Question 1)

①: −243 in 16-bit signed Binary

solution:

1) write 243 in binary

1   3   7   15   30   60   121   243

0000 0000 1 1 1 1 0 0 1 1

2) take 2's compliment

0000 0000 1111 0011

) invert the bits

1111 1111 0000 1100

+   1) add 1

1111 1111 0000 1101

⟹ Thus, the number −243 in 16-bit signed binary is :

1111 1111 0000 1101

②: Give the hexadecimal representation of −243

1111   1111   0000   1101

$2^3+2^2+2^1+2^0$ F   0   8+4+1= 13→D

= 8+4+2+1

= 15

∵ A   B ··· F
   10 11   15

⟶ Thus, the hexadecimal representation is FF0D

And, according to notes 3, the hexa. number should
be written as 0XFF0D.
But the given hexadecimal numbers
are Not in this form, so FF0D would be the answer.

③ Give the 16-bit signed binary representation of 728

write 728 in binary :
keep dividing by 2 and take the remainders

1 2 5 11 22 45 91 182 364 728

0000 0010 110 11000

→ Thus, 728 represented in 16-bit signed binary is

0000 0010 11011000

④ Give the hexadecimal representation of 728
Using the answer of the previous question
0000 0010 1101 1000
   0   2^1 $2^3+2^2+2^0$ 2^3
        =2   = 13   =8

A B C D
10 11 12 13

→ Thus, it's 0X 02D8

⑤ Give 1101. 0111 in decimal representation
                    ↖ unsigned

1) convert 1101 (unsigned) to decimal
$$2^3 + 2^2 + 2^0 = 8 + 4 + 1 = 13$$

2) convert the fraction part to decimal
. 0111
$$2^{-2} + 2^{-3} + 2^{-4} = \frac{1}{4} + \frac{1}{8} + \frac{1}{16} = 0.4375$$

3) Combine the results of 1) & 2)

⟶ $\boxed{13.4375}$ is the decimal representation

⑥ Give the hexadecimal repre. of 1101.0111 (unsigned)

Use the binary representation:

1101 . 0111

$\underbrace{\quad}$ 8+4+1 $\underbrace{\quad}$ 4+2+1

= 13   = 7

↓ ≥10

A ... D
10   13

⟹ Thus, the hexad. representation is $\boxed{D.7}$

⑦ Write 11011100 (unsigned) in decimal

1 1 0 1 1 1 0 0

2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

↳ $2^7 + 2^6 + 2^4 + 2^3 + 2^2$

= 128 + 64 + 16 + 8 + 4

= 220

⟹ the decimal representation is $\boxed{220}$

8) Give 11011100's hexadecimal representation.

1101   1100

8+4+1=13   8+4=12

↓   ↓

D   C

⟹ the hexadecimal representation is $\boxed{DC}$.

Question 1   continues

⑨   7D.8 in binary

$$7 \quad D \qquad\qquad 8$$
$$\downarrow \quad \downarrow \qquad\qquad \downarrow$$
$$7 \quad 13 \qquad\qquad 8$$

$2^3 \, 2^2 \, 2^1 \, 2^0 \quad | \quad 2^3 \, 2^2 \, 2^1 \, 2^0 \qquad 2^3 \, 2^2 \, 2^1 \, 2^0$

0. 1 1 1 | 1 1 0 1 . 1

⟶ the binary representation is ~~1 1 1 1 1 0 1 . 1~~

0 1 1 1 1 1 0 1 . 1

⑩   7D.8 in decimal

use the result from ⑨.

1 1 1 1 1 0 1 . 1

$$2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^0 = 125$$

$$0.1 \longrightarrow 2^{-1} = 0.5$$

⟶ 7D.8 is 125.5   in decimal representation

⑪   1B5 in binary

$$1 \qquad\quad B \qquad 5$$
$$\quad \qquad \downarrow$$
$$1 \qquad\quad 11 \qquad 5$$

$2^3 \, 2^2 \, 2^1 \, 2^0 \quad 2^3 \, 2^2 \, 2^1 \, 2^0 \quad 2^3 \, 2^2 \, 2^1 \, 2^0$

0 0 0 1   1 0 1 1   0 1 0 1

⟶ it's ~~1 1 0 1 1 0 1 0 1~~   0001 1011 0101

(12)   1B5 in decimal

Use the result from the last step:

110110101

$\hookrightarrow 2^8 + 2^7 + 2^5 + 2^4 + 2^2 + 2^0$

$= 437$

$\rightarrow$ the decimal representation of 1B5 is $\boxed{437}$