

Florida International University
Department of Civil and Environmental Engineering

CWR 3201 Fluid Mechanics

Fall 2018

Instructor: Arturo S. Leon, Ph.D., P.E., D.WRE

Homework Assignment 1

Mechanics of Fluids (Fifth edition), by M.C. Potter, D.C. Wiggert and B.H. Ramadan.

1. 1.17 (same number in *Fourth edition*)

Recognizing that all terms in an equation must have the same dimensions, determine the dimensions on the constants in the following equations:

- (a) $d = 4.9 t^2$ where d is distance and t is time.
- (b) $F = 9.8 m$ where F is a force and m is mass.
- (c) $Q = 80AR^{2/3} S_0^{1/2}$ where A is area, R is a radius, S_0 is a slope and Q is a flow rate with dimensions of L^3/T .

2. 1.25 (same number in *Fourth edition*)

What net force is needed to accelerate a 10-kg mass at the rate of 40 m/s^2 (neglect all friction):

- (a) Horizontally?
- (b) Vertically upward?
- (c) On an upward slope of 30° ?

3. 1.29 (same number in *Fourth edition*)

A vacuum of 31 kPa is measured in an airflow at sea level. Find the absolute pressure in:

- (a) kPa
- (b) mm Hg
- (c) psi
- (d) ft H_2O
- (e) in. Hg

4. 1.39 (same number in *Fourth edition*)

A liquid with a specific gravity of 1.2 fills a volume. If the mass in the volume is 10 slug, what is the magnitude of the volume?

5. 1.41 (same number in *Fourth edition*)

In a single cylinder engine a piston without rings is designed to slide freely inside the vertical cylinder. Lubrication between the piston and cylinder is maintained by a thin oil film. Determine the velocity with which the 120-mm-diameter piston will fall inside the 120.5-mm-diameter cylinder. The 350-g piston is 10 cm long. The lubricant is SAE 10W-30 oil at 60°C.

6. 1.47 (same number in *Fourth edition*)

A 60-cm-wide belt moves at 10 m/s, as shown in Fig. P1.47. Calculate the horsepower requirement assuming a linear velocity profile in the 10°C water.

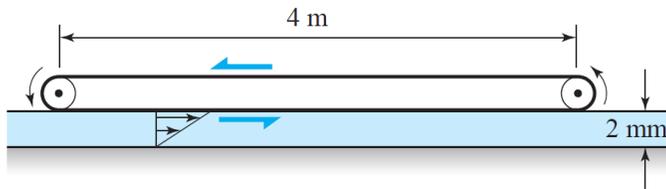


Fig. P1.47

7. 1.55 (same number in *Fourth edition*)

A pressure is applied to 20 L of water. The volume is observed to decrease to 18.7 L. Calculate the applied pressure.

8. 1.56 (same number in *Fourth edition*)

Calculate the speed of propagation of a small-amplitude wave through water at:

- (a) 40°F
- (b) 100°F
- (c) 200°F

9. 1.59 (same number in *Fourth edition*)

A small 1/16-in.-diameter bubble is formed by a stream of 60°F water. Estimate the pressure inside the bubble.

10. 1.61 (same number in *Fourth edition*)

Determine the height that 20°C water would climb in a vertical 0.02-cm-diameter tube if it attaches to the wall with an angle β of 30° to the vertical.