Hexadecimal numbers

Teacher's Notes

Lesson Plan

Length	60 mins	Specification Link	214/e_f_g	Units
Learning objective	Candidates should be able to: (e) convert positive denary whole numbers (0-255) into 2-digit hexadecimal numbers and vice versa (f) convert between binary and hexadecimal equivalents of the same number (g) explain the use of hexadecimal numbers to represent binary numbers			

Time (min)	Activity	Further Notes
10	Using a projector, display the **Interactive Starter Activity**. Stress to the students that the digits we write down can represent different numbers depending on the system we use.	
15	Watch the set of videos, pausing to discuss the content.	
5	Discuss the videos to assess learning. Ask questions such as: • Why is hexadecimal used?	It is much easier to express binary number representations in hex than it is in any other base number system.
	• How would you convert a two digit hexadecimal number to denary?	A two digit hex number can represent a byte.
	• How would you convert an 8 bit binary number to hexadecimal?	Multiply the first digit by 16 and then add on the second digit. Convert the binary number into two nibbles (4 bit numbers) and then convert each to denary. If one is higher than 9, then use the letters A, B, C, D,E and F for the numbers 10 to 15.
15	**Worksheet 1** Pupils to complete Worksheet 1 either on paper or on computer. Ask individual students for their answers and discuss with the class so that all students have the correct answers.	Answers provided. Ask students with the correct responses to explain to the class how they arrived at their answers.
10	The students use the **Interactive Activity 1**.	

Time (min)	Activity	Further Notes
	Extension Challenge/Homework Students to complete and submit Worksheet 2 for homework.	
5	**Plenary – Brain teasers** Quickly ask the students what the denary equivalent would be of the number 24 in the following numbering systems.	
	• In quinary (base 5)	14
	• In septenary (base 7)	18
	• In octonary (base 8)	20
	• In nonary (base 9)	22
	• In duodecimal (base 12)	28
	• In tridecimal (base 13)	30

WORKSHEET 1 ANSWERS

1 **Why is hexadecimal used in computing?**

The main reason that hexadecimal numbers are used is because it is much easier to express binary number representations in hex than it is in any other base number system.

Although computers do not use hex, it is easier for humans to remember and express binary numbers in hex.

A two digit hex number can represent a byte.

2 **The pixels in RGB computer images are programmed by three, 8 bit numbers for the red, green and blue channels. These binary numbers are usually represented by their hexadecimal equivalents.**

In the following table insert the binary and hexadecimal equivalents for the following colours.

COLOUR	BINARY	HEXADECIMAL
Red	11111111,00000000,00000000	#FF0000
Green	00000000, 11111111, 00000000	#00FF00
Blue	00000000,00000000, 11111111	#0000FF
Yellow	00000000, 00000000	#FFFF00
Black	00000000,00000000,00000000	#000000
White	11111111, 11111111, 11111111	#FFFFFF

3 **A student used the ipconfig program to find his ip address and MAC or physical address.**

The MAC number was shown as 6 hexadecimal numbers - C4 – 46 – 19 – 73 – 49 – 70.

In the table below, insert the denary and binary equivalents of the first three of these hexadecimal numbers.

Hexadecimal	C4	46	19
Denary	196	70	25
Binary	11000100	01000110	00011001

WORKSHEET 1 ANSWERS

4 Convert the following denary numbers to hexadecimal.

(a) 96 60

(b) 201 C9

(c) 141 8D

WORKSHEET 2 ANSWERS

1

(a) Explain why hexadecimal numbers are often used to represent binary numbers.

Hex numbers are shorter/more memorable than equivalent binary numbers…

... and can easily be converted to and from binary...

... as each hex digit corresponds to 4 binary digits

(b) Convert the hexadecimal 9C to denary. You must show your working. (2)

9*16 = 144 + 12

156

(c) Convert the hexadecimal number 9C to binary. (2)

10011100

(d) Convert the binary number 01101101 to hexadecimal. (2)

6D