Lec. (7)

PHYSICS 1

1ST LEVEL 2020 - 2021

+201064763583

ENGINEERING CAMP

SCAN FOR FACEBOOK GROUP

ISMAIL OSMAA 0106 476 3583 ISMAIL OSMAA

Quiz No. 3

Student Name:

Group No.:

Please Choose the Correct Answer

(1) Two identical fish, both at sea level, float in two identical aquariums with identical quantities of water. Fish *A* is in Alaska, so it weighs more than fish *B* at the equator, since *g* is larger at sea level in Alaska. Which statement is correct.

a. A comparison is impossible unless they are both floating at the same level.
b. Fish *A* displaces a greater quantity of water than fish *B*.
c. Fish *B* displaces a greater quantity of water than fish *A*.
(d.) They both displace the same quantity of water.
e. Fish *A* has a smaller acceleration than Fish *B* when equal horizontal forces are applied to each, because Fish *A* weighs more.

(2) A waiter in a restaurant fills a pitcher full of water and ice so that water would spill out if any more were added. As the ice starts to melt

a. the water level in the pitcher falls. (b.) the water level in the pitcher remains the same. c. water starts to flow out the spout of the pitcher.
d. the pressure on the bottom of the pitcher decreases. e. the pressure on the bottom of the pitcher increases.

(3) At a certain depth in the ocean, the absolute pressure is *p*. If you go to twice that depth reating the water as incompressible)

) the absolute pressure will be 2*p*. (B) the absolute pressure will be less than 2*p*.
) the absolute pressure will be greater than 2*p*. D) the gauge pressure will not change.
) the gauge pressure will increase but will not double.

(4) If you double the pressure on the surface of a can of water, the buoyant force on a stone placed in that water will

) increase, but not double. B) double. C) decrease, but not by one-half.
(d) not change.

(5) A wood block is placed on top of the ice in a large bowl half full of ice. The bowl is then filled the brim with water, with the wood block riding on top of the ice. As the ice melts,
the density of the water decreases. b. the water level falls below the rim.
the water level rises and water spills out of the bowl. (d.) the water level does not ange. e. the wood block descends, causing water to spill out of the bowl.

(6) An iron block of density ρ_{Fe} and of volume ℓ^3 is immersed in a fluid of density ρ_{fluid}. The block hangs from a scale which reads W as the weight. The top of the block is a height h below he surface of the fluid. The correct equation for the reading of the scale is

a. $W = (\rho_{Fe} - \rho_{fluid})gh\ell^2$. b. $W = (\rho_{fluid} - \rho_{Fe})g\ell^3$. c. $W = (\rho_{Fe} - \rho_{fluid})g\ell^3$.

d. $W = (\rho_{Fe} + \rho_{fluid})gh\ell^2$. e. $W = (\rho_{Fe} + \rho_{fluid})g\ell^3$.

7) A stonecutter's chisel has an edge area of 0.7 cm². If the chisel is struck with a force of 42 N, what is the pressure exerted on the stone?

a. 600 N/m² b. 30 000 N/m² c. 300 000 N/m² d. 600 000 N/m² e. 6 000 N/m²

8) Salt water is more dense than fresh water. A ship floats in both fresh water and salt water. Compared to the fresh water, the volume of salt water displaced by the ship is

A) greater than the volume of fresh water. B) less than the volume of fresh water.

C) the same as the volume of fresh water.

9) A rock is under water in a shallow lake. As the rock sinks deeper and deeper into water, the buoyant force on it

A) increases. B) decreases. C) remains constant.

10) A certain coin has a diameter of 21.21 mm, a thickness of 1.95 mm, and weighs 0.04905 N. What is its density?

A) 29.1×10^3 kg/m3 B) 7.26×10^3 kg/m3 C) 9.25×10^3 kg/m3

D) 2.31×10^3 kg/m3 E) 71.2×10^3 kg/m3

11) What is the radius of a sphere that has a density of 5000 kg/m3 and a mass of 6.00 kg?

A) 4.98 cm B) 1.27 cm C) 6.59 cm D) 1.56 cm E) 7.22 cm

12) A cubical box, 5.00 cm on each side, is immersed in a fluid. The gauge pressure at the top surface of the box is 594 Pa and the gauge pressure on the bottom surface is 1133 Pa. What is the density of the fluid?

A) 1000 kg/m3 B) 1100 kg/m3 C) 1220 kg/m3 D) 2340 kg/m3 E) 12,000 kg/m3

13) The small piston of a hydraulic lift has a diameter of 8.0 cm, and its large piston has a diameter of 40 cm. The lift raises a load of 15,000 N.

(a) Determine the force that must be applied to the small piston.

(b) Determine the pressure applied to the fluid in the lift.

