

**REVIEW SCIENTIFIC NOTATION /PROPORTIONS - Bring a scientific calculator.****Scientific Notation**

- (1) What is 65,300,000,000 in scientific notation?  
(a)  $6.53 \times 10^{11}$  (b)  $6.53 \times 10^{10}$  (c)  $6.53 \times 10^{-10}$  (d)  $6.53 \times 10^{-11}$
- (2) What is 0.000000072 in scientific notation?  
(a)  $7.2 \times 10^9$  (b)  $7.2 \times 10^7$  (c)  $7.2 \times 10^{-9}$  (d)  $7.2 \times 10^{-8}$
- (3) What is  $4.38 \times 10^5$  written as an ordinary string of digits?  
(a) 43,800,000 (b) 438,000 (c) 43,800 (d) 4,380,000
- (4) What is  $6.7 \times 10^{-8}$  written as an ordinary string of digits?  
(a) 0.000000067 (b) 0.00067 (c) 0.0000000067 (d) 0.00000067
- (5) What is  $3.0 \times 10^6$  multiplied by  $2.0 \times 10^4$ ?  
(a)  $5.0 \times 10^{24}$  (b)  $6.0 \times 10^{10}$  (c)  $5.0 \times 10^{10}$  (d)  $6.0 \times 10^{24}$
- (6) What is  $3.0 \times 10^{-4}$  multiplied by  $4.0 \times 10^{-7}$ ?  
(a)  $1.2 \times 10^{-28}$  (b)  $7.0 \times 10^{28}$  (c)  $1.2 \times 10^{-10}$  (d)  $7.0 \times 10^{-11}$

**Unit Conversion**

- (7) What is  $1.5 \times 10^8$  km in units of cm?  
(a)  $1.5 \times 10^3$  cm (b)  $1.5 \times 10^5$  cm (c)  $1.5 \times 10^{10}$  cm (d)  $1.5 \times 10^{13}$  cm
- (8) How many seconds are there in a day?  
(a)  $8.6 \times 10^4$  s (b)  $6.0 \times 10^4$  s (c)  $6.0 \times 10^3$  s (d)  $3.2 \times 10^7$  s

(9) The speed of light is  $3.0 \times 10^8$  m/s. What is it in units of cm/min?  
(a)  $1.8 \times 10^8$  cm/min (b)  $5.0 \times 10^6$  cm/min (c)  $5.0 \times 10^8$  cm/min (d)  $1.8 \times 10^{12}$  cm/min

(10) The gravitational constant is  $6.67 \times 10^{-11}$  m<sup>3</sup> kg<sup>-1</sup> s<sup>-2</sup>. What is it in units of cm<sup>3</sup> g<sup>-1</sup> s<sup>-2</sup>?  
(a)  $6.67 \times 10^{-8}$  cm<sup>3</sup> g<sup>-1</sup> s<sup>-2</sup> (b)  $6.67 \times 10^{-14}$  cm<sup>3</sup> g<sup>-1</sup> s<sup>-2</sup> (c)  $6.67 \times 10^{-10}$  cm<sup>3</sup> g<sup>-1</sup> s<sup>-2</sup>  
(d)  $6.67 \times 10^{-4}$  cm<sup>3</sup> g<sup>-1</sup> s<sup>-2</sup>

### Ratios and proportionality

(11) If area is proportional to radius squared ( $A \propto r^2$ ), and the the radius is increased by a factor of 4, by what factor does the area change?  
(a) 1/4 (b) 1/8 (c) 16 (d) 8

(12) Suppose the distance from the Sun to Pluto,  $40 \text{ AU} = 6 \times 10^9$  km, were compressed to the size of a pen (15 cm). On this scale, what would be the distance from the Sun to Aldebaran, a bright star (the Eye of Taurus, the Bull) whose true distance is roughly 60 light years? (1 light year =  $10^{13}$  km)  
(a) 15 km (b)  $1.5 \times 10^6$  km (c)  $1.5 \times 10^5$  cm (d)  $6 \times 10^{14}$  km (e)  $6 \times 10^{14}$  cm

13) The ratio between the distance cloud of electrons from center of atom and radius of nucleus is about 100,000 ( $10^4$ ). If the atom was as large as the Yankee stadium, the nucleus would be as small as a bug in the center. That means that the atoms are made mostly of empty space !  
Let's see if the Universe is less empty. Find the ratio between the distance to Andromeda galaxy (in the next group of galaxies = 4.2 million light years) to the size of our galaxy (radius = 50,000 light years). Compare this ratio to  $10^4$  and see if the Universe is less empty than an atom is.