Physics Name: Ans. Key
Chapter 3 Study Guide and Problems

Aims: To identify mass and weight as properties of all matter and to learn how to measure them; to learn the difference between mass and weight.

1. Read ss. 3-1 to 3-13.
2. Distinguish between mass and weight. Identify their SI units of measure.
3. What two factors influence weight? Does location have the same effect on mass?
4. What instrument is used to measure weight? Mass?
5. Carefully read Hooke's experiment on elasticity. What does Hooke's Law state?
6. Describe the graph of a direct proportion.
7. What does it mean when we say the iron is denser than aluminum?
8. Define density. What formula is used to calculate density? What is its unit of measure?
9. What is the density of water?
10. Define specific gravity.
11. How do you determine the density of a substance, given its specific gravity?
12. NOTEBOOKS: Problems (1-21), pp. 42-43.
13. **HAND-IN ASSIGNMENT: Questions (10-15), p. 42.**
14. **TEST**

Practice: Show all work for each problem. *Watch the units of measure!*

1. Write the density in terms of g/cm^3 and kg/m^3 when the specific gravity is:
a. 0.95 b. 1.32 c. 2.57 d. 5.20

Density of water = _____ g/cm^3 or _____ kg/m^3

Density of a substance = specific gravity x density of water

a) $0.95\ g/cm^3$ b) $1.32\ g/cm^3$ c) $2.75\ g/cm^3$ d) $5.20\ g/cm^3$
$950\ kg/m^3$ $1320\ kg/m^3$ $2750\ kg/m^3$ $5200\ kg/m^3$

2. Calculate the density, D. Use the unit of measure that applies to the data given:
a. m = 5.2 g V = 3.7 cm^3 $D = 5.2\ g / 3.7\ cm^3 = 1.4\ g/cm^3$

b. m = 890 kg V = 1000 m^3 $D = 890\ kg / 1000\ m^3 = 0.89\ kg/m^3$

D = m / V

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2. Calculate the density, D. Use the unit of measure that applies to the data given:
a. m = 5.2 g V = 3.7 cm^3 $D = 5.2\ g / 3.7\ cm^3 \approx 1.4\ g/cm^3$

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Ans: kg

3. Calculate the mass.

2.5g a. $D = 0.82\ g/cm^3$ $V = 3.00\ cm^3$ 2.46 g

3.5×10^4 kg b. $D = 750\ kg/m^3$ $V = 50\ m^3$ 37500 kg

1.4×10^4 kg c. $D = 1.3 \times 10^3\ kg/m^3$ l = 3.0 m, w = 5.7 m, h = 65 cm → 0.65m **(Calculate the volume)**

$V = 11.115\ m^3$ $m = 14449.5$

Since D = m / V, solving for *m* gives us m = D·V

4. Calculate the volume.

$2.0\ m^3$ a. $D = 7.2 \times 10^2\ kg/m^3$ m = 1440 kg 1440kg / $7.2 \times 10^3\ kg/m^3$

1.96 cm^3 b. $D = 2.57\ g/cm^3$ m = 5.03 g 5.03g / 2.57 g/cm^3 = 1.9572...

Again, begin with D = m / V and solve for V.

V = m / D

m = DV = 33488 kg = 3.3×10^5 kg

5. What is the mass of the water that fills a tank 7.0 m long, 5.2 m wide, and 9.2 m high? V = 7m (5.2m)(9.2m) = 334.88 m^3 D = 1000 kg/m^3

Calculate the Volume of the tank. You know the Density of water. Now, solve for mass: m = D·V Watch which D you use! (based on the unit of measure for V)

6. What is the mass of the water that fills a tank 75 cm long, 19 cm wide, and 24 cm high? V = (75cm)(19cm)(24cm) = 34200 cm^3

m = DV = 3.4×10^4 g

Similar to problem 5. D = 1 g/cm^3

2.5 g/cm^3 7. What is the density of a cube of metal that has a mass of 5.24 g and increases the water level in a graduated cylinder from 10.0 ml to 12.1 ml? V = 12.1 mL − 10.0 mL = 2.1 mL

What is the relationship between mL and cm^3? Calculate the Volume from the data given in the problem. You know the mass of the substance. Now calculate the Density: D = m / V

$D = \frac{m}{V} = \frac{5.24\ g}{2.1\ cm^3} = 2.49523\ g/cm^3$

8. What is the weight of an object with a mass of _____ when placed on the surface of the earth?

a. 100 kg b. 75.2 g c. 65.9 mg

0.0752 kg 0.0000659 kg

Weight = (mass, in kilograms)(acceleration due to gravity)
$w = m \cdot g$, where $g = 9.81\ m/s^2$ for the surface of our planet.

