

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 PARTICLE THEORY

CENSUS

These elements were logged. Work through them one at a time.

Br	Hg	H	O	Cu	Fe	Cl	Na	Ne
Ca	I	N						

How many are **liquid at 25 °C**?

How many are **gases at 25 °C**?

How many are **diatomic molecules**?

Code = the counts in that order. Careful: a solid can still be diatomic, and not every gas is diatomic.

DOOR
CODE

KEY
DIGIT

Part 1. Work out the structure of each substance from its properties.

ionic = 1 · simple molecular = 2 · giant covalent = 3 · metallic = 4

Sub.	m.p. / °C	Conducts (solid)	Conducts (molten)	In water	Other	Type
Y	1610	no	no	insoluble	hard, glassy	
W	1465	no	yes	dissolves	white crystals	
Z	1538	yes	yes	insoluble	strong metal	

Part 2. Give the **charge** (just the number) on the ion of each of these. You are expected to know them.

Potassium

Oxide

Iron(III)

Bromide

Door code = the structure types, then the ion charges.

DOOR
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KEY
DIGIT

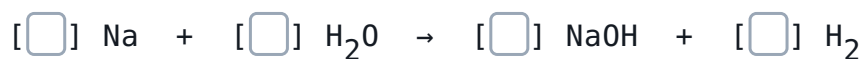
Part 1. The metal samples, each with an **ID number**, were added to solutions of the others' sulfates (the columns). ✓ = a reaction, ✗ = none, · = not tested. The ID numbers are only labels.

ID ↓	1	5	6	8
1	—	✗	·	✗
5	✓	—	✗	·
6	·	✓	—	✓
8	✓	·	✗	—

Clue: in the same dilute acid, metal **8** fizzed harder than metal **5**.

Put the ID numbers in order from **most** to **least** reactive - that sequence is the code.

Part 2. Balance the reaction and read the coefficients left to right.



Door code = the reactivity IDs in order, then the coefficients.

DOOR
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Every tube holds an identical iron nail. **Rank only the tubes that rust**, fastest first, and read their numbers in that order. Leave out any that will not rust at all.

TUBE 2

iron nail in 5% salt water, open to the air

rank

TUBE 6

iron nail in 3% salt water, open to the air

rank

TUBE 4

iron nail in 1% salt water, open to the air

rank

TUBE 8

iron nail in plain water, open to the air

rank

TUBE 5

iron nail in water, sealed under nitrogen gas

rank

TUBE 1

iron nail with a magnesium strip, in water, open to the air

rank

Both water and oxygen are needed to rust; dissolved salt speeds it up. Watch for traps.

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A single flask holds **sand, iron filings, copper(II) sulfate, water and ethanol**. Recover **every** substance, pure and separate.

Choose the techniques you need and put them in the **order you would use them**. Some are decoys. Read the numbers in your chosen order.

4 Using a magnet

6 Filtration

3 Fractional distillation

8 Crystallisation

1 Simple distillation

9 Chromatography

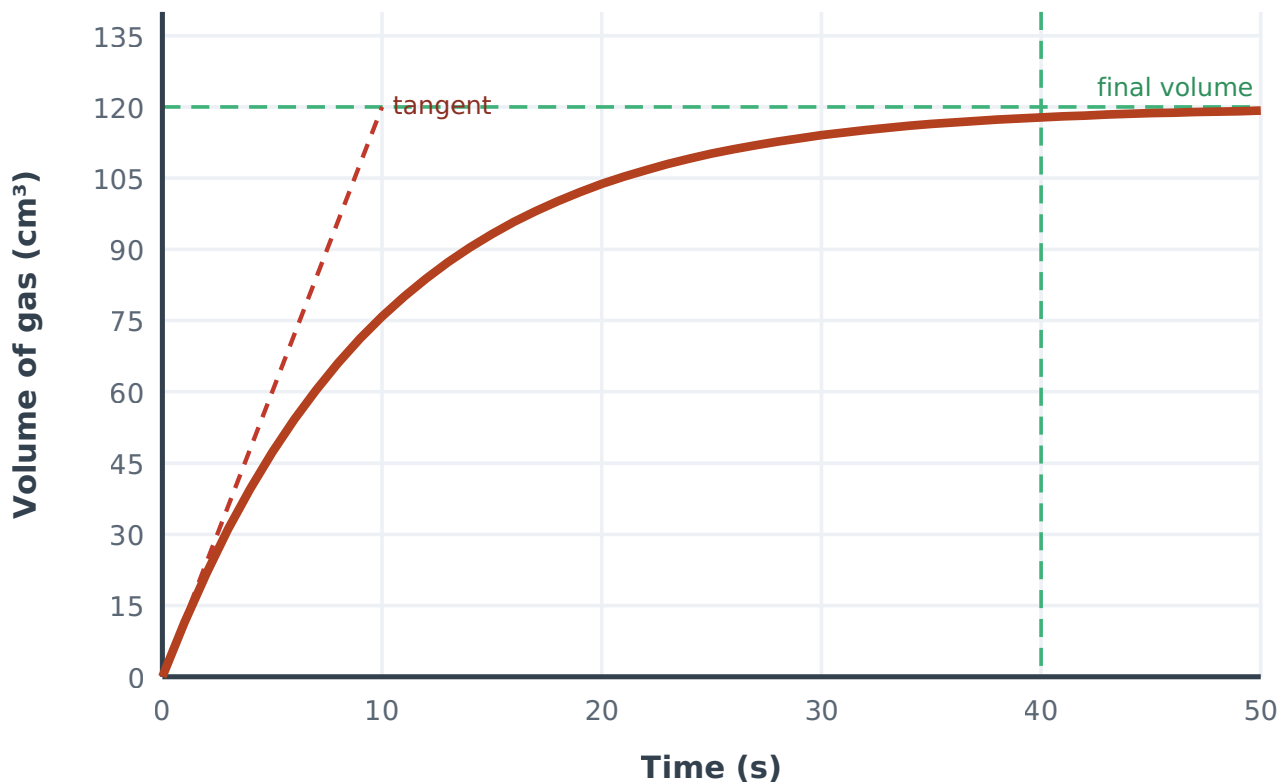
ORDER → →

Remove the magnetic solid first, then the insoluble one, before you split the liquids. Ethanol and water need fractional distillation.

DOOR
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The graph shows the gas given off as marble chips react with dilute acid.



1 Initial rate: gradient of the tangent at $t = 0$, in cm^3/s

2 Average rate over the whole reaction, in cm^3/s

3 The run is repeated with **half** the concentration: the initial rate now, in cm^3/s

Door code = the answers in order. The green lines mark the final volume and the time the reaction finishes. Read the tangent's gradient from two points on it.

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.

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

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: _____

Command Challenges (optional finals), shared by all groups — answers: The Core → **SHUT IT DOWN** (atomic numbers to letters). Chain Reaction → **212** g (steps: 44, 2, 48, 4, 160, 212). The Unknown → **CaBr₂** (calcium + bromide; $0.025 : 0.05 = 1 : 2$). Deadlock → **57492** (1 iron, 2 sodium chloride, 3 copper(II) sulfate, 4 zinc, 5 calcium carbonate).