

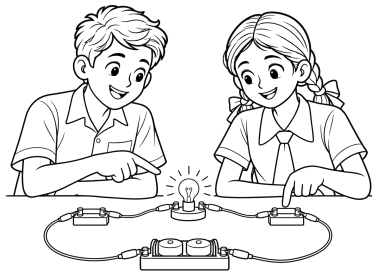
TEACHER GUIDE

ANSWERS AND MARKS

GRADE 8 · INFORMATION AND COMMUNICATION TECHNOLOGY

UNIT 5

Physical Computing



! FOR THE TEACHER ONLY

This booklet has the answers to every exercise in the Unit 5 Student Workbook, in the same order. The exercise letters match the workbook.

i WHAT IS IN THIS GUIDE

- **Marks and pacing** - every exercise and its marks
- **Class marks record** - one page to copy for each class
- **Practicals at a glance** - what to check in 5.1 - 5.4, safety, a quiz, a practical test
- **Answers** - chapters 1 to 4, in the same order as the workbook
- **Unit 5 Test** - the marking scheme and the common mistakes
- **Extra** - homework ideas and teaching tips

★ BEFORE THE FIRST LESSON

- ☐ A battery, a bulb, two switches and wires are ready for Practicals 1 and 2.
- ☐ A logic gate simulator (Logisim or CircuitVerse) opens on every computer.
- ☐ A mystery circuit file is ready for Practical 3, and the projector works.

"Students who switch on the bulb themselves never forget the truth table."

- THE KING OF ICT

TEACHER GUIDE

Marks and Pacing

You decide how much class time each part needs

Chapter	Exercise	Marks
Chapter 1	A Spot the mistakes	4
	B Word search	6
	C AND in daily life	4
	D Will the tank get water?	4
	E Fill in the blanks	6
	F Find the output	10
	G Complete the truth table	5
	H True or false	6
	I Answer these	4
	J Words into 1 and 0	6
Chapter 2	A Match the analogies	6
	B Gates in everyday life	8
	C Will the house get water?	4
	D Answer these	4
	E Draw the symbols	6
	F Find the output	9
	G Name the gate	6
	H Complete the truth tables	8

Chapter	Exercise	Marks
Chapter 3	A Find the output of the circuit	8
	B Complete the circuit table	8
	C Draw the circuit	4
	D Answer these	4
	E A chain of NOT gates	4
	F Identify the logic function	4
	G Put the steps in order	5
	H What are the inputs?	8
	I Truth table of a circuit	8
Chapter 4	A Draw the digital signal	4
	B Read the digital signal	8
	C Complete the table	6
	D Choose the correct answer	8
	E Match them	6
	F Crossword	8
	G Answer these	4
	H Fill in the blanks	5
End	Unit 5 Test	40
TOTAL		248

! SUGGESTED SHAPE OF ONE CHAPTER

READ	Teach the chapter pages. Students read with you and underline the key words.
DO	The practical tasks on real computers, in pairs.
WRITE	The written exercises. Walk around and help.
MARK	Mark the work together. Fill the tick boxes.

★ TEACHING TIPS

- Draw the AND valves on the board as two taps in one pipe. Ask: what happens if only one tap is open?
- For the human logic gates game (5.9), start with three confident students, then let others try.
- For the NOT gate, point to the street lamps near the school: daylight 1, lamp OFF 0.



TEACHER GUIDE

Class Marks Record

Copy this page for each class

No	Student name	Ch 1 (55)	Ch 2 (51)	Ch 3 (53)	Ch 4 (49)	Test (40)	Total (248)
1							
2							
3							
4							
5							
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29							



TEACHER GUIDE

Practicals at a Glance

Workbook activities 5.1 to 5.4

Activity	Students make	Check that ...
5.1	AND: two switches in one loop	the bulb lights only when both are ON (0, 0, 0, 1).
5.2	OR: two switches side by side	the bulb lights when one or both are ON (0, 1, 1, 1).
5.3	AND, OR, NOT in a simulator	AND 0, 0, 0, 1; OR 0, 1, 1, 1; NOT 1, 0; they named the mystery gate.
5.4	Two circuits in a simulator	two NOT gates give the input back; AND then NOT gives 1, 1, 1, 0.