Prepared By Eng/ Ismail Samaa

Answer: (a) 600 N (b) 1.2×10^5 Pa

14) Air is flowing through a rocket nozzle. Inside the rocket the air has a density of 5.25 kg/m3 and a speed of 1.20 m/s. The interior diameter of the rocket is 15.0 cm. At the nozzle exit, the diameter is 2.50 cm and the density is 1.29 kg/m3. What is the speed of the air when it leaves the nozzle?

A) 123 m/s B) 176 m/s C) 88.0 m/s D) 45.7 m/s E) 29.3 m/s

15) Incompressible water flows out of a large reservoir through a pipe that opens to the atmosphere 5.70 m below the level of the water in the reservoir. What is the speed of the water as it comes out of the pipe?

A) 1.72 m/s B) 7.47 m/s C) 55.8 m/s D) 10.6 m/s E) 27,9 m/s

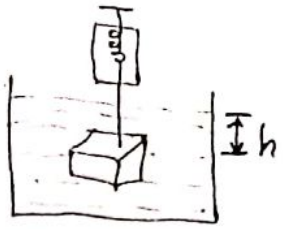
$\because F_B = W_{air} - W$

$\therefore W = W_{air} - F_B$

$= \rho_{Fe} V g - \rho_{Fluid} V g$

$= (\rho_{Fe} - \rho_{Fluid}) V g$

$= (\rho_{Fe} - \rho_{Fluid}) L^3 g$



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7 $A = 0.7\,cm^2 = 0.7 \times 10^{-4}\,m^2$

$F = 42\,N$ $\quad P = ?$

answer

$$P = \frac{F}{A} = \frac{42}{0.7 \times 10^{-4}} = \boxed{600\,000\,N/m^2}$$

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10 $D = 21.21\,mm \Rightarrow r = 10.605 \times 10^{-3}\,m$

$h = 1.95\,mm = 1.95 \times 10^{-3}\,m$

$W = 0.04905\,N$ $\quad \rho = ??$

answer

$V = \pi r^2 h$

$$W = mg = \rho V g$$

$$\therefore W = \rho (\pi r^2 h) g$$

$$\therefore \rho = \frac{W}{\pi r^2 h g} = \frac{0.04905}{\pi (10.605 \times 10^{-3})^2 \times 1.95 \times 10^{-3} \times 9.8}$$

$$= 7264.5 = \boxed{7.26 \times 10^3 \ kg/m^3}$$

II $r = ??$ $\rho = 5000 \ kg/m^3$ $m = 6 \ kg$

sphere

answer.

$$V = \frac{4}{3} \pi r^3$$

$$\because m = \rho V$$

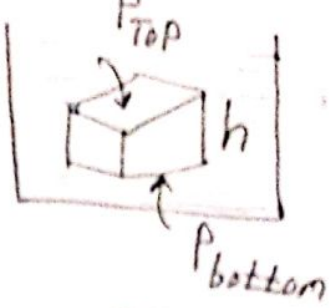
$$\therefore V = \frac{m}{\rho} = \frac{6}{5000} = 0.0012 \ m^3$$

$$\therefore V = \frac{4}{3} \pi r^3$$

$$\therefore r = \left[\frac{3V}{4\pi}\right]^{\frac{1}{3}} = \left[\frac{3 \times 0.0012}{4\pi}\right]^{\frac{1}{3}}$$

$$= 0.0659 \ m = \boxed{6.59 \ cm}$$

$h = 5\,cm = 0.05\,m$



$P_{TOP} = 594\ Pa$

$P_{bottom} = 1133\ Pa$ $\quad S_{FLUID} = ??$

answer

$$\therefore P_{bottom} - P_{TOP} = \rho_{FLUID}\, g\, h$$

$$\therefore \rho_{FLUID} = \frac{1133 - 594}{9.81 \times 0.05} = \boxed{1098\ kg/m^3}$$

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13 $D_1 = 8\,cm \longrightarrow r_1 = 4\,cm = 0.04\,m$

$D_2 = 40\,cm \longrightarrow r_2 = 20\,cm = 0.20\,m$

$F_2 = 15000\,N$ (a) F_1 (b) P

answer

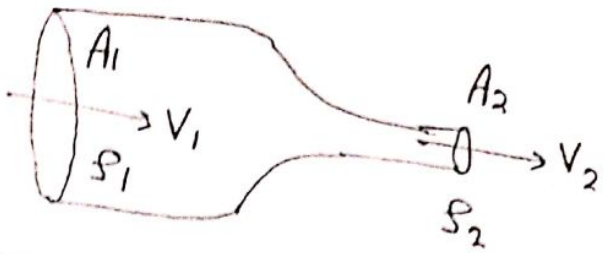
(a) $$\frac{F_1}{A_1} = \frac{F_2}{A_2} \quad \therefore F_1 = \frac{A_1 F_2}{A_2}$$

$$\therefore F_1 = \frac{\pi (0.04)^2 \times 15000}{\pi (0.20)^2} = \boxed{600\ N}$$

