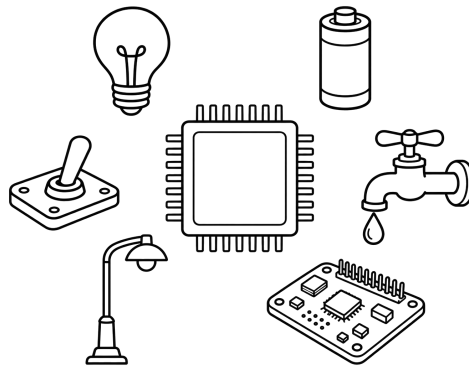


ICT

INFORMATION AND COMMUNICATION TECHNOLOGY

GRADE 8



UNIT 5

Physical Computing

Student Workbook



"The King of ICT"

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STUDENT DETAILS

Name:

School:

Institution:

Contact:

BEFORE WE START

What This Unit Is About

Read this page with your teacher

i AT THE END OF THIS UNIT YOU WILL BE ABLE TO

- ☐ Name the three basic logic gates: AND, OR and NOT.
- ☐ Explain the gates with water valves and street lamps.
- ☐ Draw the standard symbols of the AND, OR and NOT gates.
- ☐ Write truth tables with 1 and 0, and outputs like $A.B$, $A + B$ and $\bar{A}$.
- ☐ Connect gates in simple circuits and find the output.
- ☐ Use software to identify a logic function, and build simple circuits.
- ☐ Say how a computer uses logic gates, digital signals and binary values.

! THREE RULES FOR THE COMPUTER ROOM

- **Always** ask your teacher before you touch a battery, a switch or the wires.
- **Never** connect anything to the wall socket (mains electricity).
- **Never** eat or drink near the computers or the circuits.

i HOW TO USE THIS BOOK

Each chapter has three parts. First you **read** the chapter with your teacher. Then you **do** the practical task with your teacher. Last you **write** the exercises in this book. Colour the small pictures when you finish your work early.



Colour me!

THE WORDS YOU WILL LEARN

Logic gate	AND gate	OR gate	NOT gate
Input	Output	Truth table	State 1 / State 0
Analogy	Valve	Street lamp	Symbol
$A.B$	$A + B$	$\bar{A}$ (NOT A)	Circuit
Simulator	Logic function	Digital signal	Binary values
HIGH / LOW	True / False	5 V / 0 V	CPU

"Learn the gates, and you will understand the computer."

- THE KING OF ICT



CHAPTER 1

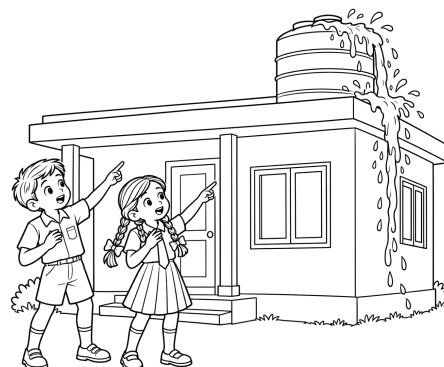
Logic Gates and the AND Gate

? A TANK THAT NEVER OVERFLOWS?

"Every morning our water tank overflows. So much water is wasted!"

"Can we stop the water when the tank is full?"

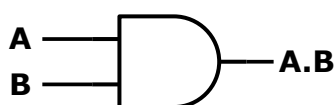
Put **two valves** in the pipe. The water goes in only when **both** valves are open. This is how an **AND gate** works.



5.1 Logic gates, 1 and 0

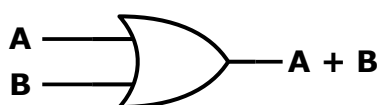
A **logic gate** takes **inputs** and gives an **output**. Its inputs and output have only two states. State **1** means that an electric signal is **available**. State **0** means that there is **no** electric signal. There are **three basic logic gates**: AND, OR and NOT.

AND GATE



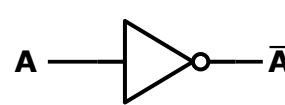
Output 1 only when **both** inputs are 1.

OR GATE



Output 1 when **at least one** input is 1.

NOT GATE

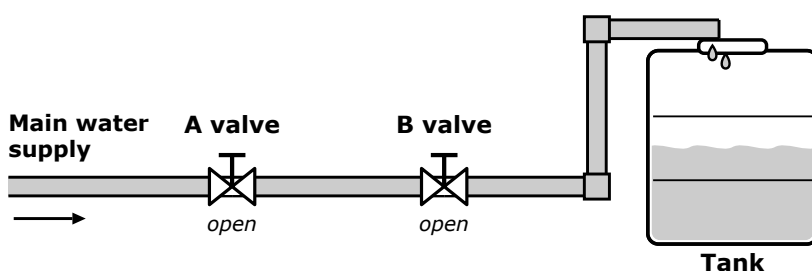


The output is the **opposite** of the input.

The inputs of a gate are shown with capital letters, like **A** and **B**.

5.2 The AND gate: two valves and a tank

Here is an **analogy** for the AND gate. The water comes from the **main supply**. It goes through **valve A**, then **valve B**, and then into the tank. Two valves fill the tank without overflowing, so no water is wasted.



i OPEN OR CLOSED?

Open valve: the water flows.

Closed valve: the water stops.

In our pictures a **white** valve is open and a **black** valve is closed.



Table 5.1 : Water supply by valves A and B

A valve	B valve	Water supply to tank
Closed	Closed	does not receive water
Closed	Open	does not receive water
Open	Closed	does not receive water
Open	Open	receives water

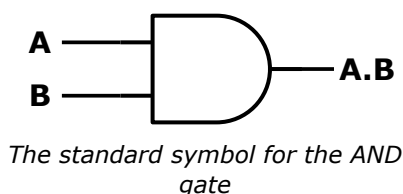
Table 5.2 : Indicating water supply by 0 and 1

A valve	B valve	Water supply to tank
0	0	0
0	1	0
1	0	0
1	1	1

In Table 5.2: **1** = open, **0** = closed, and **1** = receives water, **0** = does not receive water. The tank receives water only when **both** valves are open.