$W = m(9.81\ m/s^2)$

a) $= 100\,kg\,(9.81\ m/s^2) = 981\ N$

b) $W = (0.0752\,kg)(9.81\ m/s^2) \approx 0.738\ N$

c) $W = (6.59 \times 10^{-5}\,kg)(9.81\ m/s^2) = 6.46 \times 10^{-4}\ N$

9. What is the mass of an object on the surface of the earth that weighs _____.

a. 975 N b. 38 N c. 0.49 N

Use $w = m \cdot g$ and solve for m.
mass = (weight) / (9.81 m/s)

a) $\frac{975\,N}{9.81\ m/s^2} = 99.4\,kg$

b) $\frac{38\,N}{9.81\ m/s^2} \approx 3.9\,kg$

c) $\frac{0.49\,N}{9.81\ m/s^2} \approx 0.050\,kg$

Use what you practiced in problems 1 to 9 to answer questions 10 to 12.

10. An atom fills a cube with an edge of 3.5×10^{-12} m.

a. What is the volume of the atom? $V = (3.5 \times 10^{-12}\,m)^3 = 4.288 \times 10^{-35}\ m^3$

b. If the atom has a mass of 9.7×10^{-27} kg, what is the density of the atom?

$D = \frac{m}{V} = \frac{9.7 \times 10^{-27}\,kg}{4.288 \times 10^{-35}\ m^3} = 2.262 \times 10^{8}\ kg/m^3 \approx 2.3 \times 10^{8}\ kg/m^3$

11. What is the density of water in g/cm^3? In kg/m^3?

$1\ g/cm^3$; $1000\ kg/m^3$

12. a. What is the volume of 50 g of water? $V = \frac{m}{D} = \frac{50\,g}{1\,g/cm^3} = 50\ cm^3$

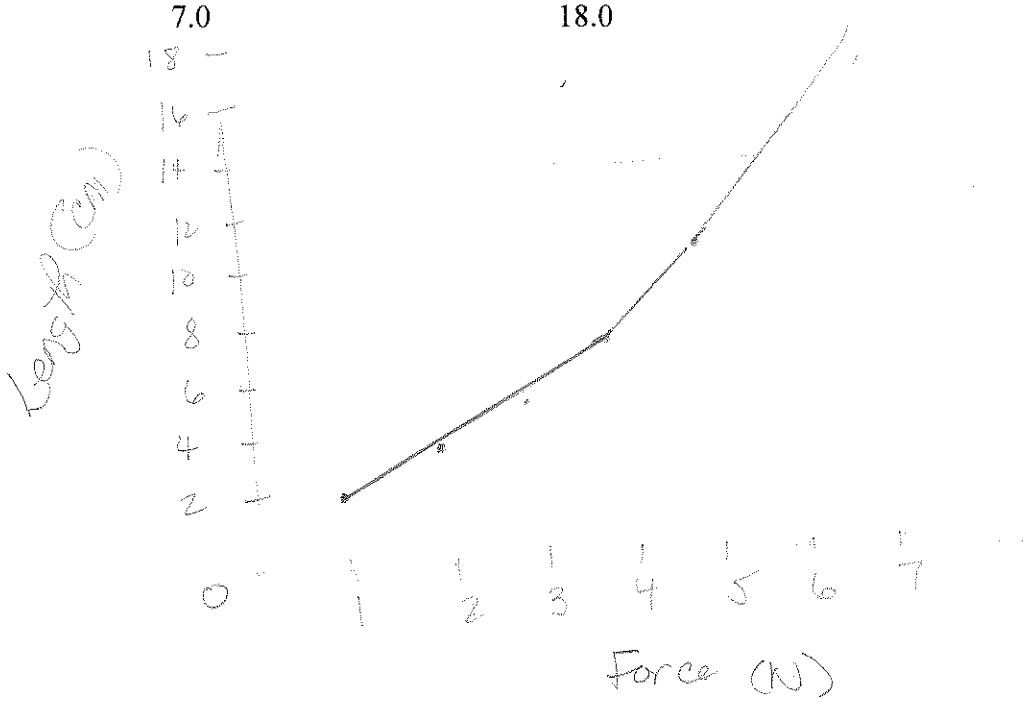
b. What is the volume of 50 kg of water? $V = \frac{m}{D} = \frac{50\,kg}{1000\,kg/m^3} = 0.05\ m^3$

