33. \( D_m = \frac{m}{V} = \frac{\frac{m}{4\pi r^3}}{3} = \frac{1.67 \times 10^{-27} \text{ kg}}{3(4.1 \times 10^{-16} \text{ m})^3} = 5.8 \times 10^{18} \text{ kg/m}^3 \)

\[ \text{sp gr} = \frac{D_{\text{material}}}{D_{\text{water}}} = \frac{5.8 \times 10^{18} \text{ kg/m}^3}{1000 \text{ kg/m}^3} = 5.8 \times 10^{15} \]

34. \( D_m = \frac{m}{V} = \frac{0.315 \text{ kg}}{0.275 \text{ m}^3} = 1.15 \text{ kg/m}^3 \)

35. \( D_m = \frac{m}{V} = \frac{0.500 \text{ kg}}{215 \text{ cm}^3 \times \left( \frac{1 \text{ m}}{100 \text{ cm}} \right)^3} = 2330 \text{ kg/m}^3 \)

Chapter 9 Review Questions

1. a, c, e  
2. a, b, c, d, e  
3. d  
4. d  
5. d  
6. b  
7. d  
8. e

9. Mass density refers to the mass per unit volume while weight density refers to weight per unit volume.  
10. Yes; no  
11. Capillary action refers to the effect of surface tension of liquids that causes the level of liquid in small diameter tubes to be higher or lower than that of the liquid in a large diameter tube due to the adhesive force between the liquid and the tube.  
12. Adhesion refers to the attractive force between different molecules; cohesion refers to the attractive force between similar molecules.  
13. Surface tension of water allows the base of many insects' legs to be supported by the surface of the water, allowing them to "walk" on the surface of a pond.

14. \( \frac{1.673 \times 10^{-27} \text{ kg}}{9.109 \times 10^{-31} \text{ kg}} = 1800 \)

15. pressure

16. Stress is directly proportional to strain as long as the elastic limit is not exceeded.  
17. kPa

18. The specific gravity of an object can be found by dividing the density of the object by the density of water. The density can be found by determining the mass of an object on a scale and dividing by its volume.  
19. mass density  
20. viscosity  
21. elastic limit  
22. solid, liquid, gas

23. An atom consists of one nucleus and its surrounding electrons. A molecule consists of two or more atoms.  
24. A proton has a positive charge; a neutron has a neutral charge.  
25. Tension, compression, shear, bending, and twisting.  
26. The hygrometer measures the density of the battery electrolyte. The density is related to the amount of sulfuric acid in the electrolyte and therefore the charge of the battery. Temperature does affect the measurement.

Chapter 9 Review Problems

1. \[ k = \frac{F}{\Delta \ell} = \frac{32.5 \text{ N}}{0.470 \text{ cm}} = 69.1 \text{ N/cm} \]

\[ F = k(\Delta \ell) = (69.1 \text{ N/cm})(2.39 \text{ cm}) = 165 \text{ N} \]

2. \[ \Delta \ell = \frac{F}{k} = \frac{7.33 \text{ N}}{0.298 \text{ N/cm}} = 24.6 \text{ cm} \]

69