Module 1 – Fluids: Quiz 1a

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The varsity football team's water cooler is a plastic cylinder 70. cm high with a 30. cm radius. A 2.0 cm diameter hole is cut near the bottom for water to flow out. This hole is plugged. ***What is the force on the plug due to the water*** (density = 1000 kg/m^3) ***in the cooler when the cooler is full of water?***

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Calculate $P = P_o + \rho g d$

$P = 1.0 \times 10^5$ N/m^2 + (1,000 kg/m^3)(9.8 N/kg)(0.70 m) = 1.0686×10^5 N/m^2

Calculate $F = P \times A_{circle} = P \times \pi r^2$

F= (107,000 N/m^2)(π)(0.01m)^2 = 34 N

Module 1 – Fluids: Quiz 1b

A rectangular pool is 8.0 m long, 4.0 m wide, and 2.0 m high and contains kerosene with density 820 kg/m^3 to a depth of 1.5 m high.
Find…

(a) the hydrostatic pressure on the bottom of the tank.
(b) the hydrostatic force on the bottom.

Answer:

A rectangular pool is 8.0 m long, 4.0 m wide, and 2.0 m high and contains kerosene with density 820 kg/m^3 to a depth of 1.5 m high. Find…

(a) the hydrostatic pressure on the bottom of the tank.
(b) the hydrostatic force on the bottom.

$$V = 8.0m\ x\ 4.0m\ x\ 1.5m = 48m^3$$ ✓

$$P = P_o + \rho g d$$ ✓

$$P = 1.01x10^5\,Pa + (820kg/m^3)(9.8m/s^2)(1.5m)$$

$$P = 1.1x10^5\,Pa$$ ✓

$$P = \frac{F}{A}$$ ✓

$$F = PA = (1.1x10^5\,Pa)(8.0m\ x\ 4.0m) = 3.6x10^6\,N$$ ✓

Module 1 – Fluids: Quiz 1c

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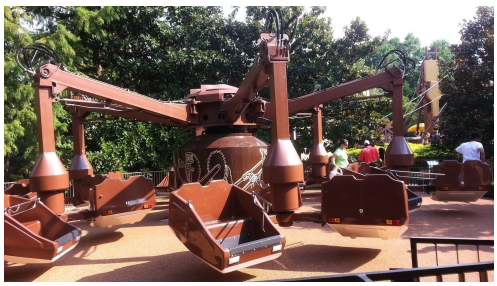
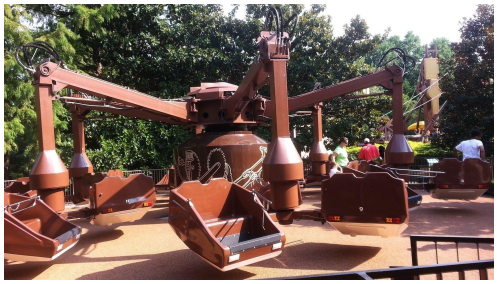
1. One of the best rides at Busch Gardens in Orlando Florida is the Flying Machine. The Flying Machine is lifted by a hydraulic jack. The operator activates the ride by applying a force of 72N to a 45.0 cm^2 cylindrical piston, which holds the 20,000N ride off the ground. What is the area of the piston that holds the ride if the process is 90% efficent?



2. A cylinder with a radius of 5.0 cm contains 15 cm of water (1000 kg/m^3). Gasoline (760 kg/m^3) is then poured on top until the total depth of the liquid is 45 cm. What is the gauge pressure at the bottom of the cylinder.

Answer:

1. One of the best rides at Busch Gardens in Orlando Florida is the Flying Machine. The Flying Machine is lifted by a hydraulic jack. The operator activates the ride by applying a force of 72N to a 45.0 cm^2 cylindrical piston, which holds the 20,000N ride off the ground. What is the area of the piston that holds the ride if the process is 90% efficent?



$$P_1 x 90\% = P_2$$

$$\frac{F_1}{A_1} x 0.90 = \frac{F_2}{A_2}$$

$$A_2 = \frac{F_2 A_1}{F_1 x 0.90} = \frac{(20,000N)(45cm^2)}{(74N)(0.90)} = 1.35x10^4 cm^2$$

2. A cylinder with a radius of 5.0 cm contains 15 cm of water (1000 kg/m^3). Gasoline (760 kg/m^3) is then poured on top until the total depth of the liquid is 45 cm. What is the gauge pressure at the bottom of the cylinder.

$$P_g = P_{water} + P_{oil}$$

$$P_g = \rho_{water} g V_{water} + \rho_{oil} g V_{oil}$$

$$P_g = (1000)(9.8)(0.15) + (760)(9.8)(0.30) = 3700 Pa$$