5.3 The AND gate symbol and truth table

The AND gate works like the two valves. It decides whether an electric signal is present (**1**) or not (**0**). A **truth table** shows the output for every input.



Input		Output
A	B	A.B
0	0	0
0	1	0
1	0	0
1	1	1

★ REMEMBER

To get the output **1**, **both** inputs must be 1.
With the inputs A and B, the output is written **A.B** (say "A AND B").

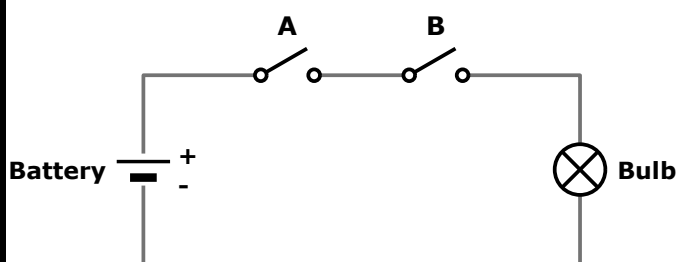
i TIP - THE ORDER OF THE INPUTS

Write the inputs of a truth table in this order: **0 0, 0 1, 1 0, 1 1**. Then no row is missing.

> DO IT - PRACTICAL 1 (WORKBOOK ACTIVITY 5.1)

An AND gate with switches. Work with your teacher. Use only a small battery (two 1.5 V cells).

1	Look at the circuit. Find the battery, switch A, switch B and the bulb.
2	With your teacher, join them in one loop : battery, switch A, switch B, bulb.
3	Keep both switches OFF . Does the bulb light? Write 1 or 0 in the table.
4	Switch ON only B. Then only A. Then both A and B. Write each result.
5	Compare your table with the AND gate truth table. Are they the same?



A	B	Bulb
0	0	
0	1	
1	0	
1	1	

1 = switch ON / the bulb lights
0 = switch OFF / no light

A Spot the mistakes

4 marks

Nimal made **FOUR** mistakes. Underline them. Write the correct words below.

There are four basic logic gates: AND, OR and NOT. In the AND analogy, the tank receives water when only one valve is open. An open valve is shown by 0. The output of an AND gate with the inputs A and B is written $A + B$.

1. 2. 3. 4.

B Word search

6 marks

Find the 6 words. They go across, down and slanting - forwards and backwards.

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

FIND THESE WORDS - TICK EACH ONE

☐ LOGIC ☐ GATE ☐ INPUT ☐ OUTPUT ☐ VALVE ☐ TANK

C AND in daily life

4 marks

Read about the rice cooker. Then complete the table.

Kamal's rice cooker cooks only when it is plugged in **AND** its switch is ON. Write 1 (it cooks) or 0 (it does not cook).

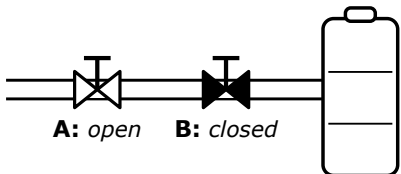
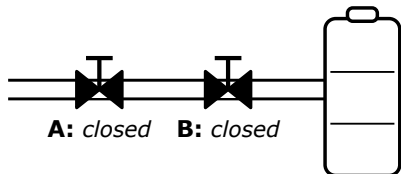
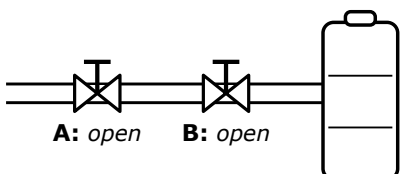
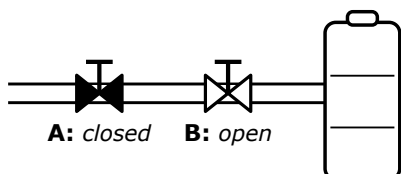
Plugged in?	Switch ON?	Cooks? (1 or 0)
Yes	No	
Yes	Yes	
No	Yes	
No	No	



D Will the tank get water?

4 marks

Look at the valves. Write 1 (water) or 0 (no water) in each box.

1  A: open B: closed Water? 1 or 0	2  A: closed B: closed Water? 1 or 0
3  A: open B: open Water? 1 or 0	4  A: closed B: open Water? 1 or 0

E Fill in the blanks

6 marks

Use the words in the box.

WORD BANK

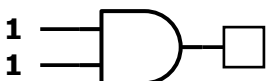
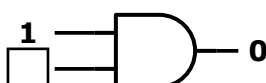
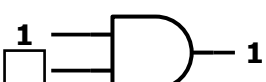
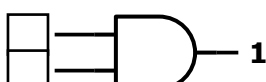
gates NOT both 1 capital A.B water 0

1. There are three basic logic
2. The three basic logic gates are AND, OR and
3. The tank receives water only when valves are open.
4. An electric signal that is available is shown by the state
5. The inputs of a gate are shown with letters, like A and B.
6. The output of an AND gate with the inputs A and B is

F Find the output

10 marks

Write 1 or 0 in each empty box.

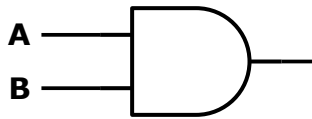
1 	2 	3 
4 	5 	6 
7 	8 	9 



G Complete the truth table

5 marks

Write the output heading and the four outputs of the AND gate.



Input		Output
A	B	
0	0	
0	1	
1	0	
1	1	

H True or false

6 marks

Write T or F in the box.

- ☐ There are three basic logic gates.
- ☐ The two valves of the tank are used to prevent water waste.
- ☐ The tank receives water when only one valve is open.
- ☐ In Table 5.2, the number 1 means that the valve is closed.
- ☐ An AND gate gives the output 1 only when both inputs are 1.
- ☐ The output of an AND gate with the inputs A and B is written $A + B$.

I Answer these

4 marks

Write full sentences.

