PUZZLE BOOK

SPACECHEM

WHAT IS SPACECHEM?

SpaceChem: Paper Edition is a paper adaptation of the puzzle game *SpaceChem,* by Zachtronics.

In this puzzle book you will "program" chemical reactors by drawing lines to combine letters like "C" and "H" (atoms) into specific sequences like "HCCH" (molecules). It would be wise to use a pencil, as you're likely to make mistakes!

YOUR OBJECTIVE

Draw a line from each **START** square to an **OUT** square so the line runs through letters "spelling out" the **sequence** of the molecule next to the OUT square.

Each START and OUT square may connect to only one line. Since the number of START squares is always equal to the number of OUT squares, you may only draw as many lines as there are START squares in the puzzle.

AN EXAMPLE

In the example below, the sequence "HNHH" must be spelled out. Because the line passes through the letters "H", "N", "H", and "H", while connecting a START to the OUT, this is a valid solution.

START H N H OUT ψ ψ

Ammonia (NH_3)
HNHH

VALID LINES

A valid line must start in a START square and end in an OUT square. It must be the only line leaving that START square and the only line entering that OUT square.

Generally speaking, a square may only be crossed once, by any line. The exception to this is the "double-cross", where a square is crossed straight through in each direction.

A line may "turn" and change direction in a square, but doing so prevents that square from being crossed again in the future.

START and END squares may not be crossed. Lines may only leave START squares and enter END squares.

The following lines are valid:
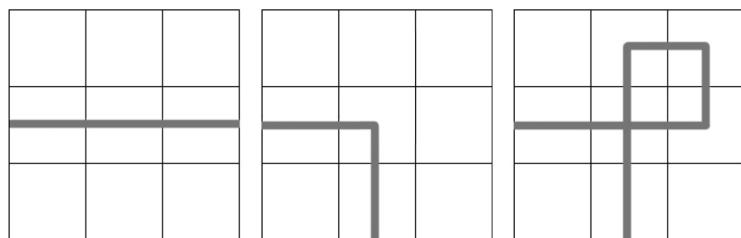
The following lines are invalid:
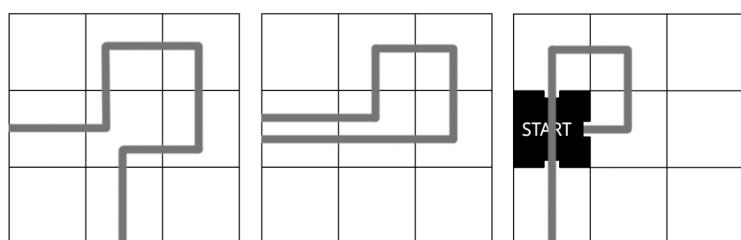
START

START

LOOKING FOR MORE?

If you enjoy solving the puzzles in *SpaceChem: Paper Edition*, you'll love the PC (or iPad, or Android) version as well. Visit spacechemthegame.com to find out more!

**START** | H | N | H | **OUT ψ** | ψ — Ammonia (NH$_3$) **HNHH**

START | H | C | H | **OUT ψ** | ψ — Methane (CH$_4$) **HHCHH**

START | O | **OUT ψ** | ψ — Oxygen (O$_2$) **OO**

START | O ... H | **OUT ψ** | ψ — Water (H$_2$O) **HOH**

START | H ... C | **OUT ψ** | ψ — Acetylene (C$_2$H$_2$) **HCCH**

START | H H H ... C ... H O O | **OUT ψ** | ψ — Acetic Acid (CH$_3$COOH) **CHHHCOOH**

