Exercises about representation of information

Add a few explanations to demonstrate how to perform each conversion. For example, from decimal to binary we use powers and then explain the corresponding operations.

1. Convert from decimal to binary:
    a. 234 1110 1010
    b. 555 1000101011
    c. 12321 11000000100001
    d. 152 10011000
    e. 32768 1000000000000000

2. Convert from binary to decimal:
    a. 100000000 256
    b. 1011110100 756
    c. 10011101 157
    d. 11111111111 2047

3. Convert from hexadecimal to binary:
    a. 45A0 100010110100000
    b. CF 11001111
    c. AAB2 1010101010110010
    d. 3020 11000000100000

4. Convert from binary to hexadecimal:
    a. 110001000 188
    b. 100010110 116

5. Complete the following conversions related to octal numeral system:
    a. Convert the numbers from exercise 4 to octal.
        i. 110001000 610
        ii. 100010110 426
    b. Convert the octal 3020 to binary.
        i. 3020 11000010000

6. Fill in the gaps, using all the conversions you need. You have to write the steps to transform each number.

BINARY	DECIMAL	HEXADECIMAL	OCTAL
100001	**33**	21	41
11111111	255	**FF**	377
11111111	255	FF	**377**
100001	33	21	41

7. How many bits do you need to represent the following numbers in binary?
    a. hexadecimal: 4B, 4AA, FF4FA, 345F
    b. decimal: 100, 256, 255, 32, 31, 3, 4350, 1024, 45, 2^{30}, 63
8. Solve the following parts using ASCII extended (8 bits).
    a. Write a random text, which contains letters, numbers and other alphanumeric characters.
    b. Encode to hexadecimal, according ASCII table.
    c. Convert to binary.

Explanation:
EXERCISE 1:
234 to binary
2^7=128
128 64 32 16 8 4 2 1
1 1 1 0 0 1 0 1
128+0 <234 ==1
128+64=192 <234 ==1
192+32=224 <234 ==1
224+16=240 >234 ==0
224+8=232 <234 ==1
232+4 >234 ==0
232+2 <=234 ==1
234+1 >234 ==0

555 to binary
2^9
512 256 128 64 32 16 8 4 2 1
1 0 0 0 1 0 1 0 1 1
512+0 <555 ==1
512+256 >555 ==0
512+128 >555 ==0
512+64 >555 ==0
512+32=544 <555 ==1
544+16 >555 ==0
544+8=552 <555 ==1
552+4 >555 ==0
552+2=554 <555 ==1
554+1 <=555 ==1

12321 to binary
2^13=8192
8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1

8192+0 <12321 ==1
8192+4096=12288 <12321 ==1
12288+2048 >12321 ==0
12288+1024 >12321 ==0
12288+512 >12321 ==0
12288+256 >12321 ==0
12288+128 >12321 ==0
12288+64 >12321 ==0
12288+32=12320 <12321 ==1
12320+16 >12321 ==0
12320+8 >12321 ==0
12320+4 >12321 ==0
12320+2 >12321 ==0
12320+1 <=12321 ==1

152 to binary
128 64 32 16 8 4 2 1
10011000
128+0 <152 ==1
128+64=192 >152 ==0
128+32=160 >152 ==0
128+16=144 <152 ==1
144+8 <=152 ==1
152+4
+2
+1

32768
2^15=32768
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
1000000000000000

EXERCISE 2:
binary to decimal
100000000
se suma.
2^8 =256

1011110100 suma = 756
2^9*1
2^8*0
10011101 157
2^7*1
2^6*0

2^5*0
2^4*1
2^3*1
2^2*1
2^1*0
2^0*1
11111111111 2^11 -1 ==2047

EXERCISE 3

45A0
0100 0101 1010 0000
-100010110100000-

CF
-1100 1111-

AAB2
-1010 1010 1011 0010-

3020
0011 0000 0010 0000
-11000000100000-

EXERCISE 4

110001000
1 1000 1000
0001 1000 1000
 1 8 8
-188-

100010110
1 0001 0110
0001 0001 0110
 1 1 6
-116-

EXERCISE 5
110001000
110 001 000
 6 1 0
-610-

100010110
100 010 110
 4 2 6
-426-

3020
011 000 010 000
-11000010000-

EXERCISE 6

	binary	decimal	hexadecimal	octal
1-		33		
2-			FF	
3-				377
4-	100001			

1. 33 decimal
binary
2^5=32
-100001-
Al ser 1 mas q la potencia de 2
tantos 0s como potencia y cambiamos el ultimo por 1
Hexadecimal
100001
10 0001
0010 0001
 2 1
-21-
octal
100001
100 001
 4 1
-41-

2. FF hexadecimal
binary
FF
-1111 1111-
decimal
2^8 -1
-255-
Al ser todo 1s es uno menos q una potencia de 2
la potencia es el numero de digitos. En este caso 8.
octal

11111111
11 111 111
011 111 111
3 7 7
-377-

3.377 octal
The ansers have to be the same as the previous exercise.
binary
377
011 111 111
-11111111-

4.100001 binary
The answers are the same as the first one.
decimal
2^5+2^0=33