- Why are two valves used in the pipe to the water tank? (2 marks)

- When does an AND gate give the output 1? (2 marks)

J Words into 1 and 0

6 marks

Use Table 5.2. Write 1 or 0 for each sentence.

Sentence	1 or 0	Sentence	1 or 0
1. Valve B is closed.		4. Valve A is open.	
2. The tank receives water.		5. The tank does not receive water.	
3. There is no electric signal.		6. An electric signal is available.	



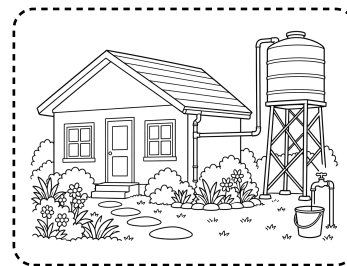
CHAPTER 2

The OR Gate and the NOT Gate

? NO WATER TODAY?

"The main water supply stopped this morning, but our taps still have water!"

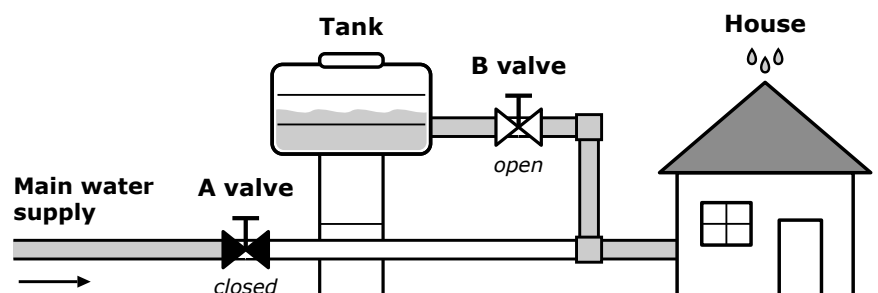
The house gets water from the **main supply** OR from the **tank**. This is how an **OR gate** works.



Colour me!

5.4 The OR gate: a tank and the main supply

An **analogy** for the OR gate: this house has a tank **as well as** the main water supply, so it always has water. Valve **A** is on the main supply, valve **B** on the pipe from the tank.



i LOOK!

Valve A is **closed**, but valve B is **open**. The house still receives water from the tank.

Water supply to the house

A valve	B valve	Water supply to house
Closed	Closed	does not receive water
Closed	Open	receives water
Open	Closed	receives water
Open	Open	receives water

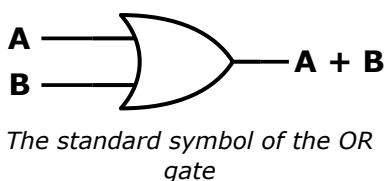
1 = open / receives, 0 = closed / does not

A valve	B valve	Water supply to house
0	0	0
0	1	1
1	0	1
1	1	1

The house receives water when **at least one** valve is open.

5.5 The OR gate symbol and truth table

The OR gate controls whether an electric signal is available (**1**) or not (**0**), just like the two valves control the water to the house.



Input		Output
A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	1

★ REMEMBER

The output is **1** when **at least one** input is 1.

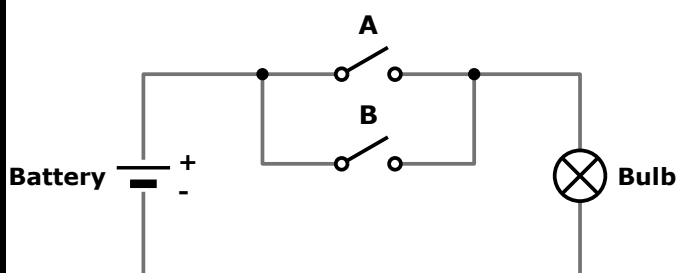
The output is written **A + B** (say "A OR B"). The inputs are added: 1 + 0 = 1, and 1 + 1 = 1 too!



> DO IT - PRACTICAL 2 (WORKBOOK ACTIVITY 5.2)

An OR gate with switches. Use the parts of Practical 1, with your teacher.

1	Now join switch A and switch B side by side (two paths), as in the circuit.
2	Keep both switches OFF . Does the bulb light? Write 1 or 0.
3	Switch ON only B. Then only A. Then both A and B. Write each result.
4	Compare your table with the OR gate truth table. Then switch everything OFF.

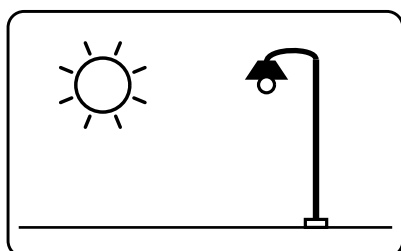


A	B	Bulb
0	0	
0	1	
1	0	
1	1	

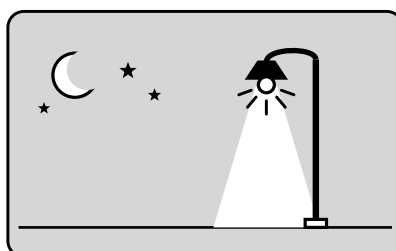
1 = switch ON / the bulb lights
0 = switch OFF / no light

5.6 The NOT gate: street lamps

An **analogy** for the NOT gate: street lamps are switched **off** during the day and **on** at night. With sunlight the lamp is OFF. With no sunlight the lamp is ON.



Day: sunlight **1**, lamp OFF **0**



Night: sunlight **0**, lamp ON **1**

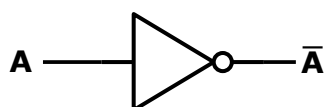
Sunlight	Electric lamp
available	OFF
unavailable	ON

Sunlight	Electric lamp
1	0
0	1

State **1** = there is daylight and state **0** = there is no daylight. Lamp OFF = **0** and lamp ON = **1**.

5.7 The NOT gate symbol and truth table

The output of the NOT gate is the **opposite** of its input. A particular voltage is shown by the state 1 and another voltage by the state 0.