START | H H H ... C ... O | **OUT ψ** | ψ — Methanol (CH$_3$OH) **CHHHOH**

START | C C ... H H H ... C C | **OUT ψ** | ψ — Ethane (C$_2$H$_6$) **HHHCCHHH**
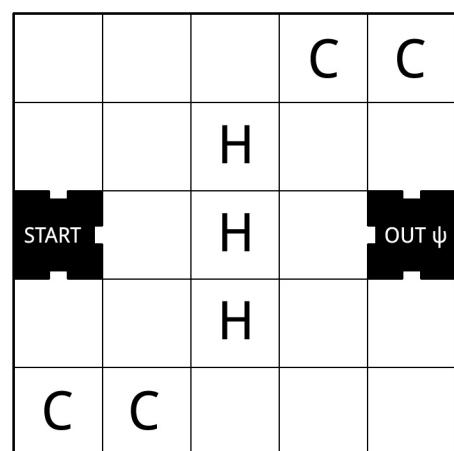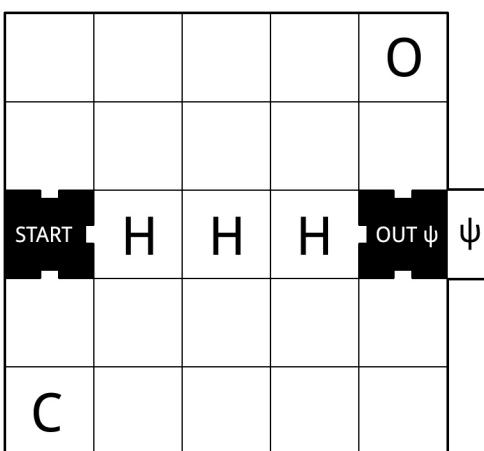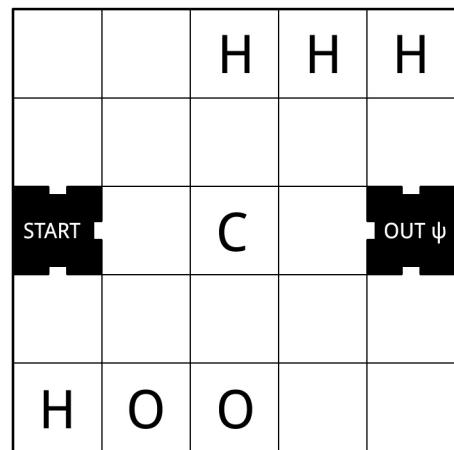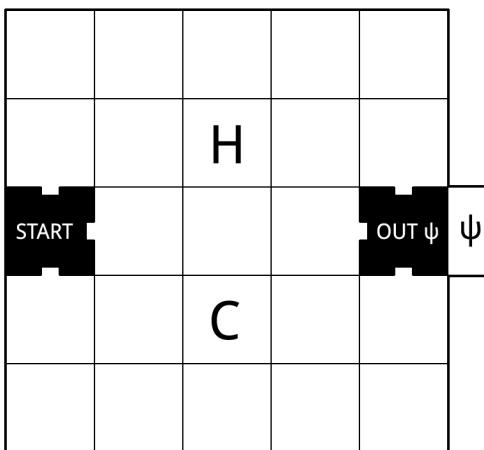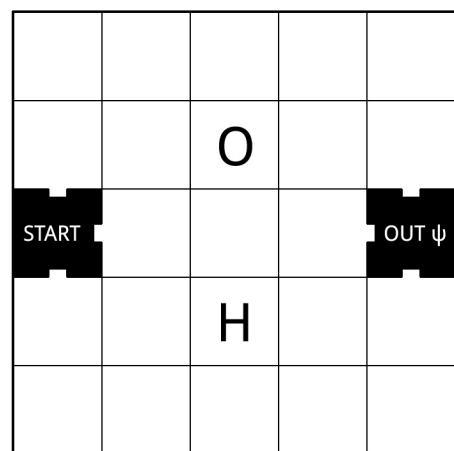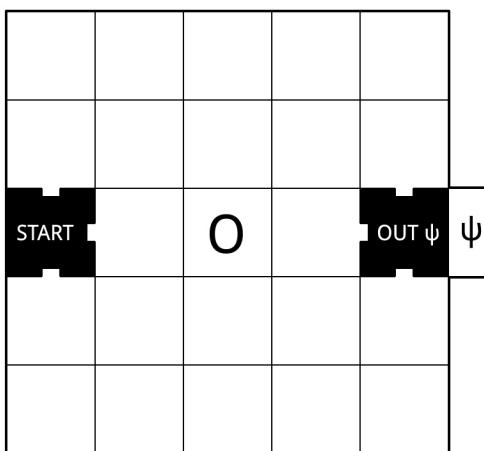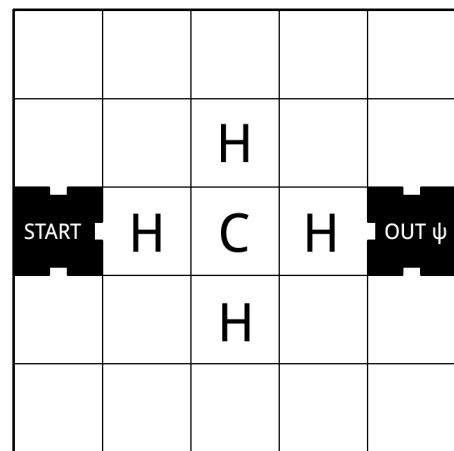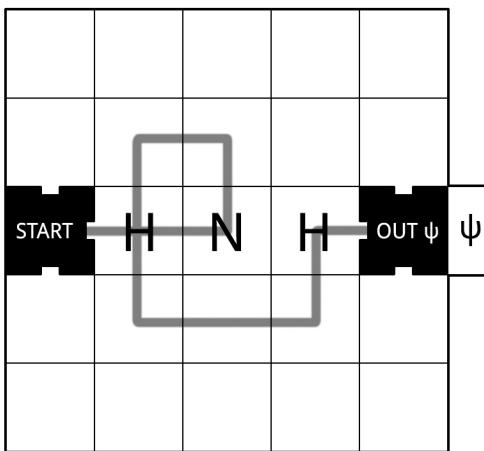
# ⬡ DUAL LINES

When a puzzle includes two START squares and two OUT squares, you must draw two lines instead of one.

A line may only cross another line in the same way that it may cross itself: by "double-crossing" perpendicularly.

Water (H₂O)
HOH

Oxygen (O₂)
OO

Carbon Monoxide (CO)
CO

Hydrogen (H₂)
HH

Oxygen (O₂)
OO

Nitrogen (N₂)
NN

Hydrogen Cyanide (HCN)
HCN

Ammonia (NH₃)
NHHH

Acetylene (C₂H₂)
HCCH

Methane (CH₄)
HHCHH
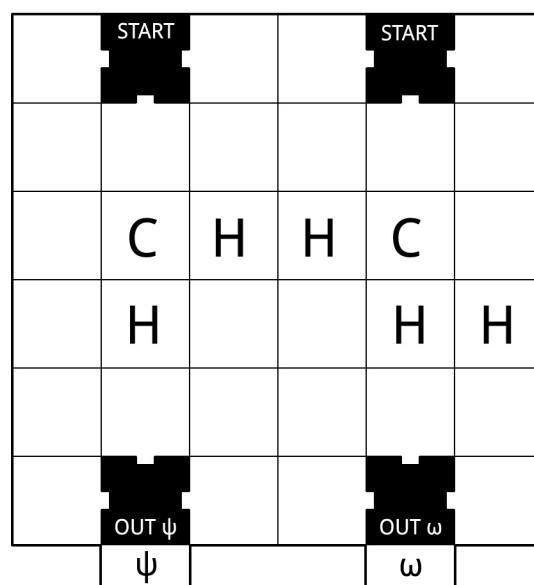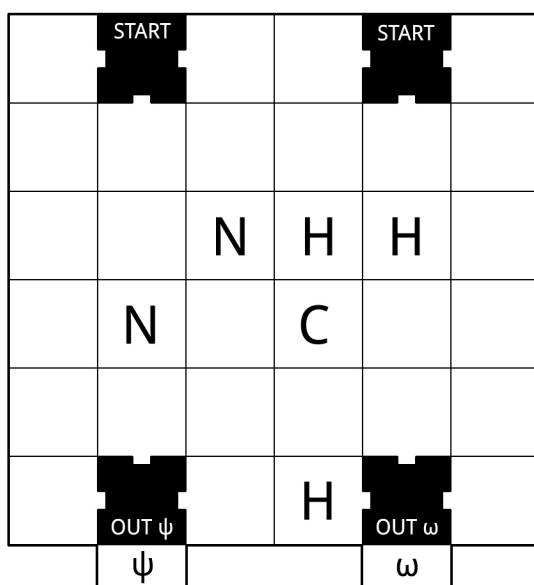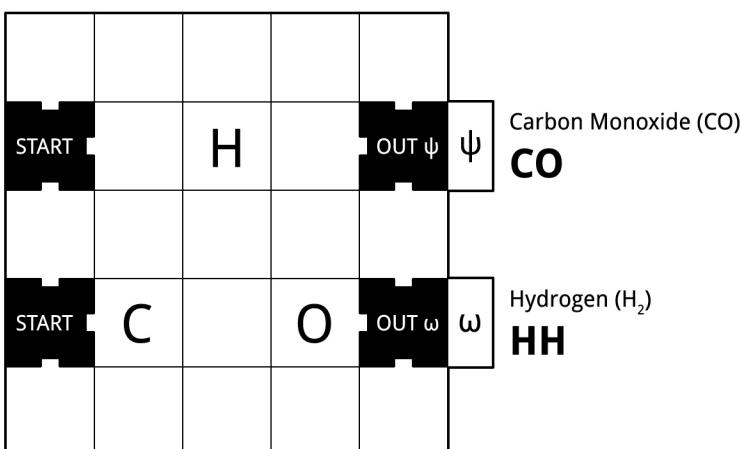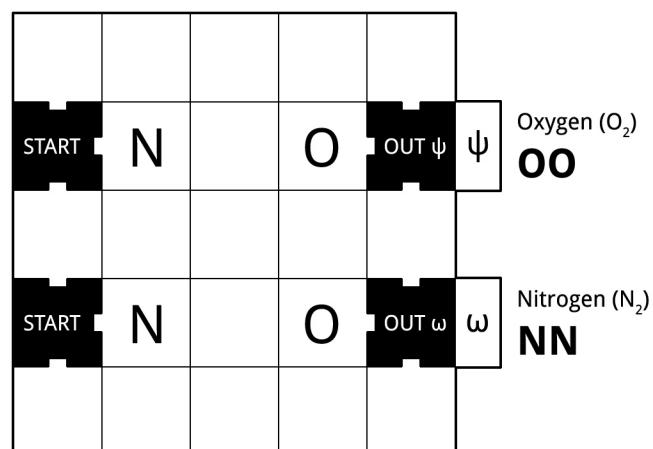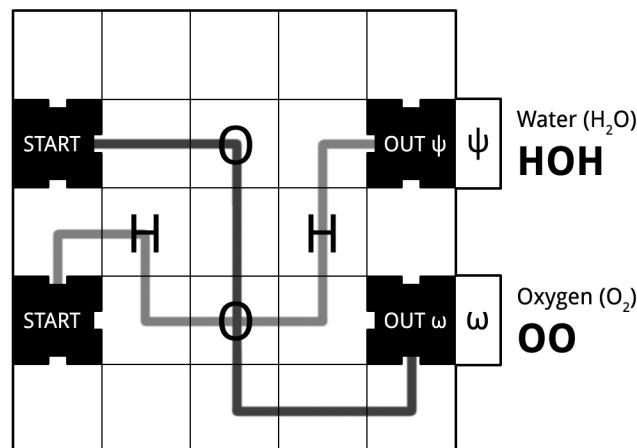
⬡ PIPELINE PUZZLES

