Unit 4 · True or False: Logic

WORKSHEET

Full marks 30

Name _____ Class _____ Roll no. ____ Date _____ Marks _____ / 30

1 Key words [4]

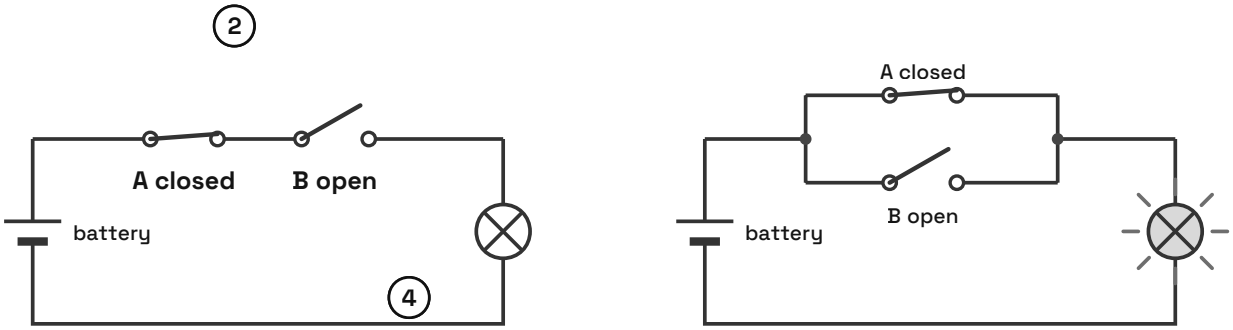
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

Boolean logic	**inverter**	**logic circuit**	**logic gate**	**overflow**	**parallel**	**series**	**statement**	**truth table**	**Venn diagram**

A sentence that is either true or false is a _____. The kind of logic computers use, with just two values, is _____. A table that lists every combination of inputs, with the output for each, is a _____. A tiny circuit of transistors that does AND, OR or NOT is a _____, and a NOT gate is also called an _____. Two switches one after the other are joined in _____ and make AND; side by side, they are joined in _____ and make OR. Gates wired together, the output of one into an input of another, make a _____.

2 Label the diagram [2]

The diagram shows two circuits, each with a battery, a bulb and two switches. In both, switch A is closed and switch B is open. Write what belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. What is **1 AND 0**? [1]

a. 0 **b.** 1

c. 10 **d.** 2

ii. What is **NOT (0 OR 0)**? [1]

a. 0 **b.** 1

c. 00 **d.** It can't be worked out.

iii. How many rows has a truth table with 4 inputs? [1]

a. 4 **b.** 8

c. 16 **d.** 32

iv. A rice shop gives a free bag to a customer who buys more than 20 kg **and** pays in cash. Ram buys 25 kg and pays by mobile wallet. Does he get the bag? [1]

a. Yes, because he bought more than 20 kg. **b.** No, because only one of the two is true.

c. Yes, because one of the two is enough. **d.** We can't tell.

v. "The alarm rings at 6 o'clock unless it is a holiday." Which is this rule? [1]

a. six OR holiday **b.** six AND holiday

c. six AND NOT holiday **d.** NOT six AND holiday

4 Truth tables [5]

Fill in each truth table. Work out a column at a time, from the inside out.

a. [2]

A	B	NOT B	A AND NOT B
0	0		
0	1		
1	0		
1	1		

b. A light on an inverter shines when its switch is on AND there is power from the mains OR the battery: **S AND (M OR B)**, with S for switch, M for mains and B for battery. [3]

S	M	B	M OR B	S AND (M OR B)
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

In how many rows is the light on?

5 Rules as logic [6]

Write short answers to the following questions.

a. Write each rule as logic, then say which output it gives for the inputs shown. [3]

i. "The fan turns on when it is hot and someone is in the room." hot = 1, someone = 0.

ii. "You may borrow a book if you have a library card or a teacher's note." card = 0, note = 1.

iii. "Go out to play unless it is raining." play time = 1, raining = 1.

b. A school's computer lab door unlocks when a teacher's card is shown, OR when a student's card is shown AND it is lab time. Write the rule as logic with brackets, and draw its logic circuit with gates. [3]

Draw the circuit here: gates, the inputs teacher, student and labtime on the left, the door's lock on the right.

6 Find and fix the bug [3]

Read the program, then answer.

A program should say "Teenager" for ages 13 to 19. Sanjay writes **if age > 12 or age < 20 then say "Teenager".** What is wrong? Give an age that shows the bug, and fix it.

7 Logic in search [3]

Write short answers to the following question.

Of twelve web pages, 6 have the word **rhino**, 6 have the word **Chitwan**, and 3 of them have both. How many pages does each search find? Give a reason for each.

i. rhino AND Chitwan
ii. rhino OR Chitwan
iii. rhino NOT Chitwan

8 Think [2]

Think, then answer.

The inverter light's rule is **switch AND (mains OR battery).** Someone leaves out the brackets and builds **switch AND mains OR battery.** What would go wrong? Give one row (switch, mains, battery) where the two rules give different answers.

9 Activity: Logic around you (not marked)

Find three rules at home, at school or on the road that a machine or a person follows, each with two or three things to check (a gate, a pump, a light, a school notice). Write each rule in words, name what it checks, and write it as logic with AND, OR, NOT and brackets.

The rule in words	What it checks	The rule as logic