! SAFETY AND MATERIALS FOR PRACTICALS 1 AND 2

- A small battery (two 1.5 V cells), a torch bulb in a holder, two switches and short wires. A logic gate kit or LEDs also work.
- Never use mains electricity. Check that no wire is bare. Few parts? Do it as a demonstration.

Textbook links

Workbook	Textbook (Grade 8, Unit 5)	Activities
Chapter 1 - Logic gates and the AND gate	pages 55 - 57	5.1
Chapter 2 - The OR gate and the NOT gate	pages 57 - 60	5.2
Chapter 3 - Simulators and circuits	pages 55, 60	5.3, 5.4
Chapter 4 - Logic gates inside the computer	page 61 (Note)	-
Unit 5 in One Page	page 62 (Summary)	-

? QUICK ORAL QUIZ - START OR END A LESSON WITH IT

Ask the class ...	Answer
1. Name the three basic logic gates.	AND, OR, NOT
2. An AND gate has the inputs 1 and 0. Output?	0
3. An OR gate has the inputs 1 and 0. Output?	1
4. A NOT gate has the input 1. Output?	0
5. Which gate is like the street lamps?	NOT
6. Which gate is like two valves in one pipe?	AND
7. How do we write the output of an OR gate?	A + B
8. What does the bar over A mean?	NOT A
9. Give another name for the state 1.	HIGH / True / 5 V
10. What are the basic building blocks of the CPU?	Logic gates



> PRACTICAL TEST - 20 MINUTES, 20 MARKS (OPTIONAL)

Use the simulator of Practicals 3 and 4. Step 4 answers: **1** (for 0, 0) and **0** (for 1, 0).

Step	The student must ...	Marks
1	Open the simulator. Build an AND gate with two inputs and one output.	2
2	Try all four inputs. Write the truth table of the AND gate.	4
3	Build an OR gate and a NOT gate. Show each one working.	4
4	Build A and B into an OR gate, then a NOT gate. Find the output for A = 0, B = 0 and for A = 1, B = 0.	5
5	Identify the mystery gate the teacher gives you (try every input).	3
6	Save the file with your name.	2
	Total	20

ANSWERS

Chapter 1

Logic gates and the AND gate

A Spot the mistakes

4 marks

1. four → three	2. only one → both	3. 0 → 1	4. A + B → A.B
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1 mark for each mistake found and corrected.

B Word search

6 marks

	L	O	G	I	C				K
				I					N
				O	N				A
				U		P			T
	G			T			U		
	A			P				T	
	T			U					
	E			T					
	E	V	L	A	V				

Word	Starts at	Direction
LOGIC	row 2, col 2	across
GATE	row 6, col 2	down
INPUT	row 3, col 5	slanting down
OUTPUT	row 4, col 5	down
VALVE	row 10, col 6	across, backwards
TANK	row 5, col 10	up

★ TEACHING TIPS

- Test the battery and the bulb before Practical 1. A flat battery spoils the lesson.
- Say "left to right, one gate at a time" every time you solve a circuit on the board.



C AND in daily life

4 marks

Plugged in?	Switch ON?	Cooks?
Yes	No	0
Yes	Yes	1
No	Yes	0
No	No	0

It cooks (1) only when it is plugged in AND switched on, like an AND gate. 1 mark for each row.

D Will the tank get water?

4 marks

1. A open, B closed: 0	2. A closed, B closed: 0
3. A open, B open: 1	4. A closed, B open: 0

Water reaches the tank only when both valves are open.

