

Solution for Homework 3

Chapter 11:

Questions:

11.3 The principal factor is forces between atoms or molecules of a substance.

11.4 Mercury, air, alcohol, and carbon dioxide are fluids.

11.5 (d)

Exercises:

$$11.4 \text{ density} = \text{mass}/\text{volume} = 750\text{kg}/1.6\text{m}^3 = 468\text{kg}/\text{m}^3$$

$$11.11 \text{ volume of the air} = 6.5\text{m} \times 4.4\text{m} \times 2.7\text{m} = 77\text{m}^3$$
$$\text{density of the air} = 1.3\text{kg}/\text{m}^3 \text{ (from table 11-3, p156)}$$
$$\text{mass} = \text{density} \times \text{volume} = 77\text{m}^3 \times 1.3\text{kg}/\text{m}^3 = 100\text{kg}$$

Chapter 12:

Questions:

12.6 No, it is density, not mass or weight, that determines whether an object sinks in a given fluid.

12.8 If the buoyant force on a submarine immersed in water is larger than the weight of the submarine, it will float. If the buoyant force on a submarine immersed in water is smaller than the weight of the submarine, it will sink. The weight of the submarine remain the same at any time, while the buoyant force acting on it can be changed via changing the volume of water which the submarine displaces. Namely a variable volume of submarine compartments enable it sinking and floating.

Exercises:

$$12.3 \text{ one atmosphere pressure is } 100\text{kPa}$$
$$\text{total pressure inside the tire} = \text{pressure (gauge reading)} + \text{atmosphere pressure}$$
$$= 190\text{kPa} + 100\text{kPa} = 290\text{kPa}$$

$$12.8 \text{ blood pressure difference} = \text{blood density} \times g \times \text{height} = \rho g h$$
$$= 1.05 \times 10^3 \text{ kg}/\text{m}^3 \times 9.8 \text{ m}/\text{s}^2 \times 1.60\text{m} = 1696\text{kg}/(\text{ms}^2) = 1696\text{Pa}$$

$$12.21 \text{ mechanical advantage} = \text{output force} / \text{input force}$$
$$= (\text{fluid pressure} \times \text{area of output piston}) / (\text{fluid pressure} \times \text{area of input piston})$$
$$= \text{area of output piston} / \text{area of input piston} = \pi(20/2)^2 / [\pi(5.0/2)^2] = 16$$

note:

- 1) according to Pascal principle, pressure on input piston and output piston are have the same value)
- 2) piston area = $\pi \times \text{radius}^2 = \pi \times (\text{diameter}/2)^2$

Chapter 13:

questions:

13.7 At 40°C, which is higher than 20°C, steel tape expands. The length between marks, e.g. 0 meter and 1 meter, on the tape is longer than 1 meter. Thus, at 40°C it will read lower.

Exercises:

13.2 $(90-32) \times (5/9) = 32.2^\circ\text{C}$

13.3 $1800 \times (9/5) + 32 = 3272\text{F}$

Chapter 14:

questions:

14.17 Closing a simple window can reduce heat mainly through convection, while closing curtain can reduce heat mainly through radiation.

For special double-glazed window, heat transfer through conduction also can be reduced since glass conducts heat faster than the sealed air in the double-glazed window.

14.21 The tile floor conduct away heat much faster than the carpet. Thus the surface temperature of your feet drops more quickly.

14.24 Under shadow, the temperature of the thermometer can reach equilibrium with the air temperature via conduction. Under sun, absorbed radiation will increase temperature reading above air temperature.

14.27 Loss of energy by radiation to cool surrounding. A baby's temperature can drop.

14.30 Because dirty snow absorbs radiation faster than clean snow.

Exercises:

14.3 work = $4.18\text{J/cal} \times 400\text{cal} = 1672\text{J}$