Multiple puzzle grids can be connected together to create a **pipeline**. When a **connection** is drawn between an **output** on one grid and an **input** on another, the sequence sent to the corresponding OUT square can be "imported" by drawing a line over the corresponding IN square.

In the example below, the first grid outputs "HH" at the ω output. The "HH" sequence then enters the second grid at the β input. When a line is drawn over the "IN β" square in the second grid, it is equivalent to drawing a line over two "H" squares at once. Thus, the sequence "IN β", "C", "IN β" becomes "HHCHH".

Connections are fixed in the next few puzzles, but you will draw your own later on!
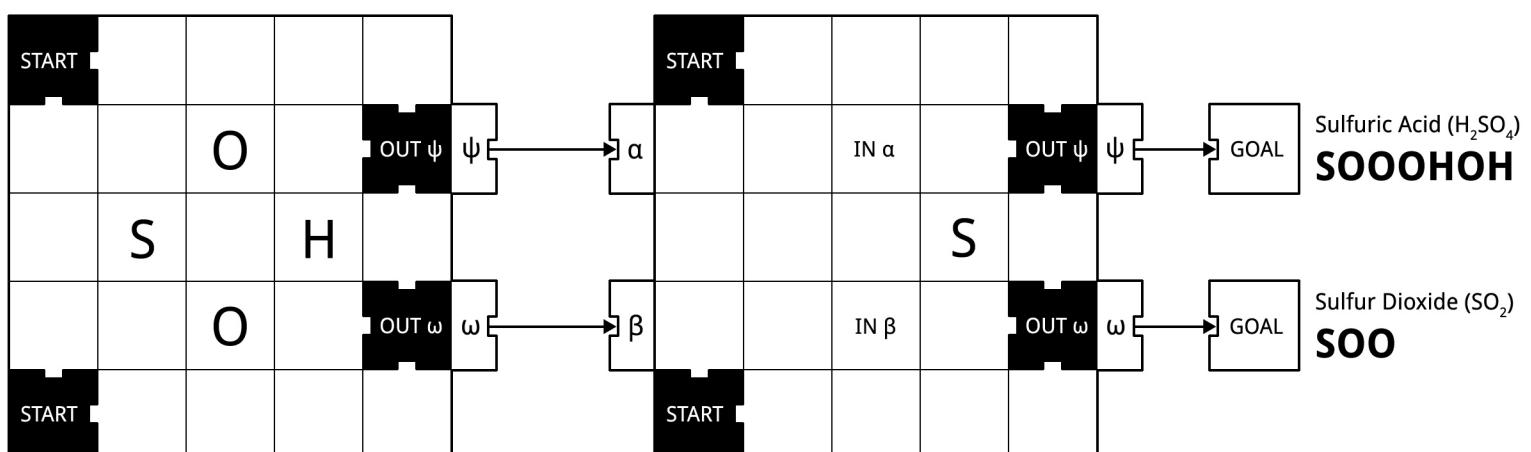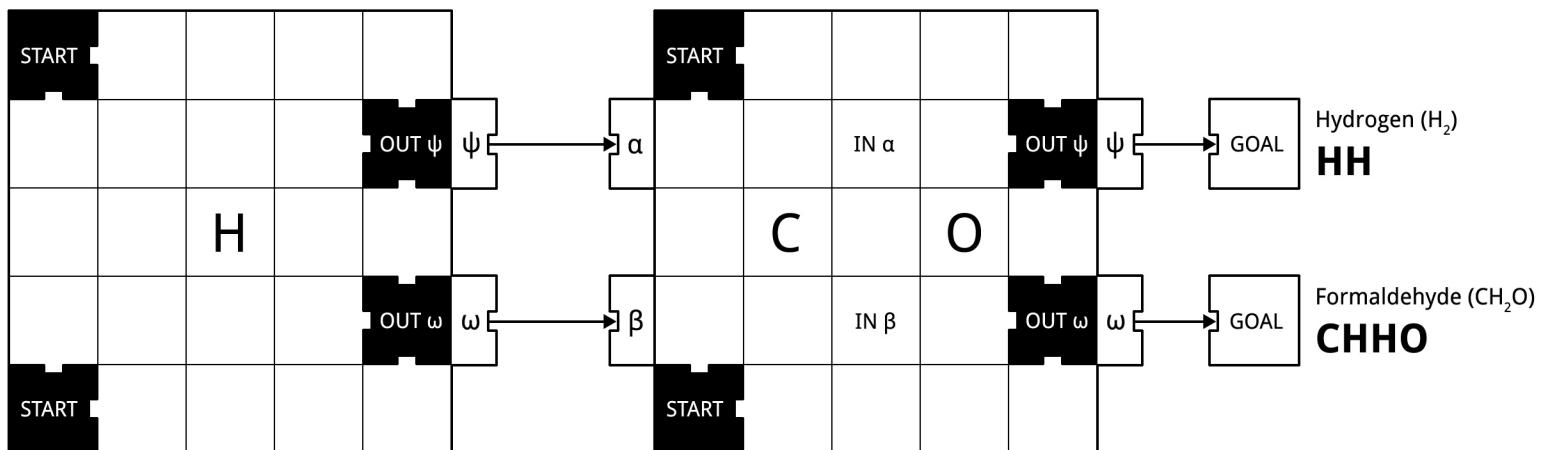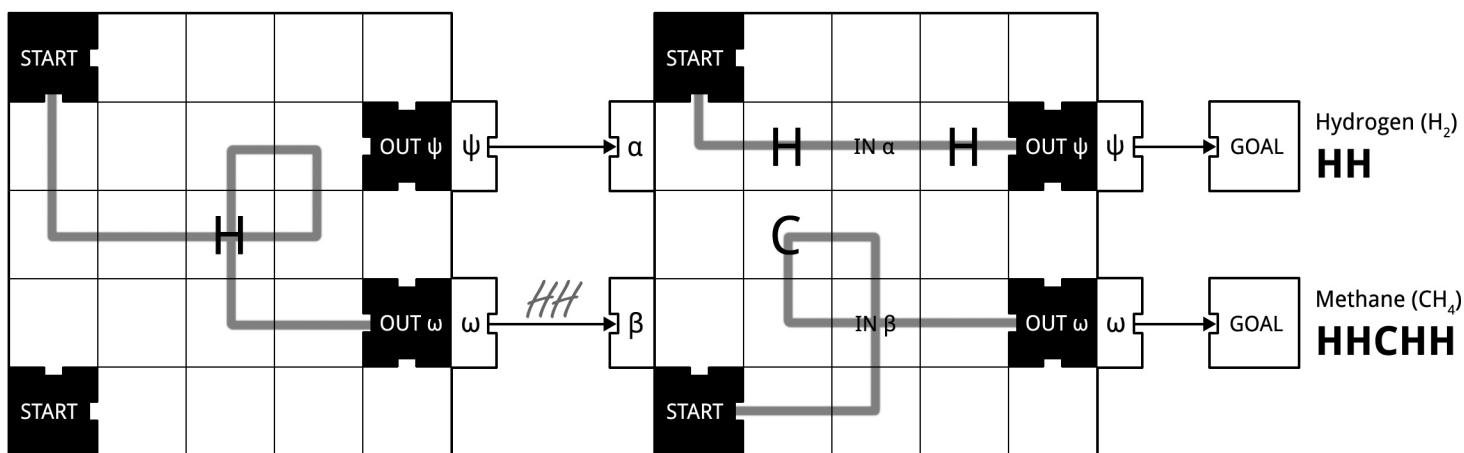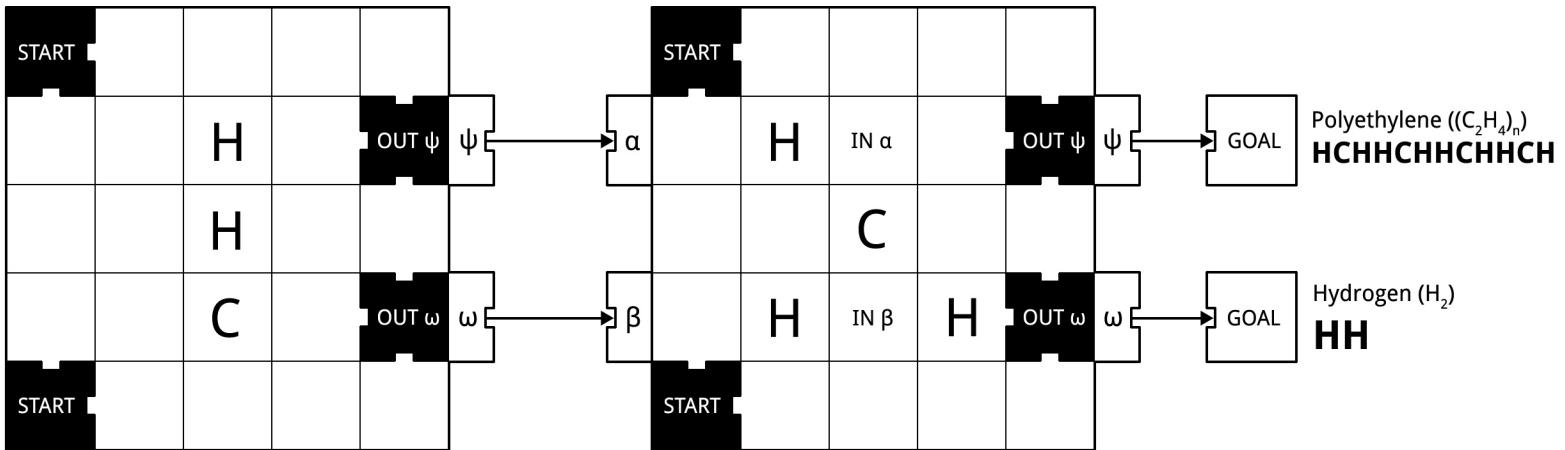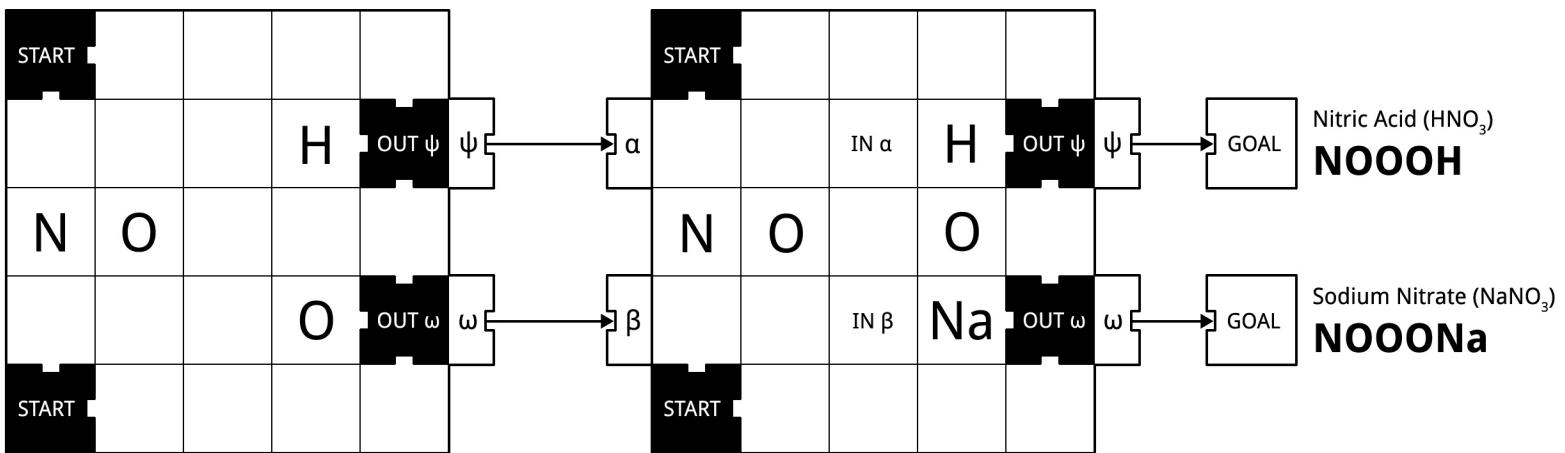
START ... OUT ψ — ψ → α ... IN α H — H OUT ψ ψ → GOAL	Hydrogen (H$_2$) **HH**
H ... OUT ω ω *HH* → β ... C ... IN β OUT ω ω → GOAL	Methane (CH$_4$) **HHCHH**