E Fill in the blanks

6 marks

1. gates	2. NOT	3. both	4. 1	5. capital	6. A.B
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F Find the output

10 marks

1. 1 (1 and 1)	2. 0 (1 and 0)	3. 0 (0 and 0)
4. 0 (0 and 1)	5. A = 1 (output 1, so both are 1)	6. B = 0 (A is 1 but the output is 0)
7. B = 1 (output 1, so both are 1)	8. A = 0 (B is 1 but the output is 0)	9. A = 1, B = 1 (output 1)

G Complete the truth table

5 marks

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

1 mark for the heading **A.B** and 1 mark for each output: 0, 0, 0, 1.

★ TEACHING TIPS

- For Practical 3, hide one gate inside a sub-circuit, or cover it with a sticky note on the projector.
- Remind the class that $1 + 1 = 1$ in an OR gate. It is not ordinary adding.



H True or false

6 marks

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

I Answer these

4 marks

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

To fill the tank without overflowing, so that no water is wasted. Water reaches the tank only when both valves are open. 2 marks.

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

Only when both inputs are 1 ($A = 1$ and $B = 1$). Give 1 mark for "when the inputs are 1" without the word both.

J Words into 1 and 0

6 marks

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

Table 5.2: 1 = open / receives water / signal available; 0 = closed / does not receive / no signal. 1 mark each.

ANSWERS

Chapter 2

The OR gate and the NOT gate

A Match the analogies

6 marks

1. Two valves in one pipe to a tank → F	2. A tank and the main supply → B
3. Street lamps → C	4. $A.B \rightarrow D$
5. $A + B \rightarrow E$	6. $\bar{A} \rightarrow A$

F, B and C link the analogies to the AND, OR and NOT gates; D, E and A link the outputs $A.B$, $A + B$ and $\bar{A}$.



B Gates in everyday life

8 marks

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

1. A closed, B closed: 0	2. A closed, B open: 1
3. A open, B open: 1	4. A open, B closed: 1

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

D Answer these

4 marks

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

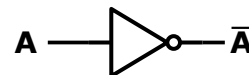
Yes. The house receives water when at least one valve is open (like an OR gate), and valve B is open. 1 mark for yes, 1 mark for the reason.

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

The output is the opposite of the input: with daylight (1) the lamp is OFF (0), and with no daylight (0) the lamp is ON (1). 2 marks.

E Draw the symbols

6 marks



For each gate: 1 mark for the correct shape (AND: flat back and round front; OR: curved back and pointed front; NOT: triangle with a small circle), 1 mark for the inputs and the output.

★ TEACHING TIP

- Not enough computers? Show the simulator on the projector and let pairs take turns at the mouse.



F Find the output

9 marks

1. 0 ($0 + 0 = 0$)	2. 1 ($1 + 0 = 1$)	3. 1 ($0 + 1 = 1$)
4. 1 ($1 + 1 = 1$)	5. 0 (opposite of 1)	6. 1 (opposite of 0)
7. B = 1 (A is 0, output 1)	8. input = 1 (output 0)	9. A = 0 (output 0)

G Name the gate

6 marks

1. OR	2. NOT	3. AND	4. NOT	5. AND	6. OR
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H Complete the truth tables

8 marks

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

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

OR: 1 mark for the heading **A + B** and 1 mark for each output (0, 1, 1, 1). NOT: 1 mark for the heading $\bar{A}$ and 1 mark for each output (0, 1).

ANSWERS

Chapter 3

Simulators and circuits

A Find the output of the circuit

8 marks

1. AND, then NOT (1, 0): 0 , then 1	2. NOT A, then AND (1, 1): 0 , then 0
3. AND, then OR (1, 0, 1): 0 , then 1	4. OR, then AND (0, 1, 0): 1 , then 0

1 mark for each box: the first gate (the middle box), then the output.

B Complete the circuit table

8 marks

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

1 mark for each cell. First NOT A: 1, 1, 0, 0. Then $\bar{A}$ AND B: 0, 1, 0, 0.

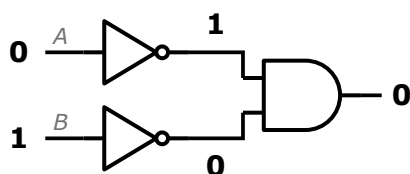


TIP: Students who finish early can colour the pictures, or draw a circuit for a friend to solve.