The standard symbol of the NOT gate

Input	Output
A	$\bar{A}$
1	0
0	1

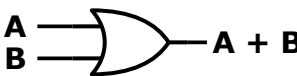
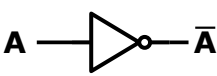
★ REMEMBER

The NOT gate has only **one** input. The output is the **opposite** of the input.

With the input A, the output is written $\bar{A}$ (say "NOT A"). The bar on top means NOT.

5.8 The three gates side by side

Here are the three basic logic gates together. Learn this table well.

	AND gate	OR gate	NOT gate
Symbol			
Inputs	2 (A and B)	2 (A and B)	1 (A)
Output written as	A.B	A + B	$\bar{A}$
Output is 1 when	both inputs are 1	at least one input is 1	the input is 0
Analogy	two valves in one pipe to a tank	a tank and the main supply	street lamps

5.9 Logic gates around us

Many things around us work like logic gates. Each one gives an output (1 or 0) from its inputs.

LIKE AN AND GATE

A washing machine starts only when the door is closed **AND** the start button is pressed.

LIKE AN OR GATE

A doorbell rings when the front button **OR** the back button is pressed.

LIKE A NOT GATE

A garden lamp with a light sensor is ON when there is **no** daylight, just like a street lamp.

★ TRY THIS IN CLASS - HUMAN LOGIC GATES

Your teacher chooses three friends. Two of them are the inputs **A** and **B**: hand up = 1, hand down = 0. The third friend is the **AND gate**: she puts her hand up only when **both** hands are up. Try all four ways. Then the third friend is an **OR gate**. Last, use one input and a **NOT gate**.

A Match the analogies

6 marks

Write the correct letter in the box.

A - Analogy or output		B - What it is
1. Two valves in one pipe to a tank		A. The output of a NOT gate
2. A tank and the main supply		B. Explains the OR gate
3. Street lamps		C. Explains the NOT gate
4. A.B		D. The output of an AND gate
5. A + B		E. The output of an OR gate
6. $\bar{A}$		F. Explains the AND gate



B Gates in everyday life

8 marks

Which gate does each one work like? Tick one box.

It works like ...	AND gate	OR gate	NOT gate
A torch shines only with a battery AND the switch ON.	☐	☐	☐
A car alarm rings if the front OR the back door opens.	☐	☐	☐
A seat belt light is ON when the belt is not fastened.	☐	☐	☐
You may enter the lab with an ID card OR with the teacher.	☐	☐	☐
A lift moves only with the door shut AND a button pressed.	☐	☐	☐
The bell rings when it is time OR the principal presses it.	☐	☐	☐
A fridge light is ON when the door is not closed.	☐	☐	☐
A computer starts only with power AND the button pressed.	☐	☐	☐

C Will the house get water?

4 marks

Look at the valves. Write 1 (water) or 0 (no water) in each box.

1

B: closed

A: closed

Water?
☐
1 or 0

2

B: open

A: closed

Water?
☐
1 or 0

3

B: open

A: open

Water?
☐
1 or 0

4

B: closed

A: open

Water?
☐
1 or 0

D Answer these

4 marks

Write full sentences.

1. Valve A is closed and valve B is open. Does the house receive water? Why? (2 marks)

2. Why are street lamps a good example of a NOT gate? (2 marks)



E Draw the symbols

6 marks

Draw each symbol. Label the inputs and write the output (A.B, A + B ...).

AND gate

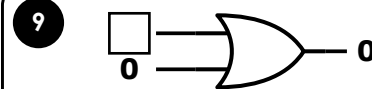
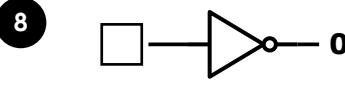
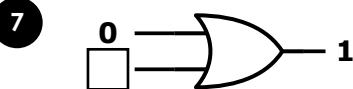
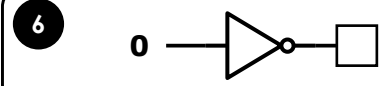
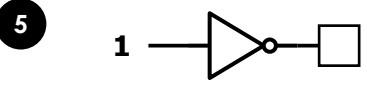
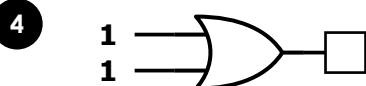
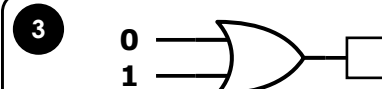
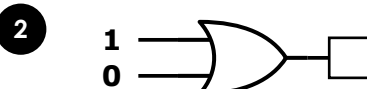
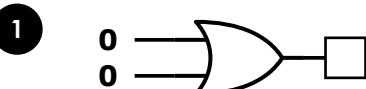
OR gate

NOT gate

F Find the output

9 marks

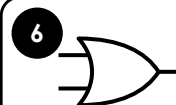
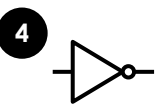
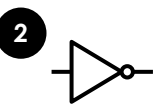
Write 1 or 0 in each empty box.



G Name the gate

6 marks

Write AND, OR or NOT under each symbol.



H Complete the truth tables

8 marks

Write the output heading and the outputs of each gate.

OR gate

Input		Output
A	B	
0	0	
0	1	
1	0	
1	1	

NOT gate

Input	Output
A	
1	
0	



CHAPTER 3

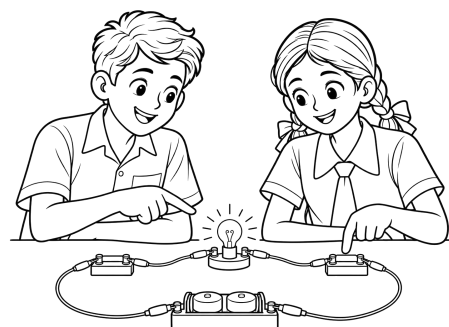
Simulators and Circuits

? GATES ON THE SCREEN, GATES AS A TEAM

"Can we see a logic gate working on the computer?"

"Can the output of one gate go into another gate?"

