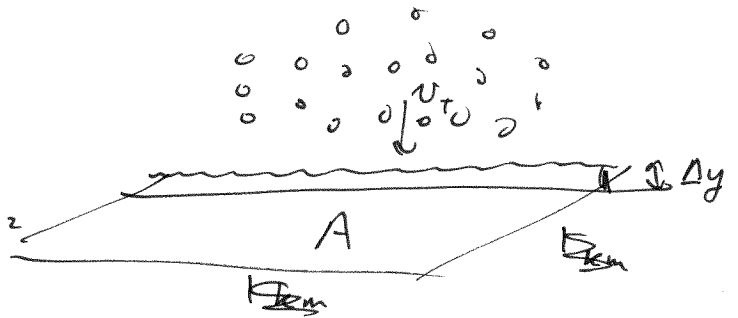


Chapter 9Problem 22

$$v_f = 10 \text{ m/s}$$

$$\Delta y = 1 \text{ cm} = 0.01 \text{ m}$$

$$A = 10 \text{ km}^2 \left(\frac{1000 \text{ m}}{1 \text{ km}} \right)^2 = 1.0 \times 10^7 \text{ m}^2$$



What is the momentum of the rain that falls?

Find the volume of rain that fell.

$$V = A \cdot \Delta y = (1.0 \times 10^7 \text{ m}^2)(0.010 \text{ m}) = 1.0 \times 10^5 \text{ m}^3$$

Using the density of water

$$\rho = 1 \text{ g/cm}^3 \left(\frac{1 \text{ kg}}{1000 \text{ g}} \right) \left(\frac{100 \text{ cm}}{1 \text{ m}} \right)^3 = 1000 \frac{\text{kg}}{\text{m}^3}$$

The mass is density times volume

$$m = V \cdot \rho = (1.0 \times 10^5 \text{ m}^3) \left(1000 \frac{\text{kg}}{\text{m}^3} \right) = 1.0 \times 10^8 \text{ kg}$$

(This is
100,000 metric tons
of water)

Momentum is mass times velocity, so

$$p = m \cdot v = (1.0 \times 10^8 \text{ kg})(10 \text{ m/s}) = \boxed{1.0 \times 10^9 \frac{\text{kg} \cdot \text{m}}{\text{s}}}$$