C Draw the circuit

4 marks



2 marks for the drawing (two NOT gates whose outputs go into one AND gate). 1 mark each for NOT A = **1**, NOT B = **0** and the AND output = **0**.

D Answer these

4 marks

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

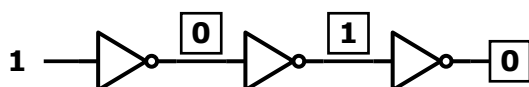
One input alone does not tell us the gate. For example 1 and 1 gives 1 in both the AND gate and the OR gate. Only the full truth table shows which gate it is. 2 marks.

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

It comes out the same as it went in. The first NOT gate changes it (1 to 0) and the second NOT gate changes it back (0 to 1). 2 marks.

E A chain of NOT gates

4 marks



0, 1, 0 (1 mark each). The sentence: **1** (1 mark), because each NOT gate changes the value.

F Identify the logic function

4 marks

1. Box W - OR	2. Box X - NOT	3. Box Y - AND	4. Box Z - AND
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Box Z is an AND gate: its rows are in a different order, but only 1 and 1 gives 1.

G Put the steps in order

5 marks

The numbers the student writes, from the top of the list down:

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

★ TEACHING TIP

- Write the bar over A clearly on the board. Students often forget it in the NOT gate output.



H What are the inputs?

8 marks

1. two NOTs, then OR: A = 1 , B = 1	2. two NOTs, then AND: A = 0 , B = 0
3. NOT A, then OR: A = 1 , B = 0	4. NOT A, then AND: A = 0 , B = 1

1 mark for each input. Work backwards from the output: a NOT gate that gives 0 must have the input 1.

I Truth table of a circuit

8 marks

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

1 mark for each cell. First NOT A: 1, 1, 0, 0. Then $\bar{A}$ OR B: 1, 1, 0, 1.

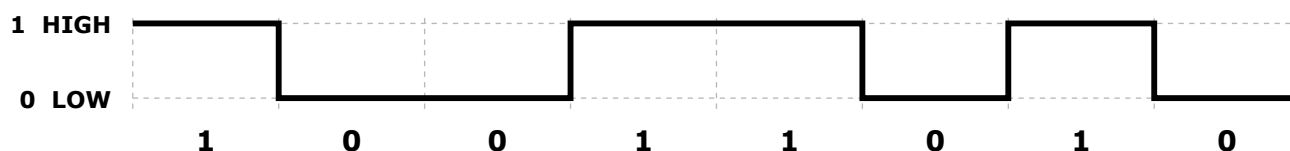
ANSWERS

Chapter 4

Logic gates inside the computer

A Draw the digital signal

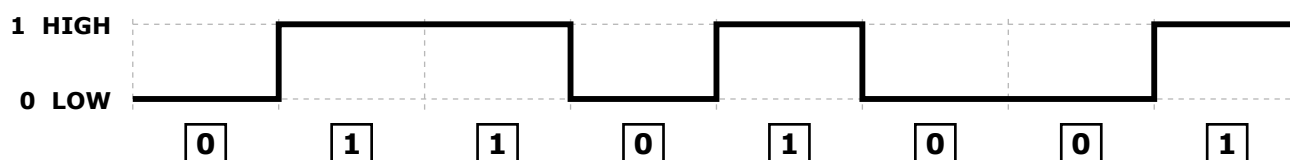
4 marks



1 mark for every two parts drawn at the right level (HIGH for 1, LOW for 0).

B Read the digital signal

8 marks



C Complete the table

6 marks

Way of showing	State 1	State 0
Numbers	1	0
Levels	HIGH	LOW
Words	True	False
Voltages	5 V	0 V

1 mark for each of the six words.