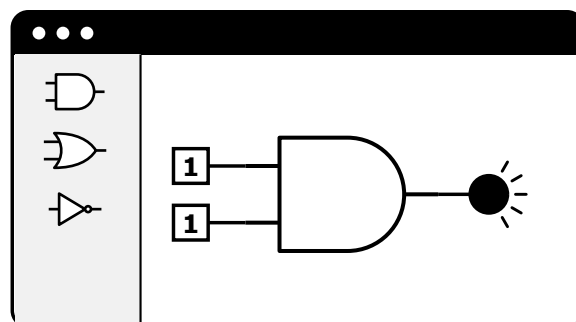
Yes and yes! A **simulator** shows gates on the screen. Then we **connect** gates to make a **circuit**.



5.10 Using software to identify a logic function

A **logic gate simulator** is software that shows gates and circuits on the screen, for example **Logisim** or **CircuitVerse**. Click an input to change it from 0 to 1. A small lamp (LED) shows the output: it lights up for 1.

To **identify a logic function** (to find out which gate is hidden in a circuit), try **every** input, write the outputs in a truth table, and compare it with the AND, OR and NOT tables.



> DO IT - PRACTICAL 3 (WORKBOOK ACTIVITY 5.3)

Use software to identify a logic function. **Ask your teacher first.**

1	Open the logic gate simulator your teacher shows you (for example Logisim or CircuitVerse).
2	Add an AND gate. Connect two inputs and one output (a lamp or LED).
3	Click the inputs to change them. Try all four: 0 0, 0 1, 1 0 and 1 1.
4	Write the outputs in the table. Do the same with an OR gate and a NOT gate.
5	Open the mystery circuit from your teacher. Try every input. Which gate is hidden?
6	Save your work with your name, for example Logic Gates - Nimal .

AND

A	B	Out
0	0	
0	1	
1	0	
1	1	

OR

A	B	Out
0	0	
0	1	
1	0	
1	1	

NOT

A	Out
0	
1	

The mystery gate is

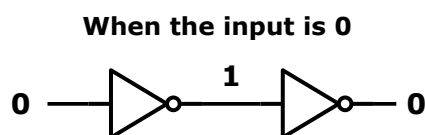
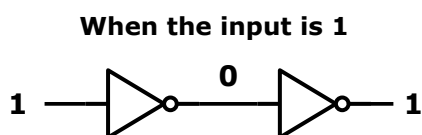
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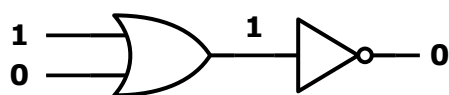
5.11 Connecting gates in a circuit

We can connect logic gates. The **output** of one gate becomes the **input** of the next gate. The values 1 and 0 are written on the wires.

i EXAMPLE 1 - TWO NOT GATES, ONE AFTER THE OTHER

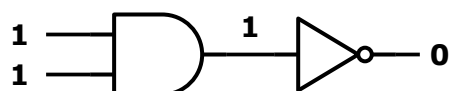


i EXAMPLE 2 - AN OR GATE, THEN A NOT GATE



In the OR gate the inputs are added: $1 + 0 = 1$. This 1 goes into the NOT gate, which changes it to **0**. So the output of the circuit is 0.

i EXAMPLE 3 - AN AND GATE, THEN A NOT GATE



Step 1: the AND gate gets 1 and 1, so its output is 1. **Step 2:** this 1 goes into the NOT gate, which gives the opposite. So the output of the circuit is **0**.

> DO IT - PRACTICAL 4 (WORKBOOK ACTIVITY 5.4)

Build simple circuits in the simulator and find the outputs.

1	In the simulator, join two NOT gates , one after the other (example 1).
2	Give the input 1, then the input 0. Write the output each time.
3	Build example 2: an OR gate and then a NOT gate. Check that 1 and 0 give 0.
4	Build an AND gate and then a NOT gate. Try all four inputs.
5	Write the outputs in the table. Show your circuits to your teacher and save your work.

Two NOT gates

A	Output
1	
0	

AND, then NOT

A	B	Output
0	0	
0	1	
1	0	
1	1	



5.12 Finding the output step by step

1. Write the input values (1 or 0) on the input wires.
2. Find the output of the **first** gate. Write it on its output wire.
3. That output is now an **input** of the next gate.
4. Find the output of the next gate. Go on until you reach the **last** gate.

Do this for every input, and you get the **truth table** of the circuit.

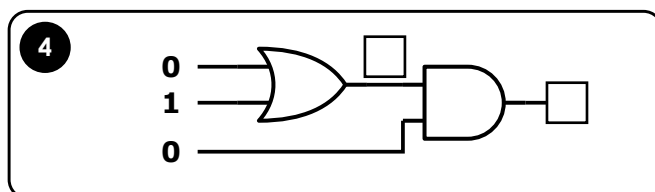
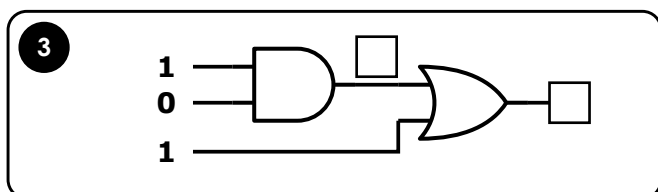
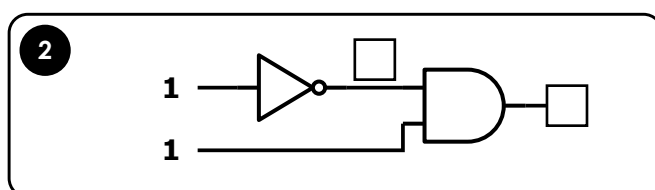
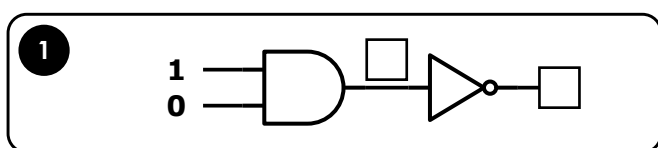
The truth table of example 2

A	B	A + B	Output
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

A Find the output of the circuit

8 marks

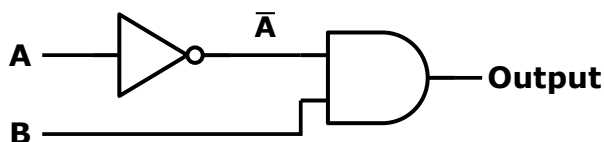
Work from left to right. Write 1 or 0 in every box.



