ASTR202 – Fall 2007: SCIENTIFIC NOTATION REVIEW

Review of scientific notation

Scientific notation provides a place to hold the zeroes that come after a whole number or before a fraction. The number 100,000,000 for example, takes up a lot of room and takes time to write out, while 10^8 is much more efficient.

Though we think of zero as having no value, zeroes can make a number much bigger or smaller. Think about the difference between 10 dollars and 100 dollars. Even one zero can make a big difference in the value of the number. In the same way, 0.1 (one-tenth) of the US military budget is much more than 0.01 (one-hundredth) of the budget.

The small number to the right of the 10 in scientific notation is called the exponent. Note that a negative exponent indicates that the number is a fraction (less than one).

The line below shows the equivalent values of decimal notation (the way we write numbers usually, like "1,000 dollars") and scientific notation (10^3 dollars). For numbers smaller than one, the fraction is given as well.

Fraction	1/100	1/10				
Decimal notation	0.01	0.1	1	10	100	100
Scientific notation	10^{-2}	10^{-1}	10^0	10^1	10^2	10^3

Practice with scientific notation

Write out the decimal equivalent (regular form) of the following numbers that are in scientific notation.

A Example: $10^3 = 1000$

1.	10^2	=	4.	10^{-2}	=
2.	10^4	=	5.	10^{-5}	=
3.	10^7	=	6.	10^0	=

B Example: $2 \times 10^2 = 200$

1.	3×10^2	=	4.	6×10^{-3}	=
2.	7×10^4	=	5.	900×10^{-2}	=
3.	2.4×10^3	=	6.	4×10^{-6}	=

C Now from decimal form to scientific notation, e.g. $1000 = 10^3$.

1.	10	=	4.	0.1	=
2.	100	=	5.	0.0001	=
3.	$100,000,000$	=	6.	1	=

D and a little more difficult... $3000 = 3 \times 10^3$.

1.	400	=	4.	0.005	=
2.	$60,000$	=	5.	0.0034	=
3.	$750,000$	=	6.	0.06457	=

More practice with scientific notation

Perform the following operations in scientific notation.

E Multiplication — Example: $(2 \times 10^2) \times (6 \times 10^3) = 12 \times 10^5 = 1.2 \times 10^6$.

Remember that your answer should be expressed in two parts, as in the model above. The first part should be a number less than 10 (e.g.: 1.2) and the second part should be a power of 10 (e.g.: 10^6). If the first part is a number greater than ten, you will have to convert the first part. In the above example, you would convert your first answer (12×10^5) to the second answer, which has the first part less than ten (1.2×10^6). For extra practice, convert your answer to decimal notation. In the above example, the decimal answer would be 1,200,000

1.	$(1 \times 10^3) \times (3 \times 10^2)$	=	=
2.	$(3 \times 10^4) \times (2 \times 10^3)$	=	=
3.	$(5 \times 10^{-5}) \times (11 \times 10^4)$	=	=
4.	$(2 \times 10^{-4}) \times (4 \times 10^3)$	=	=

F Division — It is a little harder - we basically solve the problem as we did above, using multiplication. But we need to “move” the bottom (denominator) to the top of the fraction. We do this by writing the negative value of the exponent. Next divide the first part of each number. Finally, add the exponents. Example:

$$\frac{(12 \times 10^3)}{(6 \times 10^2)} = 2 \times (10^3 \times 10^{-2}) = 2 \times 10^1 = 20$$

Write your answer as in the example; first convert to a multiplication problem, then solve the problem.

1.	$(8 \times 10^6) \,/\, (4 \times 10^3)$	=	=
2.	$(4.2 \times 10^8) \,/\, (1.2 \times 10^4)$	=	=
3.	$(2 \times 10^3) \,/\, (8 \times 10^5)$	=	=
4.	$(9 \times 10^{21}) \,/\, (3 \times 10^{19})$	=	=

G Addition — The first step is to make sure the exponents are the same. We do this by changing the main number (making it bigger or smaller) so that the exponent can change (get bigger or smaller). Then we can add the main numbers and keep the exponents the same.

Example: $(3 \times 10^4) + (2 \times 10^3) = (3 \times 10^4) + (0.2 \times 10^4) = 3.2 \times 10^4 = 32,000$ Write your answer as in the example; first convert to a multiplication problem, then solve the problem.

1.	$(4 \times 10^3) + (3 \times 10^2)$	=	=
2.	$(9 \times 10^2) + (1.1 \times 10^4)$	=	=
3.	$(8 \times 10^6) + (3.2 \times 10^7)$	=	=
4.	$(1.32 \times 10^{-3}) + (3.44 \times 10^{-4})$	=	=

H Subtraction — Just like addition, the first step is to make the exponents the same. Instead of adding the main numbers, they are subtracted. Try to convert so that you will not get a negative answer.

Example: $(3 \times 10^4) - (2 \times 10^3) = (30 \times 10^3) + (2 \times 10^2) = 28 \times 10^3 = 2.8 \times 10^4$

1.	$(2 \times 10^2) - 40$	=	=
2.	$(3 \times 10^{-6}) - (5 \times 10^{-7})$	=	=
3.	$(9 \times 10^{12}) - (8.1 \times 10^9)$	=	=
4.	$(2.2 \times 10^{-4}) - (3.1 \times 10^{-5})$	=	=

I A few more —

1.	What is 1.25×10^{-1}? Is this the same as 125 thousandths?		
2.	0.000477 is what in scientific notation?		
3.	$(2.1 \times 10^{12}) + (7.9 \times 10^{11})$	=	=
4.	$(7.2 \times 10^3) - (2.1 \times 10^2)$	=	=
5.	$(33.1 \times 10^5) \times (6.4 \times 10^{-6})$	=	=
6.	$(9.4 \times 10^4) / (3.2 \times 10^5)$	=	=