START ... OUT ψ ψ → α ... IN α OUT ψ ψ → GOAL	Hydrogen (H$_2$) **HH**
H ... OUT ω ω → β ... C O ... IN β OUT ω ω → GOAL	Formaldehyde (CH$_2$O) **CHHO**

START ... O OUT ψ ψ → α ... IN α OUT ψ ψ → GOAL	Sulfuric Acid (H$_2$SO$_4$) **SOOOHOH**
S H ... O OUT ω ω → β ... S IN β OUT ω ω → GOAL	Sulfur Dioxide (SO$_2$) **SOO**

Puzzle 1

START

			H	OUT ψ	ψ
N	O				
			O	OUT ω	ω

START

→ α

→ β

IN α

		H	OUT ψ	ψ
N	O	O		
		Na	OUT ω	ω

START / START

→ GOAL — Nitric Acid (HNO$_3$) **NOOOH**

→ GOAL — Sodium Nitrate (NaNO$_3$) **NOOONa**

Puzzle 2

START

	H		OUT ψ	ψ
	H			
	C		OUT ω	ω

START

→ α

→ β

	H	IN α	OUT ψ	ψ
	C			
	H	H	OUT ω	ω

IN β

→ GOAL — Polyethylene ((C_2H_4)$_n$) **HCHHCHHCHHCH**

→ GOAL — Hydrogen (H$_2$) **HH**

Grid 1 (top-left)

START		START	
H	H	H	H
N	O	O	N
OUT ψ		OUT ω	
ψ		ω	

Ammonia (NH₃) — **NHHH**

Nitric Acid (HNO₃) — **HONOO**

Ammonia (NH$_3$)
NHHH

Nitric Acid (HNO$_3$)
HONOO

Grid 2 (top-right)

START   START

C H H H

H

C H H

OUT ψ   OUT ω

ψ   ω
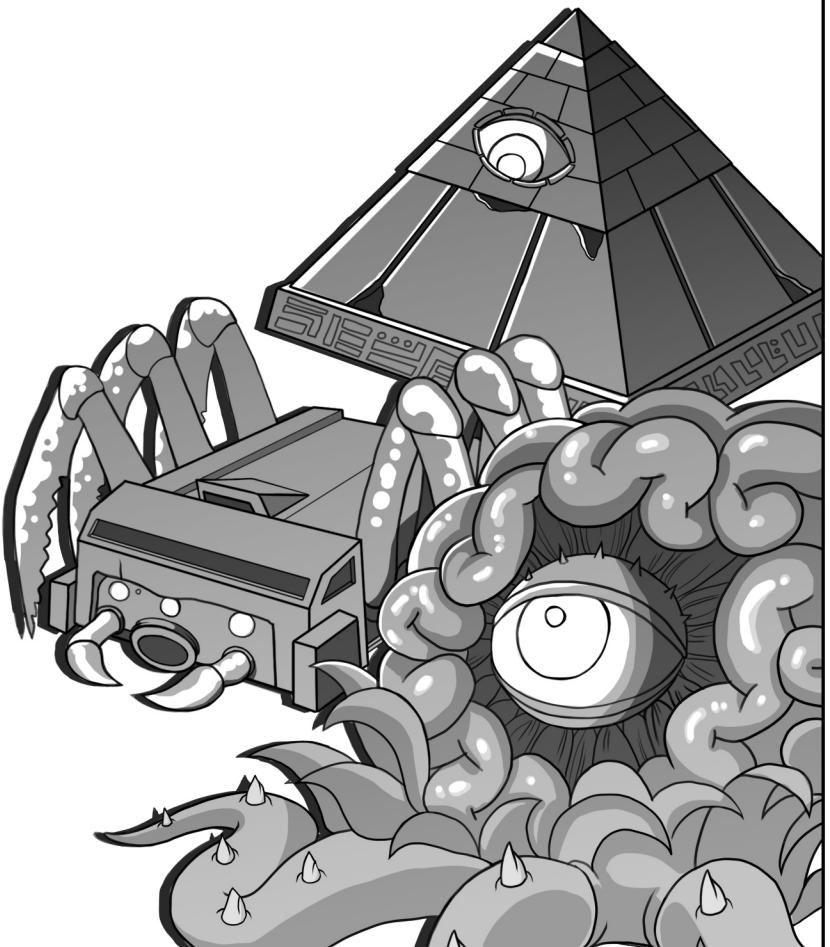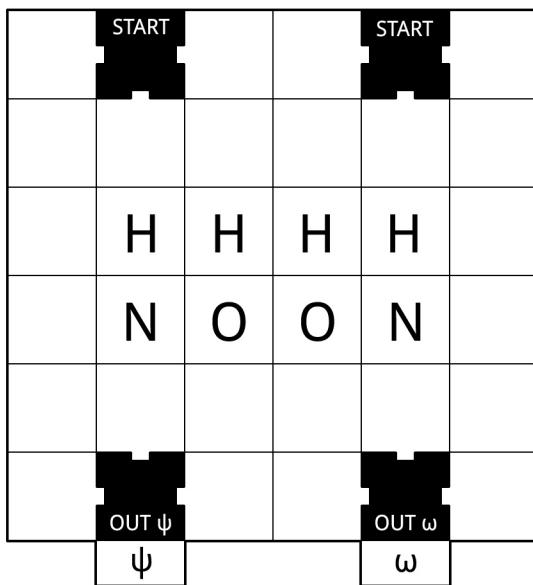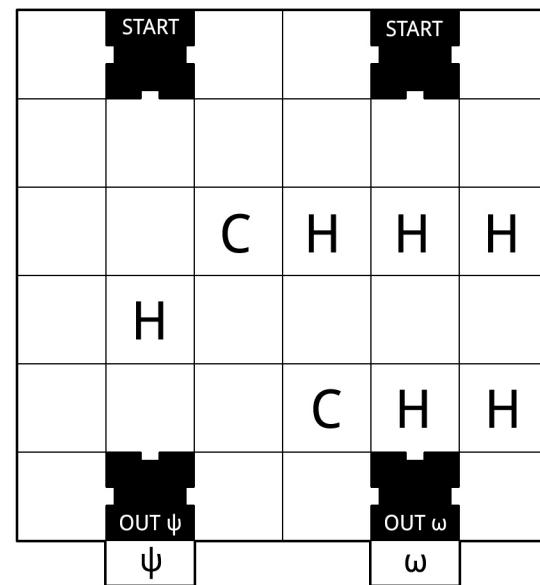
Acetylene (C$_2$H$_2$)
HCCH

