Homework solutions: Calculating weight + Density

19. $r_{saturn} = 60,268$ km 1km = 1000m

$$60,268 \text{ km}\left(\frac{1000 \text{ m}}{1 \text{ km}}\right) = 60,268,000 \text{ m}$$

$$r = 6.03 \times 10^{7} \text{ m}$$

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20. $V = \frac{4}{3}\pi r^3$

$$V = \frac{4}{3}\pi \left(6.03 \times 10^{7} \text{ m}\right)^3$$

$$V = (1.33)(3.14)\left(2.19 \times 10^{23} \text{ m}\right)$$

$$V = 9.16 \times 10^{23} \text{ m}^3$$

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21. $\rho = \frac{m}{V}$ ← kg / ← m^3

$$\rho_{saturn} = \frac{5.68 \times 10^{26} \text{ kg}}{9.16 \times 10^{23} \text{ m}^3} = 620 \frac{\text{kg}}{\text{m}^3}$$

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22. $\rho_{H_2O} = 1,000 \text{ kg/m}^3$

$\rho_{saturn} = 620 \text{ kg/m}^3$

Saturn's density is less than water's density, so Saturn would float in water

23. $1\,kg = 2.2\,lbs$

$$150\,\cancel{lbs}\left(\frac{1\,kg}{2.2\,\cancel{lbs}}\right) = \frac{150\,kg}{2.2} = 68.2\,kg$$

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24. $Weight = F_{gravity} = \dfrac{G\,m_1\,m_2}{d^2}$

G, m_1 = person mass, m_2 = Saturn Mass

$$Weight = \frac{\left(6.67\times10^{-11}\,Nm^2kg^{-2}\right)\left(68.2\,kg\right)\left(5.68\times10^{26}\,kg\right)}{\left(6.03\times10^{7}\,m\right)^2}$$

d = radius of Saturn (distance between center of person + center of saturn)

$$Weight = \frac{\left(6.67\times10^{-11}\,Nm^2kg^{-2}\right)\left(3.87\times10^{28}\,kg^2\right)}{\left(3.64\times10^{15}\,m^2\right)}$$

$$Weight = \frac{\left(2.58\times10^{18}\,Nm^2\right)}{\left(3.64\times10^{15}\,m^2\right)}$$

$$Weight = 709\,N$$

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25. $1\,N = 0.224\,lb$

$$709\,N\left(\frac{0.224\,lb}{1\,N}\right) = 159\,lbs$$