Grade 7 Computing

Unit 4 · True or False: Logic

ANSWER KEY · FOR TEACHERS

Full marks 30

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

K · 4

1. statement
2. Boolean logic
3. truth table
4. logic gate
5. inverter
6. series
7. parallel
8. logic circuit

Each carries 0.5 mark.

2 Label the diagram

U · 2

1. AND: switches in series
2. OR: switches in parallel
3. bulb off
4. bulb on

Each carries 0.5 mark.

3 Multiple choice

i. **a.** 0 — K · 1

AND is 1 only when both inputs are 1. Here one is 0, so the output is 0.

ii. **b.** 1 — U · 1

Brackets first: 0 OR 0 = 0. Then NOT 0 = 1.

iii. **c.** 16 — U · 1

Each input doubles the number of rows: $2 \times 2 \times 2 \times 2 = 2^4 = 16$. These are the 16 patterns four bits can make, 0000 to 1111.

iv. **b. No, because only one of the two is true.** — A · 1

For AND, both must be true. “More than 20 kg” is true, but “pays in cash” is false, so true AND false is false. If the shop had said “or”, one would have been enough.

v. **c. six AND NOT holiday** — A · 1

“Unless” brings in an exception, a holiday, that stops the alarm: it rings when it is 6 o’clock AND it is NOT a holiday. “six AND holiday” is the opposite: it would ring only on holidays.

4 Truth tables

a. — U · 2

ANSWER

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

MARKING SCHEME

✓ NOT B: 1, 0, 1, 0.

✓ A AND NOT B: 0, 0, 1, 0 (1 only when A is 1 and B is 0).

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b. ANSWER A · 3

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

The light is on in **3** rows: the switch on, with the mains, the battery, or both.

MARKING SCHEME

- ✓ M OR B: 0 only in the rows where M and B are both 0, 1 in the other six.
- ✓ S AND (M OR B): 0 in every row with S = 0; 0, 1, 1, 1 in the rows with S = 1.
- ✓ 3 rows.

5 Rules as logic

a. MARKING SCHEME A · 3

- ✓ i. hot AND someone = 1 AND 0 = 0: the fan stays off.
- ✓ ii. card OR note = 0 OR 1 = 1: you may borrow the book.
- ✓ iii. play time AND NOT raining = 1 AND NOT 1 = 1 AND 0 = 0: you stay in.

b. ANSWER A · 3

teacher OR (student AND labtime).
Circuit: **student** and **labtime** go into an AND gate (a D shape). Its output and **teacher** go into an OR gate (a shield shape). The OR gate's output goes to the door's lock.

MARKING SCHEME

- ✓ The rule with brackets: teacher OR (student AND labtime).
- ✓ An AND gate (drawn as a D) with student and labtime as its inputs.
- ✓ An OR gate (drawn as a shield) with the AND gate's output and teacher as its inputs, its output to the lock.

6 Find and fix the bug

MARKING SCHEME A · 3

- ✓ **or** is true when either side is true, and every age is more than 12 or less than 20, so it says "Teenager" for everyone.
- ✓ An age that shows it, such as 5 or 40.
- ✓ The fix: **if age > 12 and age < 20 then say "Teenager".**

7 Logic in search

MARKING SCHEME A · 3

- ✓ i. 3: AND finds only the pages with both words.
- ✓ ii. 9: OR finds the pages with either word, 6 + 6 − 3, each page with both counted once.
- ✓ iii. 3: the 6 rhino pages without the 3 that also have Chitwan.

8 Think

ANSWER

Without brackets, AND is done first, so the rule becomes **(switch AND mains) OR battery.** Then the battery alone is enough: the light would come on from the battery even with its

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switch off. For example, switch 0, mains 0, battery 1: the right rule gives 0 (off), the rule without brackets gives 1 (on). (Switch 0, mains 1, battery 1 differs the same way.)

MARKING SCHEME

- ✓ Without brackets AND is done first, (switch AND mains) OR battery, so the light comes on from the battery with its switch off.
- ✓ A row where they differ: switch 0, battery 1 (mains 0 or 1): the right rule gives 0, the other gives 1.

9 Activity: Logic around you

(not marked)

WHAT STUDENTS SHOULD FIND

For example: "The school bell rings at 10 unless it is a holiday": **ten AND NOT holiday.** "The water pump runs when there is water and the tank is not full": **water AND NOT full.** "You may enter with a ticket or a pass": **ticket OR pass.** Words such as "but" and "as well as" become AND, "either … or" becomes OR, and "unless" becomes AND NOT. A rule that says "and" may really mean OR ("closed on Saturdays and holidays"); a truth table shows which.

Marks by level	Knowledge	Understanding	Application	Higher ability	**Total**
Marks	5	6	17	2	**30**

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