Ethane (C$_2$H$_6$)
HHHCCHHH

Grid 3 (bottom-left)

START   START

H C

O H H H

H H O

OUT ψ   OUT ω

ψ   ω
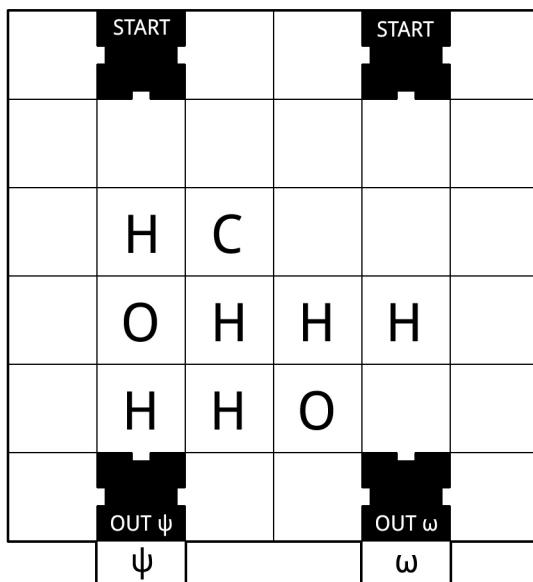
Water (H$_2$O)
HOH

Ethanol (C$_2$H$_5$OH)
CHHHCHHOH

Grid 4 (bottom-right)

START   START

H C H C H

C H C H C

C H H

OUT ψ   OUT ω

ψ   ω
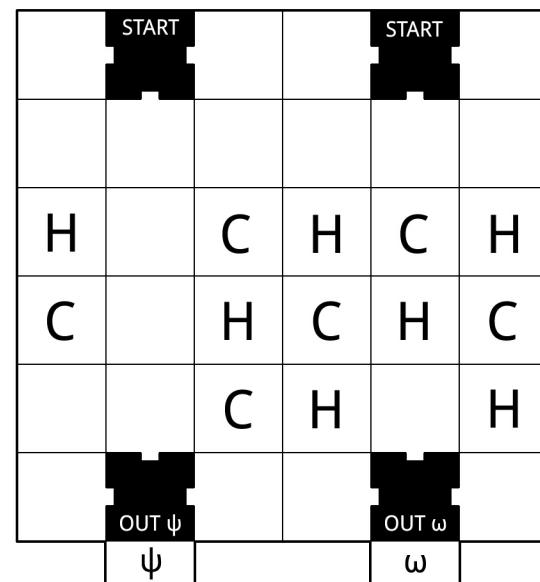
Acetylene (C$_2$H$_2$)
HCCH

Benzene (C$_6$H$_6$)
CHCHCHCHCHCH

⬡ CUSTOM CONNECTIONS

In the following pipeline puzzles, you must draw in your own connections. In addition to connecting one puzzle grid to another, this allows you to connect a puzzle grid's output to an input on the very same puzzle grid!