13. Graph the following data. Determine the elastic constant **(slope of the graph).**

Where has the elastic limit been exceeded? **(How do we know the elastic limit has been exceeded?)** after 4.0 N; slope changes

Force (N)	Elongation (cm)
1.0	2.0
2.0	4.0
3.0	6.0
4.0	8.0
5.0	11.0
6.0	14.0
7.0	18.0

$m = 2 \frac{cm}{N}$



Ans. Key

Physics C. 3 Practice Problems

1. A substance has a specific gravity of 1.35. What is its density in

a. g/cm^3 1.35 g/cm3

b. kg/m^3 1350 kg/m^3

2. What is the specific gravity if the density of a certain rock is

a. 900 kg/m^3? 900 kg/m^3 ÷ 1000 kg/m^3 = 0.9

b. 1.7 g/cm^3? 1.7 g/cm^3 ÷ 1 g/cm^3 = 1.7

3. Determine the weight of an object with a mass of × 9.81 m/s^2

a. 3.50 kg (3.50kg)(9.81 m/s^2) = 34.3 N

b. 575 g = 0.575 kg (0.575kg)(9.81 m/s^2) = 5.64 N

c. 0.750 kg (0.750kg)(9.81 m/s^2) = 7.36 N

d. 0.820 g = 0.000820kg = 8.20×10^{-4} kg (8.20×10^{-4} kg)(9.81 m/s^2) = 8.04×10^{-3} N

4. Determine the mass of an object with a weight of ÷ 9.81 m/s^2

a. 245 N 245N ÷ 9.81 m/s^2 = 25.0 kg

b. 9.35 N 9.35N ÷ 9.81 m/s^2 = 0.953 kg

c. 0.500 N 0.500N ÷ 9.81 m/s^2 = 0.050968... kg = 5.10×10^{-2} kg

5. A spring has a proportionality constant of 2.50 N/cm. If the spring stretches 7.00 cm, what weight is attached?

$\frac{2.50N}{1cm} = \frac{X}{7.00cm}$ $X = 2.5(7)$ $= 17.5N$

6. A spring has a proportionality constant of 5.0 N/cm. If a 12.5 N weight is attached to the spring, what is the elongation?

$\frac{5.0N}{1cm} = \frac{12.5N}{X}$ $5X = 12.5$ $X = 2.5cm$

1130kg 7. What is the mass in kilograms of the water filling a tank 75. 5cm long, 0.500 m wide and 3.00 m high? 0.755m

$V = (0.755m)(0.500m)(3.00m)$ $= 1.1325 m^3$ $D = 1000 \frac{kg}{m^3}$ $m = DV$ $= 1132.5 kg$

2250kg 8. What is the mass in kilograms of the water filling a tank 1.50 m long, 75.0 cm wide and 2.00 m high? $D = 1000 kg/m^3$

0.75m

$V = (0.75m)(1.50m)(2m) = 2.25 m^3$ $m = DV = 2250 kg$

2.32×10^4 g 9. The density of a metal is 3.00 g/cm^3. What is the mass of a slab of the metal 10.0 cm long, 0.500 m wide and 15.5 cm high?

$D = 3.00 g/cm^3$ $m = DV$

$V = 10 cm (50cm)(15.5cm)$ $= 7750 cm^3$ $= 3(7750) = 23250 g$

2510 kg 10. The density of a substance is 750. kg/m^3. What is the mass of a block of the substance 2.25 m long, 1.75 m wide and 85.0 cm high?

$D = 750. kg/m^3$ $m = DV$

$V = (2.25m)(1.75m)(0.850m)$ $= (750.)(3.34688)$

$= 3.346875 m^3$ $= 2510 kg$

2.2×10^{-3} m^3 11. The specific gravity of a substance is 0.45. What is the volume of one kilogram of the substance?

$D = 0.45 (1000 kg/m^3)$ $= 450 kg/m^3$ $V = \frac{m}{D} = \frac{1.0 kg}{450 kg/m^3} = 2.2 \times 10^{-3} m^3$

5.81×10^{-4} m^3 12. The specific gravity of a substance is 1.72. What is the volume of one kilogram of the substance?

$D = 1.72 (1000 kg/m^3)$ $= 1720 kg/m^3$ $V = \frac{m}{D} = \frac{1.0 kg}{1720 kg/m^3} = 5.81 \times 10^{-4} m^3$