D Choose the correct answer

8 marks

1. (d) CPU	2. (a) AND gate
3. (b) A + B	4. (c) NOT gate
5. (c) NOT gate	6. (d) HIGH
7. (b) 0	8. (a) simulator

E Match them

6 marks

1. Logic gates $\rightarrow$ D	2. Digital signal $\rightarrow$ A	3. Binary values $\rightarrow$ F
4. State 1 $\rightarrow$ E	5. State 0 $\rightarrow$ B	6. CPU $\rightarrow$ C

F Crossword

8 marks

The crossword puzzle grid is shown with the following words filled in:

- Across:** 2 BINARY, 3 FALSE, 5 DIGITAL, 8 HIGH
- Down:** 1 VALVE, 4 LOGIC, 6 TRUTH, 7 LAMP

G Answer these

4 marks

- 1. What is a digital signal? (2 marks)**
A signal that has only one value out of two (1 or 0) at a particular time. 2 marks.
- 2. Write TWO other ways to show the binary values 1 and 0. (2 marks)**
Any two: HIGH and LOW; True and False; 5 V and 0 V. 1 mark each.

H Fill in the blanks

5 marks

1. building	2. CPU	3. digital	4. two	5. process
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TIP: Let the class say the AND table aloud: 0 0 gives 0, 0 1 gives 0, 1 0 gives 0, 1 1 gives 1.



MARKING SCHEME

Unit 5 Test

Total 40 marks

1 Choose the correct answer

8 marks (1 each)

1. (b) three	2. (b) OR gate
3. (c) $\bar{A}$	4. (a) 0
5. (a) AND gate	6. (b) 1
7. (a) one value out of two	8. (c) 5 V

2 Fill in the blanks

8 marks (1 each)

1. NOT	2. 1	3. one	4. opposite
5. truth	6. capital	7. on	8. LOW

3 Look at the gates

8 marks (1 each)

1. AND gate - output 1	2. OR gate - output 1
3. NOT gate - output 0	4. AND gate - output 0

1 mark for each name and 1 mark for each output.

4 Answer these

16 marks

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

1 mark for the OR shape (curved back and pointed front), 1 mark for the inputs A and B, 1 mark for the output A + B.

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

Outputs 0, 0, 0, 1 (for 0 0, 0 1, 1 0, 1 1). 1 mark each.

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

Daylight is the input and the lamp is the output (1 mark). With daylight (1) the lamp is OFF (0) (1 mark). With no daylight (0) the lamp is ON (1) (1 mark). The output is the opposite of the input.

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

The AND gate gives 0 (1 and 0). The NOT gate gives 1. 1 mark each.



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

1 means the electric signal is available (present). 0 means it is not available. 1 mark each.

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

They are the basic building blocks of the CPU (1 mark). The computer uses AND, OR and NOT gates to process data (1 mark).

i WHAT STUDENTS USUALLY GET WRONG

- They write 2 for an OR gate with the inputs 1 and 1. In an OR gate **1 + 1 = 1**.
- They mix up the symbols. **AND**: flat back, round front. **OR**: curved back, pointed front.
- They forget the small circle at the tip of the **NOT** gate, or the bar over A in its output.
- They think an open valve is 0. In the textbook **open = 1** and **closed = 0**.
- In circuits they start at the output. Work from **left to right**, one gate at a time.
- They give the first gate's inputs to the second gate, instead of the first gate's **output**.
- They think a digital signal can have many values. It has **one value out of two** at a time.

★ HOMEWORK AND EXTRA PRACTICE

- Draw the AND, OR and NOT symbols with their truth tables from memory.
- Draw a circuit of two gates for a friend. Give the inputs and ask for the output.
- Draw a digital signal for 0 1 1 0 0 1 0 1. Write it again as HIGH and LOW.
- Fast learners: build a circuit of three gates in the simulator and write its truth table.

★ TEACHING TIPS

- Use the school water tank as a real example. Where are the valves? What if one is closed?
- Before the test, give pairs two minutes to draw the three symbols from memory and check each other.
- Keep "1 = available, 0 = not available" in one corner of the board for the whole unit.

i MY NOTES