Formaldehyde (CH₂O)
CHHO

Water (H₂O)
HOH

Benzene (C₆H₆)
CHCHCHCHCHCH

START H OUT ψ ψ
O
H OUT ω ω
START

START IN α OUT ψ ψ
α
H
β IN β OUT ω ω
START

GOAL · Ethanol (C$_2$H$_5$OH)
CHHHCHHOH

START H OUT ψ ψ
C
H OUT ω ω
START

START IN α OUT ψ ψ
α
H O
β IN β OUT ω ω
START
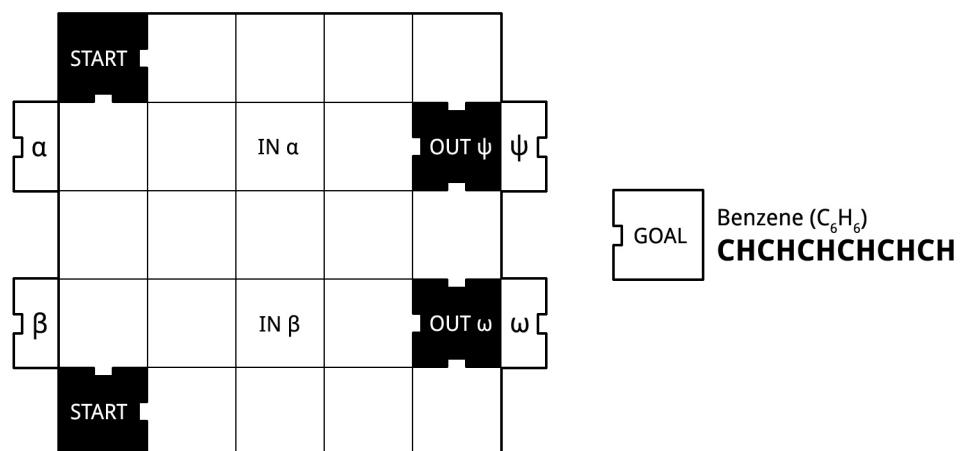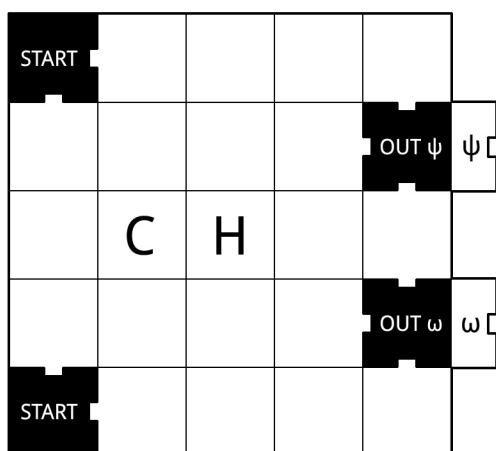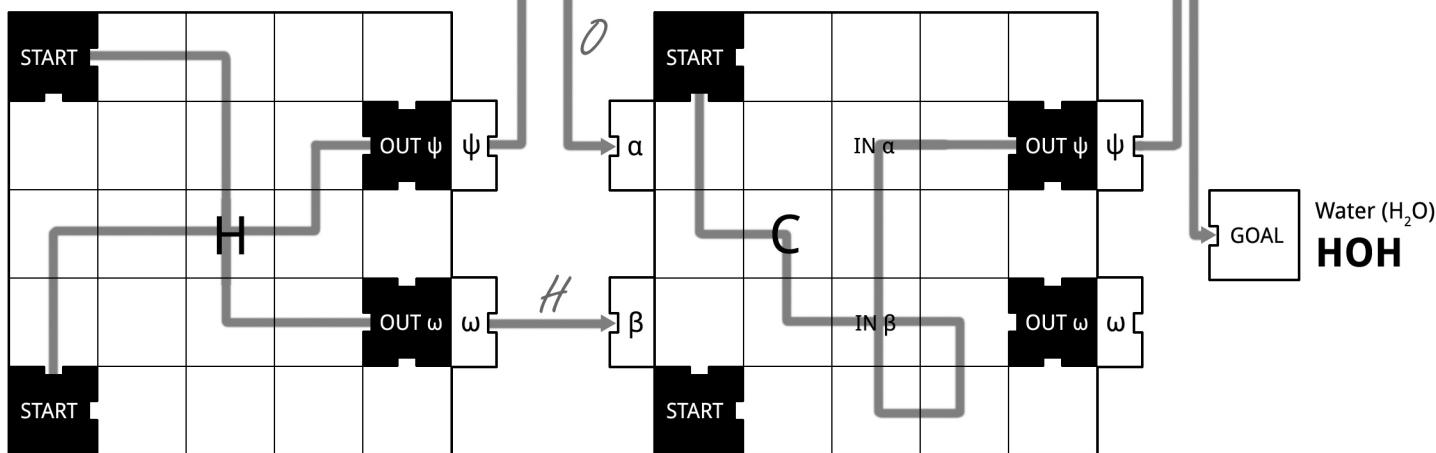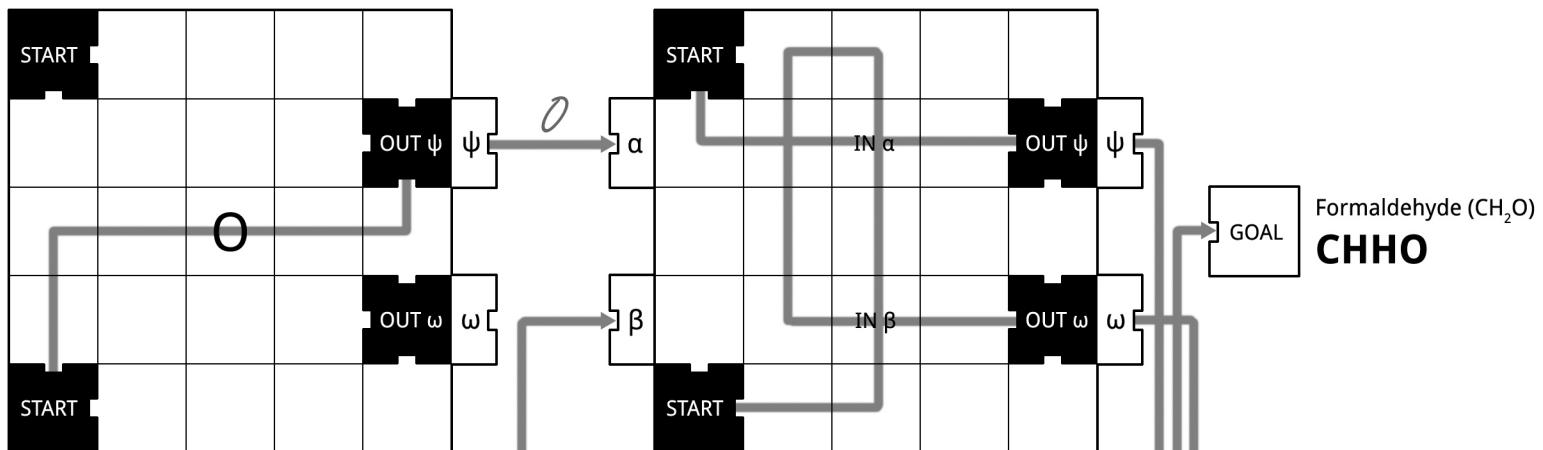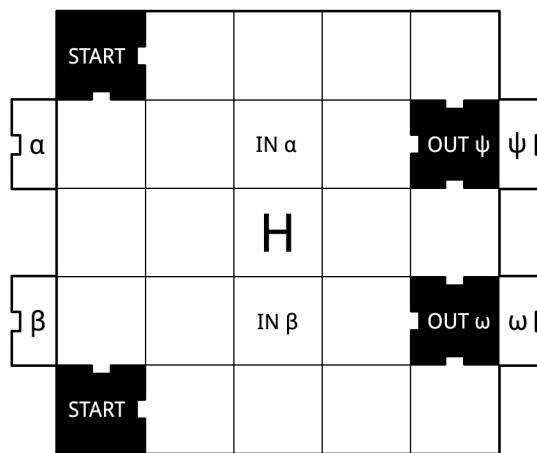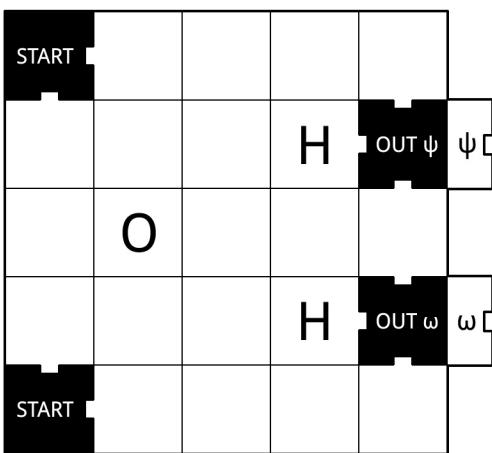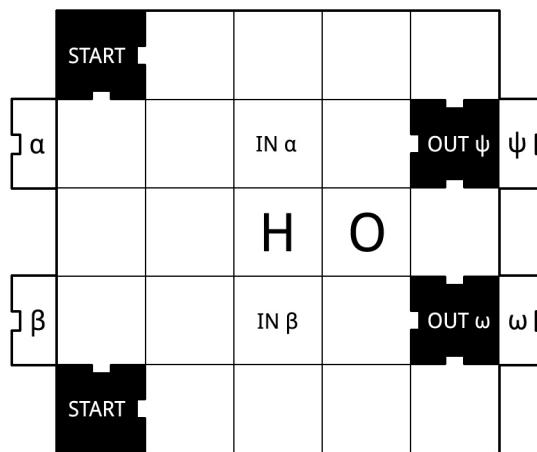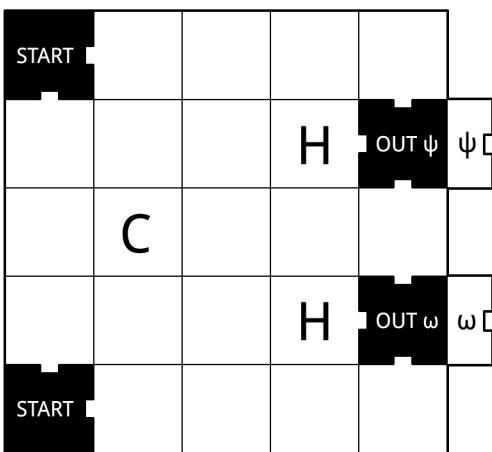
GOAL · Acetaldehyde (CH$_3$CHO)
CHHHCHO

