Gravity Fact Sheet

Physics 152 Michael Fowler 1/15/07

Gravitational acceleration $g = 9.81\ m/sec^2$.

Newton's Universal Gravitational Constant $G = 6.67 \times 10^{-11}\ N.m^2/kg^2$.

The **Sun** has a **mass** of 1.99×10^{30} kg, and a **radius** of 6.96×10^8 m.

The **Moon** has a **mass** of 7.35×10^{22} kg, a **radius** of 1738 km., and an average **orbital radius** of 3.84×10^5 km., and **orbital period** of 27.3 days. The orbital **eccentricity** is 0.055, the orbit is **inclined** at 5.15 degrees to the Earth's orbit around the Sun.

Planetary Data

Planet	Radius (km)	Orbital Semimajor Axis(10^6km)	Mass (kg)	Orbital Period	Orbital Eccentricity	Inclination to Earth's Orbit
Mercury	**2440**	**57.9**	**3.30×10^{23}**	**88 days**	**0.206**	**7.00**
Venus	**6050**	**108**	**4.87×10^{24}**	**225 days**	**0.00677**	**3.39**
Earth	**6380**	**150**	**5.97×10^{24}**	**1 yr**	**0.0167**	**0**
Mars	**3400**	**228**	**6.42×10^{23}**	**1.88 yr**	**0.0934**	**1.85**
Jupiter	**71,500**	**778**	**1.90×10^{27}**	**11.9**	**0.0484**	**1.31**
Saturn	**60,300**	**1430**	**5.69×10^{26}**	**29.4**	**0.0542**	**2.48**
Uranus	**25,600**	**2870**	**8.69×10^{25}**	**83.8**	**0.0472**	**0.770**
Neptune	**24,800**	**4500**	**1.02×10^{26}**	**164**	**0.00859**	**0.770**
Pluto	**1150**	**5920**	**1.31×10^{22}**	**248**	**0.249**	**17.1**

From the AIP Physics Desk Reference, Third Edition, which gives original sources, and many more details. (Except Pluto mass: that's from http://arxiv.org/abs/astro-ph/0512491)

Astronomical Distance Units

1 AU = 1.5×10^{11}m. (AU = Astronomical Unit = Earth-Sun distance.)
1 light year = 9.46×10^{15} m.
1 parsec = 3.09×10^{16} m. (= 3.27 ly.) (The distance to a star that has apparent parallax movement caused by the Earth's orbital motion of one second of arc amplitude.)

Angle Measurement

1 radian = 57.3°, $1° = 60'$ (minutes), $1' = 60''$ (seconds).

Comparing Other Planets with the Earth

Planet	Radius compared with Earth's	Mass compared with Earth's	Orbital Period compared with Earth's	*g* at surface compared with Earth's
Mercury	0.382	0.0553	0.241	0.378
Venus	0.949	0.815	0.615	0.894
Earth	1	1	1	1
Mars	0.533	0.107	1.88	0.379
Jupiter	11.2	318	11.9	2.54
Saturn	9.41	95.2	29.4	1.07
Uranus	4.0	14.5	83.8	0.8
Neptune	3.9	17.2	164	1.2
Pluto	0.19	0.0021	248	0.059

And …

	Radius compared with Earth's	Mass compared with Earth's	*g* at surface compared with Earth's
Sun	109	3.33×10^5	$28 g_{earth}$
Moon	0.272	0.0123	$0.166 g_{earth}$

Neutron Stars, etc.

Neutron stars are formed when stars run out of nuclear fuel and collapse (see Wikipedia.) They have masses 1.35 to 2.1 solar masses, radii between 20 and 10 km (heavier ones are smaller!). Gravity *g* at the surface is 2×10^{11} to 3×10^{12} g_{earth}. Stars with less mass form white dwarfs, about the size of the Earth, but the mass of the Sun. Collapsing stars with masses above about 3 solar masses form black holes.

Energies

Sun's luminosity: 3.83×10^{26} J/sec.
1 megaton = 4.18×10^{15} J.