

YOU ESCAPED — BUT THE SYSTEM ISN'T CLEAR

Four command-level overrides remain: optional and hard. Solve any on paper, then enter the answer on the escape screen under **Command Challenges**.

🔒 CHALLENGE 1 THE SIGNAL

ELEMENTAL CIPHER

The system needs one command to stabilise. It is hidden in these nine element tiles.

Si h tile, find the element's **atomic number**, then turn it into a letter (**1 = A, 2 = B ... 26 = Z**). Read the letters as a command.

Type the command into **The Signal** on the escape screen.

A 500 cm³ flask is filled with clean, dry air.

Gas	% of clean, dry air
Nitrogen	78
Oxygen	21
Argon	~1
Carbon dioxide	0.04

1 What volume of **nitrogen** is in the flask? (cm³)

2 What volume of **oxygen** is in the flask? (cm³)

Enter the nitrogen volume then the oxygen volume into **Atmosphere**.

🔒 CHALLENGE 3 PERCENTAGE YIELD

REACTING MASS + YIELD

Industrial hydration of ethene makes ethanol: $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$.

A_r : C = 12 · H = 1 · O = 16

1 What is the **maximum (theoretical) mass** of ethanol from **28 g** of ethene? (g)

2 The reaction actually made **34.5 g** of ethanol. What is the **percentage yield**?

Enter the theoretical mass then the % yield into **Percentage Yield**.

CHALLENGE 4 AVOGADRO

PARTICLES TO MASS

A flask holds 1.204×10^{24} molecules of oxygen, O_2 .

$A_r: O = 16 \cdot \text{Avogadro constant} = 6.02 \times 10^{23}$ per mole

1 How many **moles** of O_2 are in the flask?

2 What is the **mass** of this oxygen? (g)

Enter the moles then the mass into **Avogadro**.

🔒 CHALLENGE 5 LOCKDOWN CORE

LIMITING REAGENT

The core mixes **8 mol of magnesium** with **3 mol of oxygen**: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$.

1 How many **moles of MgO** are produced?

2 How many **moles of the excess reagent** are left over?

Work out which reagent runs out first. Enter the MgO moles then the excess moles into **Lockdown Core**.