

**Logic**

1 Two truth tables are given below. A and B are inputs. P and Q are outputs.

Draw the correct logic gates for each of these truth tables.

a)

| A | P |
|---|---|
| 0 | 1 |
| 1 | 0 |

[1]

b)

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

[1]

[Total 2 marks]

2 A logic gate can be written as  $P = A \text{ AND } B$ .

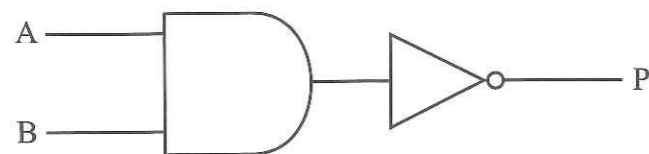
a) State the value of input B when input A is 1 and output P is 0.

B = .....  
[1]

b) A NOT logic gate is placed after the AND logic gate to make the logic diagram below. State the input values when output P is 0.

[3]

[Total 6 marks]



A = ..... B = .....  
[1]

[Total 2 marks]

3 Ollie writes a truth table for the logic circuit  $Q = A \text{ OR } (\text{NOT } B)$ .

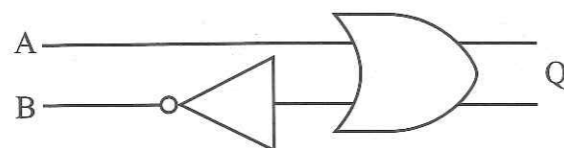
a) Complete his truth table below.

'True' and 'False' can be thought of as 1s and 0s.

| A     | B     | Q    |
|-------|-------|------|
| FALSE | FALSE | TRUE |
| FALSE | TRUE  |      |
|       | FALSE |      |
| TRUE  |       |      |

[3]

b) Ollie draws the following logic diagram for  $Q = A \text{ OR } (\text{NOT } B)$ . Annotate the diagram to show **two** things that are incorrect.



[2]

[Total 5 marks]

4 A series of transistors make the two-level logic circuit (NOT A) AND (B AND C).

a) Complete the truth table below.

| A | B | C | NOT A | B AND C | (NOT A) AND (B AND C) |
|---|---|---|-------|---------|-----------------------|
| 0 | 0 | 0 |       |         |                       |
| 0 | 0 | 1 |       |         |                       |
| 0 | 1 | 0 |       |         |                       |
| 0 | 1 | 1 |       |         |                       |
| 1 | 0 | 0 |       |         |                       |
| 1 | 0 | 1 |       |         |                       |
| 1 | 1 | 0 |       |         |                       |
| 1 | 1 | 1 |       |         |                       |

[3]

b) Draw the logic diagram that represents (NOT A) AND (B AND C).

5 A car uses a logic circuit to decide whether to start the engine or not.

- The car has two buttons, labelled S (START) and D (DRIVE). If both buttons are on, the engine will start.
- The engine also starts if the ignition switch I is turned on.

a) Draw the logic circuit diagram for this system, with Z as an output.

[3]

b) Write a Boolean expression for this logic circuit.

.....  
[1]

c) State all possible values of the inputs and outputs if:

i) Button D is on but the car doesn't start.

.....  
[1]

ii) Buttons I and S are both on.

.....  
.....

[2]

[Total 7 marks]

