

## Kepler's Laws Worksheet

Complete the following table.

Object	Mass (kg)	Semi-Major Axis (km)	Eccentricity	Semi-Minor Axis (km)	Aphelion (km)	Perihelion (km)	Period of Revolution	Radius of Object (km)	Acceleration of gravity (m/s <sup>2</sup> )	Escape Velocity (m/s)
Sun	$1.991 \times 10^{30}$						<b>Years</b>	695,950	274.2	617,800
Mercury	$3.181 \times 10^{23}$	$5.795 \times 10^7$	0.2056	56,711,962	69,864,520	46,035,480	0.241	2,433	3.58	4,176
Venus	$4.883 \times 10^{24}$	$1.0811 \times 10^8$	0.0068	108,107,500	108,845,148	107,374,852	0.614	6,053	8.89	10,370
Earth	$5.979 \times 10^{24}$	$1.4957 \times 10^8$	0.0167	149,549,141	152,067,819	147,072,181	1.00	6,371	9.82	11,190
Mars	$6.418 \times 10^{23}$	$2.2784 \times 10^8$	0.0934	226,844,035	249,120,256	206,559,744	1.880	3,380	3.75	5,033
Jupiter	$1.901 \times 10^{27}$	$7.7814 \times 10^8$	0.0484	777,228,046	815,801,976	740,478,024	11.86	69,758	26.06	60,290
Saturn	$5.684 \times 10^{26}$	$1.4270 \times 10^9$	0.0543	1424,894,699	1,504,486,100	1,349,513,900	29.46	58,219	11.19	36,100
Uranus	$8.682 \times 10^{25}$	$2.8703 \times 10^9$	0.0460	2867,261,614	3,002,333,800	2,738,266,200	84.04	23,470	10.51	22,210
Neptune	$1.027 \times 10^{26}$	$4.4999 \times 10^9$	0.0082	4,499,748,711	4,536,799,180	4,463,000,820	165.0	22,716	13.27	24,560
Pluto	$1.27 \times 10^{22}$	$5.909 \times 10^9$	0.2481	5,724,251,729	7,375,022,900	4,442,977,100	248.2	1137	.66	1,200

Some helpful information:

$a = AQ$

$b = CQ$

$e = SQ/AQ$

Aphelion =  $a(1+e)$

Perihelion =  $a(1-e)$

Semi-minor axis =  $a\sqrt{1-e^2}$      $T^2 = a^3$     1 orbit =  $2\pi r$      $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

$F = GM_1M_2/r^2$      $F = mv^2/r$      $g = GM_p/r^2$     velocity of orbit =  $\sqrt{GM_p/r}$     escape velocity =  $\sqrt{2GM_p/r_p}$

