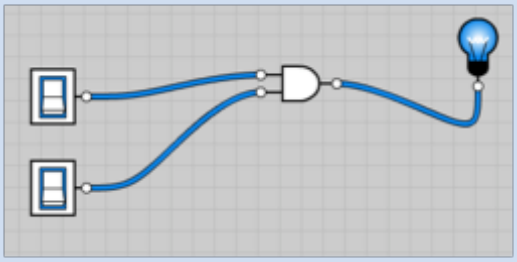
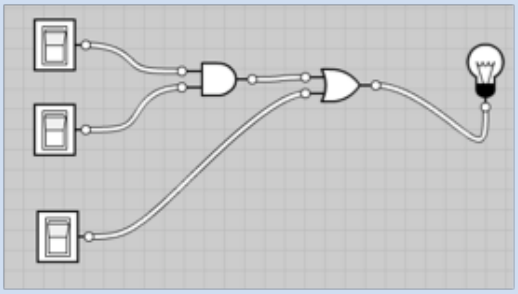
Truth tables

Teacher's Notes

Lesson Plan

Length	60 mins	Specification Link	2.1.2/f	Binary logic
Learning objective		Students should be able to (a) produce a truth table from a given logic diagram		

Time (min)	Activity	Further Notes
10	Using a projector show the **Starter Activity**. Ask the students to predict what should be selected for each of the logical arguments and then display the results. The reset button will then display all of the elements. Inform the students that they have been investigating Boolean logic, first proposed by George Boole in the 1800s. In Boolean algebra, all values can be reduced to 'true' or 'false' and is therefore important in the operation of computers as it coincides with the binary numbering system. Show students the link to the specification. Explain the purpose and objectives of the lesson.	NB press the reset button between buttons, otherwise only the results currently displayed will appear.
5	Watch the set of videos.	
5	Ask some questions about the videos to assess learning. For example: • What is a truth table? • What are the shapes of the symbols used to represent AND, OR and NOT?	A table that displays all the possible results of a logic function.
20	**Worksheet 1** Students to complete Worksheet 1 either on paper or on a computer. Ask individual students for their answers and discuss with the class so that all students will have the correct answers entered on their worksheets.	Answers provided.

Time (min)	Activity	Further Notes
15	The students should now use the Kent State University logic gate simulator. (http://www.cambridgegcsecomputing.org/weblink9) The students can simulate the operation of logic gates and switches.  They should demonstrate all of the examples in Worksheet 1 and compound operations e.g. AND with NOT	Instructions for using this resource may be found in the help section at the top of the webpage.
	Extension Challenge/Homework The students should complete and submit Worksheet 2.	
5	**Plenary** Display the following example:  Ask the students to produce a truth table for this function.	A B C Q 0 0 0 0 1 0 0 0 1 1 0 1 0 1 0 0 0 1 1 1 0 0 1 1 1 0 1 1 0 1 1 1 1 1 1 1

WORKSHEET 1 ANSWERS

1 **(a) Explain what is meant by the following terms:**

(i) Binary digit

Either of the digits 0 or 1 used in the binary number system. It is shortened to the term ‘bit’.

(ii) Byte

A unit that usually consist of 8 bits. A byte is the number of bits needed to encode a single character of text and is the smallest addressable unit of memory.

(b) Explain what is meant by a ‘nibble’ and why it is used in computing.

A nibble consists of 4 bits or half a byte. As there are possible values, so a nibble corresponds to a single hexadecimal digit. Therefore an eight digit byte can be represented by two digits of hexadecimal.

2 **Split the following bytes into nibbles and then convert them to hex. Write your answers in the spaces provided.**

(a) 1 1 0 1 0 0 1 1

Nibbles	1 1 0 1	0 0 1 1
Hex	D	3

(b) 0 1 1 0 0 1 1 0

Nibbles	0 1 1 0	0 1 1 0
Hex	5	3

(c) 1 1 1 1 0 0 1 1

Nibbles	1 1 1 1	0 0 1 1
Hex	F	3

3 **In the spaces below place the following into ascending order according to size.**

Megabyte Bit Nibble Terabyte Byte Gigabyte Kilobyte

Bit	Nibble	Byte	Kilobyte
Megabyte	Gigabyte	Terabyte	

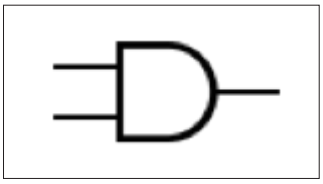
WORKSHEET 2 ANSWERS

1 **Complete the following sentence:**

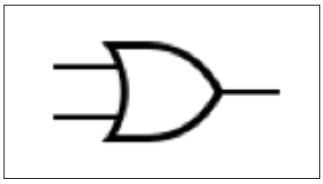
Logic gates are switches which perform a logical function on one or more logical inputs and produce a single logical **output**.

2 **In the spaces below draw the symbols used to represent the following logic gates.**

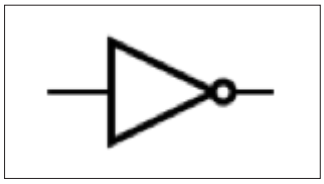
AND



OR



NOT



3 **Complete the following sentence:**

A truth table is a breakdown of a logic function by listing all possible **values** the function can attain.

4 **Complete the truth tables for the following gates.**

(a)

Symbol	Truth table		
	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	1

WORKSHEET 1 ANSWERS

4 **Complete the truth tables for the following gates.**

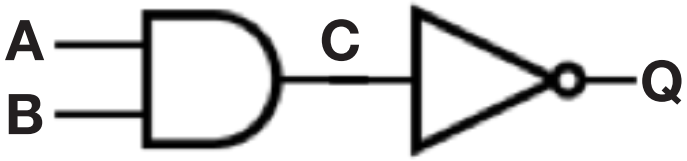
(b)

Symbol	Truth table		
	**A**	**B**	**Q**
	0	0	0
	0	1	0
	1	0	0
	1	1	1

(c)

Symbol	Truth table	
	**A**	**B**
	0	1
	1	0

5 **(a) Complete the truth table for the following combination.**



A	B	C	D
0	0	0	1
1	0	0	1
0	1	0	1
1	1	1	0

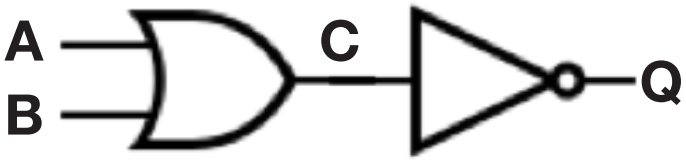
(a) Give the logic statement for this combination.

Q = NOT (A AND B)

WORKSHEET 1 ANSWERS

6 **Give the logic gate drawing and the truth table for the following logic statement.**

Q = NOT (A OR B)



A	B	C	D
0	0	0	1
1	0	1	0
0	1	1	0
1	1	1	0

WORKSHEET 2 ANSWERS

1

A	B	P
0	0	0
0	1	1
1	0	0
1	1	0

2

1,1 1 1