B Complete the circuit table

8 marks

Input A goes into a NOT gate. Its output and B go into an AND gate.



A	B	$\bar{A}$	Output
0	0		
0	1		
1	0		
1	1		

C Draw the circuit

4 marks

A and B each go into a NOT gate. Both outputs go into an AND gate.

The inputs are **A = 0** and **B = 1**. Draw the circuit. Write 1 or 0 on every wire.

Use the standard symbols.

D Answer these

4 marks

Write full sentences.

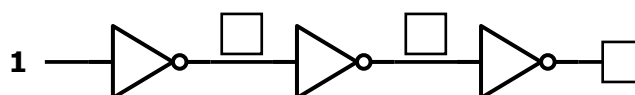
1. Why do we try every input when we identify a logic function? (2 marks)

2. A signal goes through two NOT gates, one after the other. What happens to it? (2 marks)

E A chain of NOT gates

4 marks

Write 1 or 0 in the boxes. Then complete the sentence.



When the input is **0**, the output of these three NOT gates is

F Identify the logic function

4 marks

Each box hides one gate. Read its truth table. Write AND, OR or NOT.

Box W

A	B	Out
0	0	0
0	1	1
1	0	1
1	1	1

Box X

A	Out
0	1
1	0

Box Y

A	B	Out
0	0	0
0	1	0
1	0	0
1	1	1

Box Z

A	B	Out
1	1	1
1	0	0
0	1	0
0	0	0

Gate: Gate: Gate: Gate:

G Put the steps in order

5 marks

You want to find the gate inside a mystery circuit. Number the steps 1 to 5.

1. Write each output in a truth table.
2. Open the logic gate simulator.
3. Compare your table with the AND, OR and NOT tables.
4. Connect two inputs and an output to the mystery circuit.
5. Click the inputs to try every input: 0 0, 0 1, 1 0 and 1 1.



H What are the inputs?

8 marks

The output is given. Work backwards. Write the inputs (1 or 0) in the boxes.

1

2

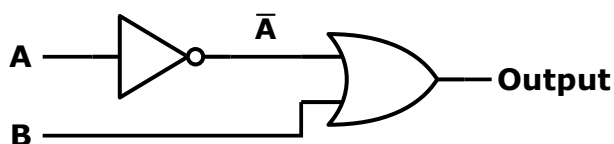
3

4

I Truth table of a circuit

8 marks

Input A goes into a NOT gate. Its output and B go into an OR gate.



A	B	$\bar{A}$	Output
0	0		
0	1		
1	0		
1	1		

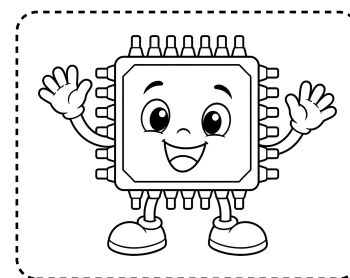
CHAPTER 4

Logic Gates Inside the Computer

? HOW DOES A COMPUTER WORK WITH 1 AND 0?

"My computer does sums, plays songs and shows videos. How does it do all that?"

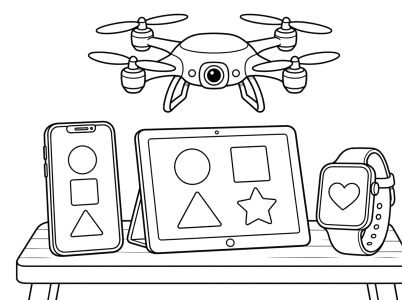
The **CPU** is built from **logic gates**. The gates work with only two states: **1** and **0**.



Colour me!

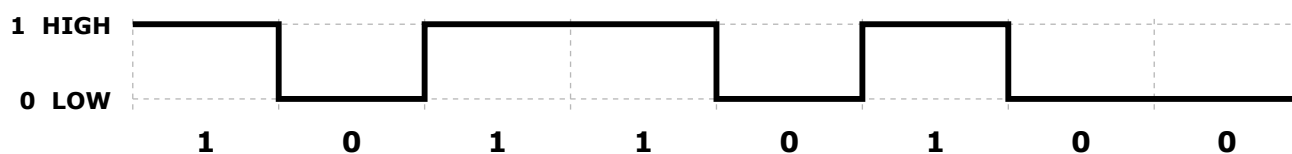
5.13 Logic gates in the CPU

- Logic gates are the basic building blocks of the **Central Processing Unit (CPU)**, of computers and of other electronic devices, like phones and tablets.
- The basic function of the CPU uses logic gates.
- A computer uses **AND**, **OR** and **NOT** gates to **process data**. The gates take 0 or 1 as inputs and give 0 or 1 as outputs.



5.14 Digital signals

Digital computers use **digital signals**. A digital signal has only **one value out of two** at a particular time: 1 or 0. Logic gates take digital inputs and give digital outputs.



A digital signal

5.15 Binary values

The digital inputs and outputs of logic gates are **binary values**: they are only 0 or 1.

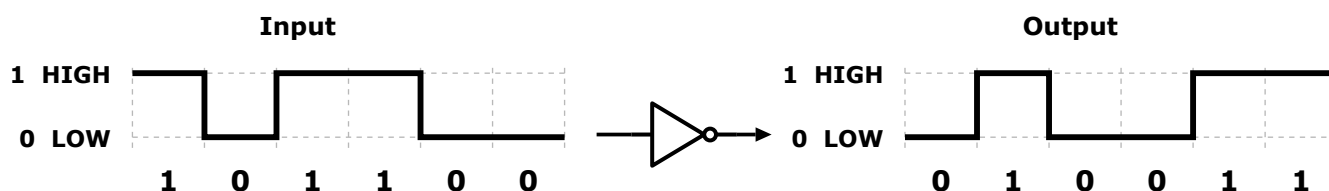
The most common way to show them is **1** and **0**. They can also be shown as **TRUE / FALSE** or **HIGH / LOW**. In computer hardware they are voltages: **5 V** and **0 V**.

