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A busy, productive day

"Work expands to fill the time available ..."

John Brannon lives on Lodge Hill in Cambria, California, U.S.A., Earth, Solar System, Milky Way, Local Group ...

This column is directed to those people, who, like myself, have days when nothing seems to get done, and we are left with a sense of having accomplished little. There are occasions when I spend time like a drunken sailor spends money.

But you might be surprised at what all has taken place during the course of these apparently wasted hours.

I suggest you take a late afternoon stroll on Moonstone Beach; find a seat on one of those beautifully weathered old logs and look west as the sun heads towards its rendezvous with the distant horizon, as it has for the past 4.5 billion years.

The sunrise and sunset result from the earth spinning on its axis — spinning at 1,000 mph. Checking my references — even the tabloids — there has never been a documented case of a human ever being flung into outer space from this high-speed spinning.

The topic of today's essay is the amazing science of astronomy; but don't turn the page on me yet — I think you will find this offering fun and fascinating.

As you watch the lowering sun, from your resting spot on the log, realize that this nearest star is nearly a million miles in diameter. By comparison, the earth is about 8,000 miles in diameter (a mere speck compared to ol' Sol). Our planet orbits the sun at a speed of 70,000 mph. This journey, of course, takes one year to complete.

Now for some really astounding speeds. Light travels at 186,000 miles per *second.* The sun's light requires about eight minutes to reach us; moonlight takes around two seconds. Despite a speed of 11 million miles a *minute,* sunlight takes five hours to reach Pluto, the most distant planet in our solar system (most of the time).

As you can see, to talk about astronomy in terms of miles is useless; it would soon call for pages and pages of zeroes. We shall use the term "light year," the distance traveled by light in a single year — 5.8 trillion miles. There, are you more comfortable with that?

Place one on the log next to you; get in your car and drive to the San Simeon pier. Place the second grain on the railing. Two grains of sand, seven miles apart–this is the next nearest star!

Stars are grouped in clusters called galaxies. Our galaxy is the Milky Way; it contains at least 400 billion stars and was thought to be the entire universe until discoveries made by Edwin Hubble in the 1920s showed otherwise. It is now accepted that there are more than a billion galaxies, each containing billions of stars. Some scientists declare there are more stars in the universe than grains of sand on all the beaches of the world!

If viewed from afar, the Milky Way resembles a rotating disk-shaped pinwheel. Some pinwheel! It is 100,000 light years in diameter. Our solar system is seven billion miles in diameter. Reduce the solar system to the size of a dime — the Milky Way would be the size of Tennessee. This pinwheel takes 230 million years to complete one revolution; the solar system is orbiting the center of our galaxy at a speed of 500,000 mph.

Galaxies lie in all directions outside the Milky Way; the nearest is Andromeda, which is two million light years distant. We are part of a cluster containing some 17 galaxies that astronomers call (without cracking a smile) the Local Group. The closest galaxy beyond the Local Group is Virgo — 50 million light years away. The Local Group is rushing towards a point in the universe at the rate of 1 million mph.

Whew, this is a little exhausting.

The closest star to our sun is Proxima Centauri, similar in size to the sun and is 4.3 light years away. How far is that? Reduce both stars to the size of an orange; place one in Denver, the other in Los Angeles. Reach down from your log and gather two grains of sand. Place one on the log next to you; get in your car and drive to the San Simeon pier. Place the second grain on the railing. Two grains of sand, seven miles apart—this is the next nearest star! This separation is the average density of stars in galaxies.

Astronomers have recently observed a stellar object estimated to be nearly ***16 billion light years*** from Earth! Imagine, 186,000 miles per second times 16 billion years. You do the math, my pencil just broke.

So, you and I have traveled far and fast today, and I think we can call that a successful day. In fact, I'm a little pooped from all this racing around ... perhaps I've earned a short nap in the recliner. I'm sure I have. I'll get to the rest of the projects on today's list after a bit.

Maybe.

"... and expenditures rise to meet income."

— C. Northcote Parkinson

Ah, but that is another column.

Read this story and then comment (in a short essay) about how this story shows the need for scientific notation.

Extra Practice

Name: _____ Period: _____

Metric System: Friend of the Scientist

Prefix / Measurement	kilo	hecto	deka	unit	deci	centi	milli

Instructions: To convert from unit to another, simply count the number of steps between those units and then move the decimal the same number of steps and the same direction. For example, to convert from kilometers to decimeters you would move the decimal four spaces to the right.

Practice *(Show your work!):*

A. 2 km = _____ m

B. 3.7 dam = _____ cm

C. 258.3 ml = _____ l

D. 0.0038 hm = _____ cm

E. 14,372 mg = _____ kg

F. 1.2293 dm = _____ mm

G. 23,923 cm = _____ km

H. 0.0096 kg = _____ g

I. 912 mm = _____ hm

J. 68.291 m = _____ dam

K. 0.0024 cm = _____ m

L. 0.00000752 kg = _____ mg