Billion

Having Trouble With Large Numbers?

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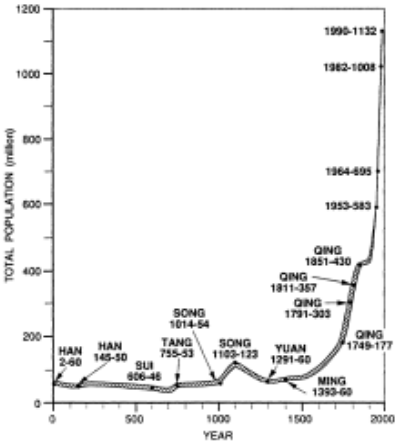
For most of us, a 'billion' (as with most large numbers) means nothing, or is no more than an exaggeration, as in, "I've told you that a billion times." We have no problem understanding 100 or 1,000 of something, but as we enter the world of *"illions"* things become vague. Take a million for instance: you have probably never seen a million of anything, not even stars despite the fact that our galaxy contains over 100 billion. Depending on your location, on a clear night you can see about 5,000 – 10,000 stars without the use light gathering instruments. Aerial pictures of Woodstock and the Million Man March show very large crowds, but Woodstock was estimated to be "half-a-million strong" and the Million Man March was assigned various conflicting numbers by the National Park Service, ABC News, and event organizers.

This is what a billion dollars looks like.

So, what is a billion? It depends. in the United States a billion is one followed by nine zeros (10^9). In many European countries a billion is one followed by twelve zeros, what us Yanks call a trillion (10^{12}). The European word for our billion is milliard, but it is usually referred to as a thousand million. Confused? It gets even worse: what Europeans call a trillion, Americans call a quintillion (10^{18}), and what they call a quintillion, we call a nonillion (10^{30}), and on and on, until we reach the *googol*. Everyone on both sides of the pond agrees that a googol is one followed by 100 zeros. A *googolplex* is one followed by a googol of numbers (10^{googol}) or ($10^{10^{\wedge}100}$).

Back To A Billion

Since our brain has difficulty grasping *1,000,000,000*, such a number may seem useless, but it turns out to be very helpful when trying to comprehend the Avogadro constant, geological eras, the age of the Earth, the number of neurons in the human brain, and the scale of the Universe.



China Population Growth from 2 - 2000 A.D. The nation reached one billion in 1982

Perhaps the best way to approach a 'billion' is to apply the number to something we can understand. For example, if you are over the age of 30 (31.7 to be exact), you have lived for a billion seconds. A billion seconds ago (1978) no one had ever seen a cell phone, personal computer, CD, DVD, or iPod, and the Internet was in its nascent stage as the ARPNET, restricted to a few clusters of scientists and military personnel. China lifted a ban on works by Aristotle, Shakespeare and Charles Dickens, *Annie Hall* won best picture at the Academy Awards, and 918 followers of Jim Jones took part in a mass suicide.

A *billion minutes* equals approximately 1,902 years. A billion minutes ago, paper making was refined in China and would remain a secret for the next 500 years. The great mathematician and astronomer Ptolemy was formulating his works on astronomy and astrology. John The Apostle had recently died, Ignatius of Anitoch is recorded as the first person to use the term 'Christianity', and the Greek historian Plutarch published *Private Lives*.

A billion hours is approximately 114,000 years. A billion hours ago, both Homo sapiens and Neanderthals shared the late Stone Age with the likes of woolly mammoths and saber-tooth cats. The Eemian interglacial period was coming to an end, giving way to the next ice age. During the Eemian, sea levels rose 10 – 20 feet higher than today, turning the Scandinavian Peninsula into an island.

A *billion days* is 2.7 million years. A billion days ago in the early Stone Age, Australopithecus, an ape like creature related to an ancestor of modern humans roamed the African Savannas. It is the Pliocene Epoch, plate tectonics push North American and South America towards each other, closing the gap between them and creating the Isthmus of Panama. This alters ocean circulation and that combined with a slight change in the tilt of the Earth's axis, triggers the formation of ice sheets on the Artic Ocean. These ice sheets grow to cover large portions of the northern hemisphere as glaciers

The continents during the early Cretacious Period

A *billion months* is 82 million years. A billion months ago is the late Cretacious Period. Dinosaurs roam the planet and species of small marsupials appear. The supercontinent Gondwana splits apart, forming Australia, Antarctica and New Zealand, and all continents will soon have a modern day look. Birds begin to diversify in large numbers, flowering plants and insects can be found everywhere. Marine life is recovering after the Cenomanian – Turonian extinction around 92 million years ago that wiped out 27% of marine genera. The central part of North America is covered by a large inland sea and other continents also have areas inundated by seas.

A *billion years* ago the 'year' had about 516 days, divided into about 40 months and a day was 17-18 hours long. The moon orbited the Earth in around 23 days and the Suns luminosity was 8% lower than its present level. Life consists of the first multi-cellular organisms – blue/green algae that begin producing enough oxygen to create the early ozone layer that will protect life on land from damaging levels of ultraviolet radiation. The planet has a new supercontinent – Rodinia – that will last for approximately 250 million years.

North America during the Cretaceous

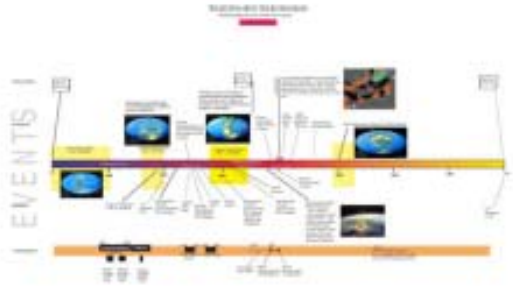
Billion Trivia

Besides using time, we can try to visualize a 'billion' in other ways:

June, 2008 – Personal computers in use surpasses one billion
August, 2009 – Africa's population reaches one billion
November, 2008 – Twitter passed one billion tweets
January, 2009 – It is estimated there are over one billion Internet Users
January, 2009 – It is estimated that there are one billion motorized vehicles in the world
March, 2010 – Lady Gaga becomes the first artist with one billion online video views

A billion centimeters is the distance from Chicago, IL to Tokyo, Japan; it takes light three seconds to travel a billion meters; and a billion pennies stacked on each other would be 1,000 miles high. Oddly enough, the US mint *STILL* mints ten billion pennies annually –just in case there's an outbreak of penny stacking.

If you ever find yourself looking for something to do, try counting to a billion. At the rate of one number per second, it will take you 31 years, 251 days, 7 hours, 46 minutes, and 39 seconds to reach a billion.



The above graphic depicts astronomical, geological, biological, and climatalogical events for a billion years in the past and a billion years into the future. For a full size version of this pdf file, go to www.theumwelt.com/1 billion.pdf