Ways of showing binary values

State 1	State 0
1	0
HIGH	LOW
True	False
5 V (volt)	0 V

5.16 A digital signal through a NOT gate

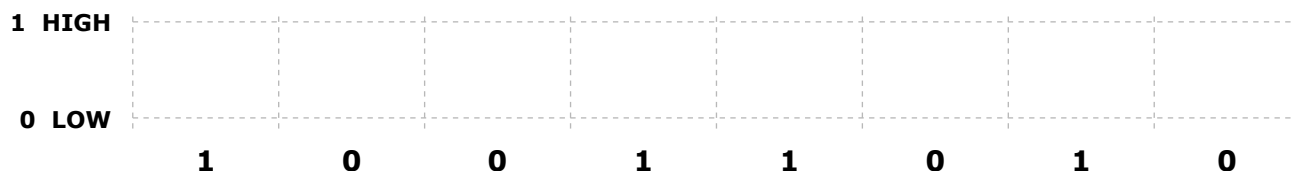
Logic gates take **digital inputs** and give **digital outputs**. Here a digital signal goes into a NOT gate. Each part of the output is the **opposite** of the input.



A Draw the digital signal

4 marks

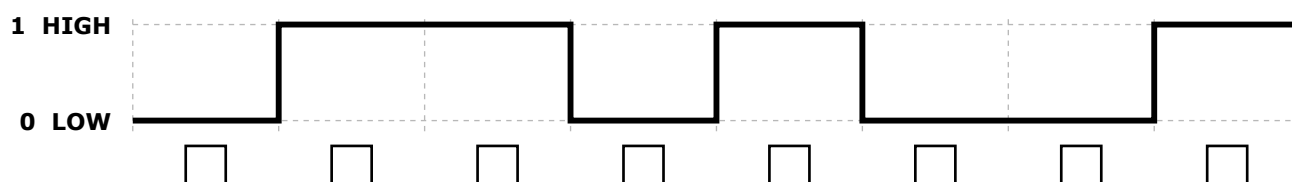
Draw the signal for these values. Use the dotted lines for 1 and 0.



B Read the digital signal

8 marks

Write 1 or 0 in the box under each part.



C Complete the table

6 marks

Write the other ways of showing 1 and 0.

Way of showing	State 1	State 0
Numbers	1	0
Levels		
Words		
Voltages		

D Choose the correct answer

8 marks

Underline your answer.

- Which one is NOT a basic logic gate?
(a) AND (b) OR (c) NOT (d) CPU
- Which gate gives the output 1 only when both inputs are 1?
(a) AND gate (b) OR gate (c) NOT gate (d) none of them
- The output of an OR gate with the inputs A and B is
(a) A.B (b) A + B (c) $\bar{A}$ (d) $\bar{B}$
- Which gate has only one input?
(a) AND gate (b) OR gate (c) NOT gate (d) all of them
- Street lamps that switch on at night are like the
(a) AND gate (b) OR gate (c) NOT gate (d) CPU
- Which one shows the state 1?
(a) LOW (b) False (c) 0 V (d) HIGH
- An OR gate has the inputs 0 and 0. The output is
(a) 1 (b) 0 (c) HIGH (d) True
- Software that shows how logic gates work on the screen is a
(a) simulator (b) spell checker (c) printer (d) search engine

E Match them

6 marks

Write the correct letter in the box.

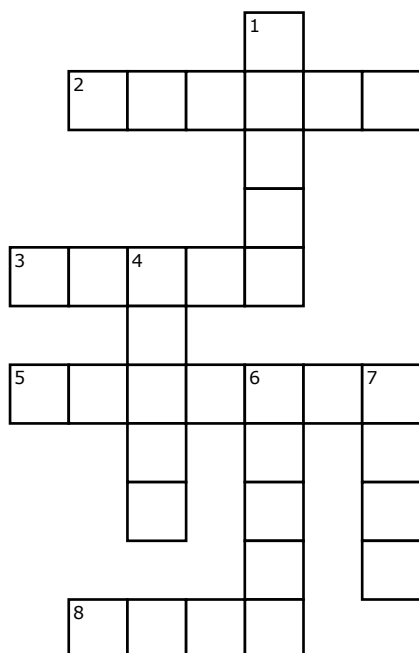
A - The word		B - What it means
1. Logic gates		A. It has only one value out of two at a time.
2. Digital signal		B. LOW, False or 0 V.
3. Binary values		C. Central Processing Unit.
4. State 1		D. The basic building blocks of the CPU.
5. State 0		E. HIGH, True or 5 V.
6. CPU		F. Values with only two states: 0 or 1.



F Crossword

8 marks

Use the clues. Write one letter in each square.



ACROSS

2. 0 and 1 are ... values (6)
3. Another way to write 0 (5)
5. A ... signal has only one of two values at a time (7)
8. Another name for the state 1 (4)

DOWN

1. Two of these in one pipe explain the AND gate (5)
4. AND, OR and NOT are the basic ... gates (5)
6. A ... table shows the output for every input (5)
7. A street ... is ON at night and OFF in the day (4)

G Answer these

4 marks

Write full sentences.

1. What is a digital signal? (2 marks)

2. Write TWO other ways to show the binary values 1 and 0. (2 marks)

H Fill in the blanks

5 marks

Use the words in the box.

WORD BANK

building CPU digital two process valve

1. Logic gates are the basic blocks of the CPU.
2. The basic function of the uses logic gates.
3. Digital computers use signals.
4. A digital signal has one value out of at a time.
5. A computer uses AND, OR and NOT gates to data.



