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12.001 Introduction to Geology
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Scales: Time, Temperature, Length

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Time: Ages and Durations	ybp=years before present
Largest eruption in the last 100 years: Pinatubo, Phillippines, 1991	15 ybp
Beginning of Kilauea's most recent eruption (1983)	23 ybp
<i>Voyager 1</i> detects active volcanism on Io, the first body in the solar system aside from the Earth seen to have volcanism (1979)	27 ybp
Beginning of acceptance of plate tectonic theory (paper by J. Tuzo Wilson published in 1963)	43 ybp
Eruption of Tambora, the most deadly volcano in recorded history (1815, killed ~92,000 people)	191 ybp
Invention of the telescope by Hans Lippenshey (1608)	398 ybp
Beginning of Stromboli's (Italy) near-continuous eruption	at least 2,000 ybp
Crater Lake formed from catastrophic explosion of Mt. Mazama	7,700 ybp
Last woolly mammoth	9,000 ybp
Peak of last glacial cycle	20,000 ybp
Eruption of Toba	75,000 ybp
Earliest <i>homo sapiens</i>	195,000 ybp
Most recent Yellowstone eruption	640,000 ybp
Most recent flood basalt event on Earth (the Columbia River flood basalts, in Idaho, Washington, and Oregon states)	16,000,000 ybp
First primates	55,000,000 ybp
First mammals (<i>e.g.</i> orders triconodonta and therapsida, <i>e.g.</i> Eozostrodon, Jeholodens, Megazostrodon)	~210,000,000 ybp
Siberian flood basalt eruptions (lasted ~500,000 years)	251,000,000 ybp
Approximate age of the most recent volcanic activity on the Moon	2,000,000,000 to 3,000,000,000 ybp
First life on Earth	~3,500,000,000 ybp
Age of the Earth (and the rest of the solar system)	4,560,000,000 ybp
Age of the Universe	~10,000,000,000 ybp

Temperatures	
Coldest temperature attained in a laboratory (MIT, surpassing Helsinki's 1 nanokelvin effort)	-273.149 999 999 55°C (equivalent to 0.45 nanoKelvins)
Coldest temperature found in nature (Boomerang nebula)	-272.15°C (1K)
Coldest nighttime temperature on the Moon	-233°C
Freezing temperature of oxygen	-218.4°C
Surface temperature of Saturn's moon Enceladus, which is thought to be resurfaced by ammonia ice volcanoes	-200°C
Surface temperature of Mercury at night	-187°C
Boiling point of oxygen	-183°C
Surface temperature of Jupiter's moon Io, the most volcanically active body in the solar system	-200 to -140°C
Coldest temperature recorded on Earth (Vostok Station, Antarctica)	-89.2°C
Freezing temperature of water	0°C
Average temperature at sea level on the Earth	17°C
Normal human body temperature	37°C
Hottest temperature recorded on Earth (during 43 consecutive days in July and August in 1913 the temperature in Death Valley, CA, was over 120°F; the temperature listed at right was recorded by the National Weather Service on July 10)	56.7°C
Boiling temperature of water on top of Mt. Everest	71°C
Boiling temperature of water at one atmosphere pressure	100°C
Hottest daytime temperature on the Moon	123°C
Baking temperature for brownies	180°C
Self-cleaning oven	260°C
Melting temperature of lead	327°C
Lowest temperature of volcanism measured on Jupiter's moon Io (thought to be sulfur lava)	400°C
Surface temperature of Mercury during its day	427°C
Surface temperature of Venus (hottest planetary surface in the solar system)	460°C
Pyroclastic flow on Earth	500°C (variable)
Rhyolite eruption temperature	700 to 850°C
Andesite eruption temperature	900 to 1,100°C
Melting temperature of gold at one atmosphere pressure	1064.43°C
Basalt eruption temperature	1,100 to 1,300°C
Upper mantle	1,200 to 1,400°C
Melting temperature of steel at one atmosphere pressure	1,370°C
Highest temperature of volcanism measured on Jupiter's moon Io	1,600°C
Boiling point of gold at one atmosphere pressure	2,200°C
Melting point of diamond at one atmosphere pressure	3,500°C

Temperature of Earth's core (give or take a thousand degrees)	5,000°C
Surface temperature of the Sun (photosphere)	6,000°C
Interior temperature of the Sun	15,000,000°C
Hottest temperature attained in an experiment (Sandia National Labs, 2006)	2,000,000,000°C

Lengths	
Diameter of a small spatter cone	0.002 km, or 2 m
Local depth of the Bishop Tuff (varies widely), deposited by the eruption of Long Valley Caldera, California, 760,000 years ago	0.2 km, or 200 m
Local depth of the tuff deposited by the eruption of Toba, Indonesia, 75,000 years ago	0.6 km, or 600 m
Height of Mauna Loa, measuring from sea floor (tallest volcano on Earth)	4.1 km
Height below which 80% of the Earth's atmosphere exists	10 km
Height of Olympus Mons, Mars (tallest volcano in the solar system, far taller than Mt. Everest, at 8.8 km)	21.2 km
Depth to the Earth's upper mantle (thickness of the lithosphere)	40 to 200 km
Length of Boston marathon	42.2 km
Diameter of Yellowstone caldera	65 km
Distance above the Earth someone must travel to be considered by the United States an astronaut	80 km
Height above the Earth at which atmospheric effects become noticeable to re-entering spacecraft	120 km
Distance from New York to Boston	306 km
Longest lava flow on Earth (Pomona flow in the Columbia River flood basalts)	600 km
Diameter of basalt-filled Mare Imbrium on the Moon	1,123 km
Diameter of a very large flood basalt province on Earth	1,500 km
Radius of the Moon	1,736 km
Radius of Jupiter's moon Io, the most volcanically-active body in the solar system	1,830 km
Distance at which eruption of Krakatoa was heard	4,000 km
Distance from New York to San Francisco	4,156 km
Radius of the Earth	6,378 km
Length of volcanically-produced Dali Chasma, Venus (longest channel in the solar system, longer than the Nile, at 6,695 km)	7,400 km
Average distance from the Earth to the Moon	384,400 km