

Your Name:

Date:

A) Powers of ten

Give all your answers as powers of ten.

- 1) What is 0.1×0.1 ?
- 2) What is $0.1 \times 0.1 \times 0.1$?
- 3) What is $1 / 10^6$?
- 4) What is $10^2 / 10^4$?
- 5) What is 1 ?
- 6) What is 10 ?
- 7) What is $10^4 \times 10^3 \times 10^2 \times 10^1$?
- 8) What is $10^4 \times 10^3 \times 10^2 \times 10^1 \times 10^0$?
- 9) What is $10^6 \times 10^2 / 10^4$?
- 10) What is 1,000,000,0000?

P, Q, and R are unknown numbers

- 10) What is $10^P \times 10^Q$?
- 11) What is $10^P / 10^R$?
- 12) What is $10^P \times 10^Q / 10^R$?
- 13) Express in words the answers to questions 10 and 11

B) Working with Units

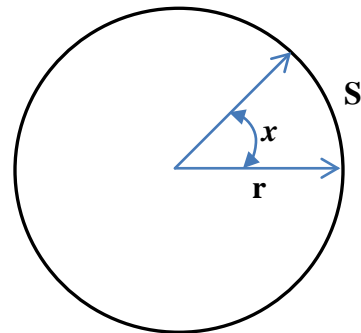
Before you begin any problem, think ahead and identify the units you expect for the final answer. Then operate on the units along with the numbers as you solve the problem. Units are just multiplicative factors. For example, a distance **d** equal to 500 km really means '500 x kilometers', and, likewise, a time **t** of 10 hr means '10 x hours'. If we divide the two, 500 km/10 hr, we find a velocity, **v**, equal to 50 km/hr (50 kilometers per hour). The algebraic expression is $\mathbf{v = d/t}$. Often the number you are given is not in the units you wish to work with. For example, you may be given that the speed of light is 300,000 km/s but need it in units of m/s for a particular problem. To convert the units, simply multiply the given number by a *conversion*

factor: a fraction in which the numerator (top of the fraction) and the denominator (bottom of the fraction) are equal, so that the value of the fraction is 1.

- 1) Express the speed of light in m/s
- 2) How many seconds are there in 1 hour? in 1 minute, and in 1 year?
- 3) The average speed of a spacecraft orbiting the Earth is 5 km/s. How many meters the spacecraft moves in 1 hour?
- 4) The Sun's diameter is 1,396,000 km. What is its volume? If the Earth's radius is 6,378 km, how many Earths can fit in the Sun?

5) In Astronomy, our knowledge about the sizes of things usually depends on knowing how the size of an object, its distance, and the angle it covers in the sky are related. The natural unit to measure angles is the **radian**. As shown in the Figure below, the size of an angle x in radians is just the length of the arc subtending the angle, S , divided by the radius of the circle r : $x = S / r$. Knowing that the circumference of a circle is 2π multiplied by the radius, $C = 2\pi r$, calculate:

- a) what is the angular measure of a complete circle in radians?
and in degrees?



- b) from your result in part a) what is the value of 1 radian expressed in degrees?