Topic: Multiplying and dividing scientific notation

Question: Rewrite the expression in scientific notation.

$$\frac{(60 \times 10^{7})(200 \times 10^{-2})}{1{,}000 \times 10^{-5}}$$

Answer choices:

A 1.2×10^{9}

B 1.2×10^{-10}

C 1.2×10^{11}

D 1.2×10^{10}

Solution: C

We'll begin by doing the multiplication in the numerator, so we'll multiply the decimal numbers and the powers of 10 separately, remembering that we have to add the exponents.

$$\frac{(60 \times 10^7)(200 \times 10^{-2})}{1{,}000 \times 10^{-5}}$$

$$\frac{(60 \times 200)(10^7 \times 10^{-2})}{1{,}000 \times 10^{-5}}$$

$$\frac{12{,}000 \times 10^{7+(-2)}}{1{,}000 \times 10^{-5}}$$

$$\frac{12{,}000 \times 10^{7-2}}{1{,}000 \times 10^{-5}}$$

$$\frac{12{,}000 \times 10^5}{1{,}000 \times 10^{-5}}$$

The result we got for that multiplication $12{,}000 \times 10^5$ isn't in proper scientific notation, but we'll go ahead and do the division, and then at the end we'll make any adjustments that are needed to express the answer in proper scientific notation.

Dividing the decimal numbers, we get

$$12{,}000 \div 1{,}000 = 12$$

Divide the powers of 10, remembering to subtract the exponents.

$$10^5 \div 10^{-5} = 10^{5-(-5)} = 10^{5+5} = 10^{10}$$

Multiplying the results of those two divisions, we get

$$12 \times 10^{10}$$

This still isn't in proper scientific notation, because there are two digits to the left of the place where the decimal point would be in 12. We first put a decimal point after the 12 (giving $12.$), and then we move the decimal point one place to the left, so the exponent will be 1.

$$12 = 1.2 \times 10^{1}$$

Now we'll multiply 1.2×10^{1} by 10^{10}, adding the exponents.

$$(1.2 \times 10^{1}) \times 10^{10}$$

$$1.2 \times (10^{1} \times 10^{10})$$

$$1.2 \times 10^{1+10}$$

$$1.2 \times 10^{11}$$

Topic: Multiplying and dividing scientific notation

Question: Rewrite the expression in scientific notation.

$$\frac{(0.04 \times 10^{-9})(50 \times 10^{10})}{(0.000004)(50{,}000)}$$

Answer choices:

A 1×10^2

B 10^8

C 2×10^8

D 100

Solution: A

If we start with the given expression

$$\frac{(0.04 \times 10^{-9})(50 \times 10^{10})}{(0.000004)(50{,}000)}$$

we'll first work on the numerator separately from the denominator. And when we're working inside the numerator or inside the denominator, when we multiply numbers in scientific notation, we multiply the decimal terms.

$$\frac{0.04 \cdot 50 \times 10^{-9} \cdot 10^{10}}{0.000004 \cdot 50{,}000}$$

$$\frac{2 \times 10^{-9} \cdot 10^{10}}{0.2}$$

Then we'll multiply the powers of 10, adding the exponents when we do that.

$$\frac{2 \times 10^{1}}{0.2}$$

Now that we've somewhat simplified the numerator and denominator, we'll divide the decimal terms, and then separately divide the powers of 10.

$$\frac{2}{0.2} \times 10^{1}$$

$$10 \times 10^{1}$$

Now we have to put this answer into proper scientific notation. To change the 10 decimal term into proper scientific notation, we need to move the decimal point one place to the left.

$$1.0 \times 10^{1}$$

But because we made the decimal term smaller, we have to make the 10 term larger. We moved the decimal point one place, so we need to increase the exponent by 1.

$$1.0 \times 10^{2}$$

Drop the 0 from the decimal term since it's not a significant figure.

$$1 \times 10^{2}$$

Topic: Multiplying and dividing scientific notation

Question: Rewrite the expression in scientific notation.

$$\frac{(40{,}000 \times 10^{5})(120 \times 10^{-20})}{(0.003 \times 10^{-8})(2{,}000)}$$

Answer choices:

A 80×10^{2}

B 8

C 0.8×10^{-2}

D 8.0×10^{-2}

Solution: D

In the numerator and denominator, we'll multiply the decimal numbers, and then separately multiply the powers of 10, remembering that we have to add the exponents. But first we can rewrite each number in scientific notation.

$$\frac{(40{,}000 \times 10^5)(120 \times 10^{-20})}{(0.003 \times 10^{-8})(2{,}000)}$$

$$\frac{(4 \times 10^4 \times 10^5)(1.2 \times 10^2 \times 10^{-20})}{(3 \times 10^{-3} \times 10^{-8})(2 \times 10^3)}$$

$$\frac{(4 \times 10^{4+5})(1.2 \times 10^{2-20})}{(3 \times 10^{-3-8})(2 \times 10^3)}$$

$$\frac{(4 \times 10^9)(1.2 \times 10^{-18})}{(3 \times 10^{-11})(2 \times 10^3)}$$

$$\frac{(4 \times 1.2)(10^9 \times 10^{-18})}{(3 \times 2)(10^{-11} \times 10^3)}$$

$$\frac{4.8 \times 10^{9-18}}{6 \times 10^{-11+3}}$$

$$\frac{4.8 \times 10^{-9}}{6 \times 10^{-8}}$$

$$0.8 \times 10^{-9-(-8)}$$

$$0.8 \times 10^{-1}$$

In order to write this in scientific notation, we have to express 0.8 as only one digit in the ones (units) place, and one digit in the tenths place. We need to move the decimal one place to the right in order to get 8.0. So we'll change the expression to

$$8.0 \times 10^{-1} \times 10^{-1}$$

$$8.0 \times 10^{-1-1}$$

$$8.0 \times 10^{-2}$$