REVISION

Unit 5 in One Page

Read this the night before the test

Topic	The key facts
Logic gates	There are three basic logic gates: AND, OR and NOT. Inputs given to a gate produce an output.
1 and 0	1 = an electric signal is available. 0 = there is no electric signal. Inputs are capital letters: A, B.
AND gate	Output A.B . The output is 1 only when both inputs are 1. Like two valves in one pipe to a tank.
OR gate	Output A + B . The output is 1 when at least one input is 1. Like a house with a tank and the main supply.
NOT gate	Output $\bar{A}$. One input. The output is the opposite of the input. Like street lamps: day (1) lamp OFF (0).
Truth table	A table that shows the output of a gate for every input. Inputs in order: 0 0, 0 1, 1 0, 1 1.
Gates around us	Washing machine: door closed AND button pressed. Doorbell: front OR back button. Garden lamp: ON when there is NOT daylight.
Circuits	The output of one gate is the input of the next gate. Work from left to right.
Software	A logic gate simulator shows how gates work. Try every input to identify a logic function.
Digital signal	It has only one value out of two (1 or 0) at a particular time.
Binary values	1 / 0 HIGH / LOW True / False 5 V / 0 V
The CPU	Logic gates are the basic building blocks of the CPU. A computer uses AND, OR and NOT gates to process data.

★ TICK WHEN YOU CAN DO IT

- ☐ I can name the three basic logic gates.
- ☐ I can draw the symbols of the AND, OR and NOT gates.
- ☐ I can explain the gates with the valves and the street lamps.
- ☐ I can complete truth tables with 1 and 0.
- ☐ I can find the output of a simple circuit of gates.
- ☐ I can use a simulator to identify a logic function.
- ☐ I can show 1 and 0 as HIGH / LOW, True / False and 5 V / 0 V.

"Check every gate twice. A careful student never loses easy marks."

- THE KING OF ICT



WORD POWER

Unit 5 Word List

Twenty-four words you must know

Word	What it means
Logic gate	A basic building block of the CPU. It takes inputs (1 or 0) and gives an output.
AND gate	Gives the output 1 only when both inputs are 1.
OR gate	Gives the output 1 when at least one input is 1.
NOT gate	Has one input. The output is the opposite of the input.
Input	What goes into a gate. Inputs are named with capital letters: A, B.
Output	What comes out of a gate.
Truth table	A table that shows the output of a gate for every input.
State 1	An electric signal is available. Also HIGH, True or 5 V.
State 0	There is no electric signal. Also LOW, False or 0 V.
Analogy	An example from daily life that helps us to understand an idea.
Valve	A tap in a water pipe. Open: water flows. Closed: water stops.
Symbol	The standard drawing of a gate in a circuit.
A.B	The output of an AND gate with the inputs A and B.
A + B	The output of an OR gate with the inputs A and B.
$\bar{A}$ (NOT A)	The output of a NOT gate with the input A.
Circuit	Gates joined with wires. The output of one gate can go into the next gate.
Simulator	Software that shows how logic gates and circuits work, on the screen.
Logic function	What a gate does with its inputs (AND, OR or NOT).
Digital signal	A signal that has only one value out of two at a time.
Binary values	Values that have only two states: 0 or 1.
HIGH / LOW	Another way to write 1 and 0.
True / False	Another way to write 1 and 0.
5 V / 0 V	The voltages that show 1 and 0 in computer hardware.
CPU	Central Processing Unit. Its basic building blocks are logic gates.

"Learn the words today, and the ideas will flow like water through an open valve."

- THE KING OF ICT

"Switch ON your mind. The rest of the circuit will follow."

- THE KING OF ICT



Colour me!



END OF UNIT

Unit 5 Test

Time: 45 minutes

Total: 40 marks

Name _____

Class _____

Marks

1 Choose the correct answer

8 marks

Underline your answer.

1. How many basic logic gates are there?
 (a) two (b) three (c) four (d) five
2. Which gate gives the output 1 when at least one input is 1?
 (a) AND gate (b) OR gate (c) NOT gate (d) none of them
3. The output of a NOT gate with the input A is written
 (a) A.B (b) A + B (c) $\bar{A}$ (d) A
4. If the input of a NOT gate is 1, the output is
 (a) 0 (b) 1 (c) HIGH (d) True
5. Two valves in one pipe to a tank explain the
 (a) AND gate (b) OR gate (c) NOT gate (d) CPU
6. An AND gate has the inputs 1 and 1. The output is
 (a) 0 (b) 1 (c) LOW (d) False
7. At a particular time, a digital signal has
 (a) one value out of two (b) three values
 (c) no value (d) ten values
8. In computer hardware, the state 1 is shown by
 (a) 0 V (b) 1 V (c) 5 V (d) LOW

2 Fill in the blanks

8 marks

One word in each blank.

1. The three basic logic gates are AND, OR and
2. In an AND gate, both inputs should be to get the output 1.
3. The output of an OR gate is 1 when at least input is 1.
4. The output of a NOT gate is the of its input.
5. A table shows the output of a gate for every input.
6. The inputs of a gate are shown with letters.
7. Street lamps are switched at night.
8. Binary values can also be shown as HIGH and



3 Look at the gates

8 marks

Write the name of each gate on the line. Write its output in the box.

1



Name of the gate:

.....

2



Name of the gate:

.....

3



Name of the gate:

.....

4



Name of the gate:

.....

4 Answer these

16 marks

Write in the space given.

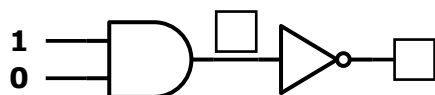
1. Draw the symbol of the OR gate. Label the inputs A and B, and the output. (3 marks)

2. Complete the truth table of the AND gate. (4 marks)

A	B	A.B
0	0	
0	1	
1	0	
1	1	

3. Explain how street lamps show the function of a NOT gate. (3 marks)

4. Write the output of each gate in this circuit. (2 marks)



5. What do the states 1 and 0 mean for an electric signal? (2 marks)

6. Why are logic gates important for a computer? (2 marks)

