Name Answer Key Date _____

Honors Physics Gravity and Circles WS #2

Period _____ Mrs. Nadworny

(30 pts)

Determining the Value of 'g'

Procedure: Using the equation for acceleration due to gravity and the values provided in the table below, determine the acceleration due to gravity for the other seven planets and the "new" dwarf planet. In the spaces provided show your calculations for each planet. The table will count as your givens and unknowns. Write your final answers in the box provided. Remember to use proper significant figures.

Planet	Radius (m)	Mass (kg)
Mercury	2.43×10^6	3.2×10^{23}
Venus	6.073×10^6	4.88×10^{24}
Mars	3.38×10^6	6.42×10^{23}
Jupiter	6.98×10^7	1.901×10^{27}
Saturn	5.82×10^7	5.68×10^{26}
Uranus	2.35×10^7	8.68×10^{25}
Neptune	2.27×10^7	1.03×10^{26}
Sun	6.96×10^8	1.99×10^{30}

Data Processing: (2 pts each)

Mercury

$$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(3.2\times10^{23}\ kg)}{(2.43\times10^{6}\ m)^2} = 3.6\ \frac{m}{s^2}\ \text{down}$$

3.6 m/s^2 down

Venus

$$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(4.88\times10^{24}\ kg)}{(6.073\times10^{6}\ m)^2} = 8.83\ \frac{m}{s^2}\ \text{down}$$

8.83 m/s^2 down

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Mars		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(6.42\times10^{23}\ kg)}{(3.38\times10^{6}\ m)^2} = 3.75\ \frac{m}{s^2}$ down	3.75 m/s^2 down

Jupiter		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(19.01\times10^{27}\ kg)}{(6.98\times10^{7}\ m)^2} = 26.0\ \frac{m}{s^2}$ down	26.0 m/s^2 down

Saturn		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(5.68\times10^{26}\ kg)}{(5.82\times10^{7}\ m)^2} = 11.2\ \frac{m}{s^2}$ down	11.2 m/s^2 down

Uranus		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(8.68\times10^{25}\ kg)}{(2.35\times10^{7}\ m)^2} = 10.5\ \frac{m}{s^2}$ down	10.5 m/s^2 down

Neptune		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(1.03\times10^{26}\ kg)}{(2.27\times10^{7}\ m)^2} = 13.3\ \frac{m}{s^2}$ down	13.3 m/s^2 down

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Sun		
	$g = \frac{Gm}{r^2} = \frac{(6.67\times10^{-11}\ \frac{N\cdot m^2}{kg^2})(1.99\times10^{30}\ kg)}{(6.96\times10^{8}\ m)^2} = 274\ \frac{m}{s^2}$ down	274 m/s^2 down

Procedure: Using your mass in pounds (lbs), calculate your mass in kilograms (kg). Show your work below using dimensional analysis. (2 pts)

Conversion factor: 1 kg = 2.2 lbs

$$150\ \text{lbs}\left(\frac{1\ \text{kg}}{2.2\ \text{lbs}}\right) = 68\ \text{kg}$$

Procedure: Determine your weight on each planet using the equation $F_{grav} = m \bullet g$. Show **one** sample calculation below using the GUESS method, and fill the remainder of your answers into the data table provided. Remember to use proper significant figures. (12 pts)

$$F_g = mg = (68kg)(-3.6\ \tfrac{m}{s^2}) = 240N \text{ down}$$

Planet	Weight (F_{grav})
Mercury	240 N down
Venus	600 N down
Earth	670 N down
Mars	260 N down
Jupiter	1,800 N down
Saturn	760 N down
Uranus	710 N down
Neptune	900 N down
Sun	19,000 N down