DOOR 4

DOOR 5

DOOR 6

Enter codes at: _____