Find the binary for the following decimal in 32-bit single precision IEEE754 format:

22.34

Step 1: Convert the given decimal into binary form

Exponent: Divide 22 by 2

Quotient	Remainder
11	0
5	1
2	1
1	0

Mantissa: Multiply 0.34 by 2

0.34*2 =	0
0.68*2 =	1
0.36*2 =	0
0.72*2 =	1
0.44*2 =	0
0.88*2 =	1
0.76*2 =	1
0.52*2 =	1
0.04*2 =	0
0.08*2 =	0
0.16*2 =	0
0.32*2 =	0
0.64*2 =	1
0.28*2 =	0
0.56*2 =	1
0.12*2 =	0
0.24*2 =	0
0.48*2 =	0
0.96*2 =	1
0.92*2 =	1

Decimal:	22					.	34
Binary:	1	0	1	1	0	.	0101 0111 0000 1010 0011…

Step 2: Represent the obtained binary in scientific notation

In scientific notation, a float binary is written in a form so that it begins with "1."
Hence, we must move the point 4 places to the *left* in the obtained binary.

We have,	1	0	1	1	0	.	0101 0111 0000 1010 0011…

After bit-shifting,

1	.	0	1	1	0	0101 0111 0000 1010 0011… *2^4

Step 3: Convert the scientific notation into 32-bit single precision IEEE754 format

We need to represent the power of 2, 4 in our case, in bits. As per the IEEE rules, we must add a
bias to the power, and then represent the resultant in bits. In 32-bit format,

Bias: 127

=>   Exponent = 127 + 4 = 131

Binary of 131:

Quotient	Remainder
65	1
32	1
16	0
8	0
4	0
2	0
1	0

Now we can represent the exponent in 8 bits as per the 32-bit IEEE format.

1	0	0	0	0	0	1	1

So in single precision, 22.34 is represented as:

Sign	Exponent	Mantissa	
0	10000011	01100101011100001010001	
		01100101011100001010010	*Rounded!*

Sign	0		
	1		
	0		
	0		
Exponent	0		
	0		
	0		
	1		
	1		
	0	2^ -1	0
	1	2^ -2	0.25
	1	2^ -3	0.125
	0	2^ -4	0
	0	2^ -5	0
	1	2^ -6	0.015625
	0	2^ -7	0
	1	2^ -8	0.00390625
	0	2^ -9	0
Mantissa	1	2^ -10	0.0009765625
	1	2^ -11	0.00048828125
	1	2^ -12	0.000244140625
	0	2^ -13	0
	0	2^ -14	0
	0	2^ -15	0
	0	2^ -16	0
	1	2^ -17	0.00000762939453125
	0	2^ -18	0
	1	2^ -19	0.0000019073486328125
	0	2^ -20	0
	0	2^ -21	0
	1	2^ -22	0.0000002384185791015625
	0	2^ -23	0
			0.3962500095367431640625 Sum

Cross-verification:

The above sum is in IEEE format, so it must be converted to decimal. The standard formula for the same:

$$(-1)^{sign} * (1 + mantissa) * 2^{exponent}$$

=> $(-1)^0 * (1 + 0.3962500095367431640625) * 2^4$

= $1.3962500095367431640625 * 16$

= **22.340000152587890625**