Lesson Plan: Logic Gate Chain

Year Group: 8 | **Duration:** 50 minutes | **Topic:** Boolean Logic & Logic Gates

1. Overview

Core Concept: Boolean logic — every value is TRUE or FALSE, and AND, OR, NOT gates combine these to make decisions.

Learning Objectives:

- Evaluate AND, OR, and NOT with TRUE/FALSE inputs using truth tables
- Trace values through a chain of logic gates
- Predict the output of a combined gate circuit
- Connect logic gates to real computer hardware and IF statements

Key Vocabulary:

Term	Definition
Boolean	A value that is either TRUE or FALSE — nothing in between
AND gate	Output is TRUE only if BOTH inputs are TRUE
OR gate	Output is TRUE if AT LEAST ONE input is TRUE
NOT gate	Output is the OPPOSITE of the input
Truth table	A table showing every possible input combination and the resulting output
Gate chain	A sequence of gates where one gate's output feeds the next

2. Before the Lesson

Print and Cut:

- ☐ `resource-gate-cards.md` — 1 full set for the class physical activity (gate rule cards + TRUE/FALSE hand cards). 1 reduced set per group for desk work.

Room Setup:

- Clear space at front of room for the physical gate chain (5 students in a line)
- Standard seating for desk work

3. Timed Lesson Flow

0–5 min — Hook: Real-World AND and OR

1. *"Stand up if you are a student AND you have a bag with you."* (both conditions must be true)

2. *"Now: stand up if you are taller than 160cm OR you are wearing something blue."* (either condition works)
3. *"Why did more people stand for the OR rule?"* Because OR is generous — only one must be true.

5–12 min — Truth Tables

1. Draw AND, OR, and NOT truth tables on the board.
2. Work through 2–3 examples together as a class.
3. Key insight: **these three gates can be combined to make any logical decision a computer ever needs.**

12–25 min — Physical Gate Chain

1. 5 volunteers: Input A, Input B, NOT gate, AND gate, Output.
2. NOT gate takes Input A and outputs the opposite.
3. AND gate takes NOT's output and Input B — outputs TRUE only if both are TRUE.
4. Output student shows the final result.
5. Run 4 different input combinations.

25–40 min — Desk Activity

Groups draw a gate chain (NOT → AND → OR with third input C) and complete the full truth table for all input combinations.

40–47 min — Reverse Challenge

Given output = TRUE, find ALL valid input combinations.

47–50 min — Real-world connections: CPU arithmetic, memory, security access, IF statements.

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4. Teacher Facilitation Notes

What to look for:

- Students applying AND logic to OR gates — always check the gate card rule first
- Confusion with chained gates — trace one step at a time, left to right
- Students who "just know" without tracing — insist on showing each step

Common misconceptions:

- OR means only one input matters — both TRUE + TRUE → TRUE for OR (not exclusive OR)
- NOT changes the gate type — NOT only changes the value passing through it

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5. Extension Tasks

1. Design a 3-gate chain that outputs TRUE only when EXACTLY ONE of three inputs is TRUE.
2. Research: what is a NAND gate? Why can all logic be built from NAND gates alone?
3. Write an IF statement in pseudocode using AND and OR. Which gates would it compile to?

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6. Key Takeaway

> **Every decision a computer makes is built from AND, OR, and NOT gates — billions of them, at nanosecond speed. Every IF statement you write compiles down to gate logic.**