START H OUT ψ ψ
H O
C OUT ω ω
START

START IN α OUT ψ ψ
α
C C O H
β IN β OUT ω ω
START
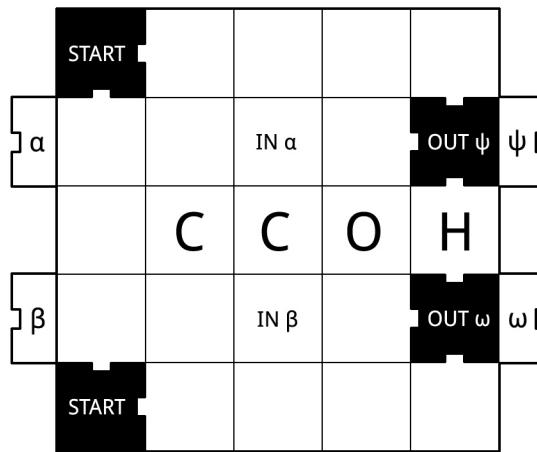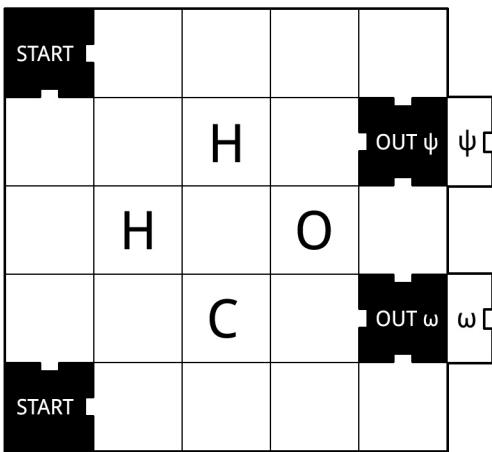
GOAL · Acetone (CH$_3$COCH$_3$)
HHHCCOCHHH

START OUT ψ ψ
O H
OUT ω ω
START

START IN α OUT ψ ψ
α
C N
β IN β OUT ω ω
START
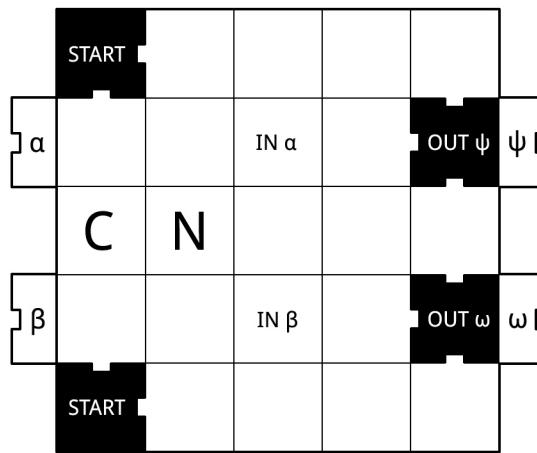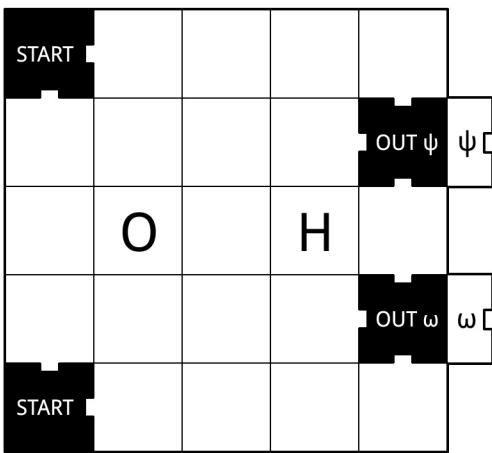
GOAL · Glycine (NH$_2$CH$_2$COOH)
HHNCHHCOOH