(b) $$P = \frac{F_2}{A_2} = \frac{15000}{\pi (0.20)^2} = 119366\ Pa \simeq \boxed{1.2 \times 10^5\ Pa}$$

$\rho_1 = 5.25\ kg/m^3$

$V_1 = 1.2\ m/s$



$D_1 = 15\ cm \longrightarrow r_1 = 7.5\ cm = 7.5 \times 10^{-2}\ m$

$D_2 = 2.5\ cm \longrightarrow r_2 = 1.25\ cm = 1.25 \times 10^{-2}\ m$

$\rho_2 = 1.29\ kg/m^3$ $\qquad V_2 = ??$

answer

⇒ Continuity of mass

$\therefore \rho_1 V_1 A_1 = \rho_2 V_2 A_2$

$$\therefore V_2 = \frac{\rho_1 V_1 A_1}{\rho_2 A_2} = \frac{5.25 \times 1.2 \times \pi (7.5 \times 10^{-2})^2}{1.29 \times \pi \times (1.25 \times 10^{-2})^2}$$

$$= 175.8\ m/s \simeq \boxed{176\ m/s}$$

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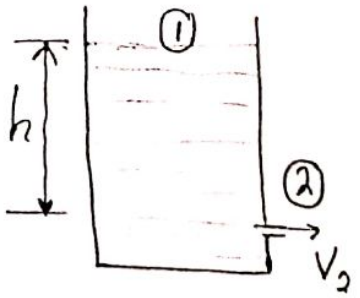
15 $h = 5.7\ m$, water

$V_2 = ??$ $\qquad$ answer

$P_1 = P_a \quad V_1 = 0 \quad h_1 = h$

$P_2 = P_a \quad V_2 = ? \quad h_2 = 0$



$$\therefore P_1 + \rho g h_1 + \frac{1}{2}\rho V_1^2 = P_2 + \rho g h_2 + \frac{1}{2}\rho V_2^2$$

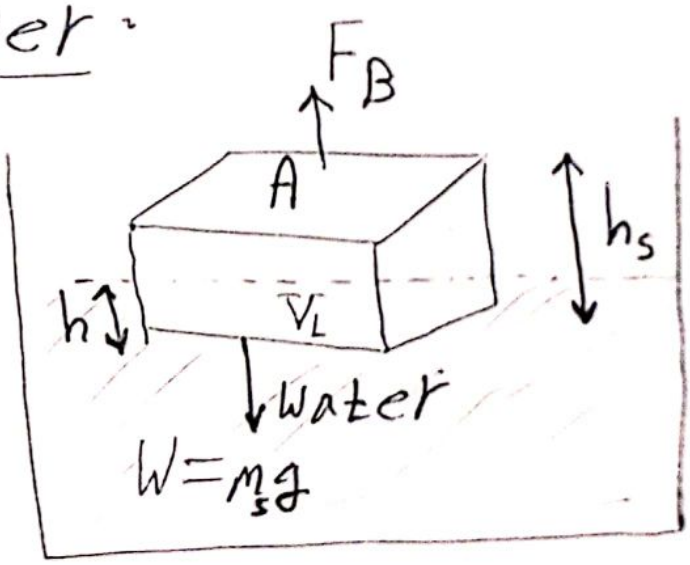
($\frac{1}{2}\rho V_1^2 \to 0$, $\rho g h_2 \to 0$)

$$\therefore V_2 = \sqrt{2gh} = \sqrt{2 \times 9.81 \times 5.7} = \boxed{10.575\ m/s}$$

Examples

[1] A raft is constructed of Wood has a density of 6×10^2 kg/m^3, Its surface area is 5.7 m^2 and its Volume is 0.6 m^3, When the raft is placed in fresh water, to what depth (h) The bottom of raft submerged?

answer



$W = F_B$

$m_s g = \rho_L V_L g$

$\rho_s V_s = \rho_L V_L$

$\rho_s A h_s = \rho_L A h$

$$\therefore h = \frac{\rho_s h_s}{\rho_L} = \frac{6 \times 10^2 \ \frac{0.6 \text{ m}^3}{5.7}}{1000}$$

$$= \boxed{0.0632 \text{ m}}$$

Each second $5525\ m^3$ of water تجري خلال flows Through 670m of Nigra Falls شلالات نيجرا 2m deep, estimate the water speed.

"answer"

Flow rate $= 5525\ m^3/sec$

$\therefore AV = 5525 \Rightarrow V = \frac{5525}{A}$

$\therefore V = \frac{5525}{670 \times 2} \simeq \boxed{4\ m/s}$

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[3] A gardener uses a water hose خرطوم 2.5 cm in diamter to يملأ fill 30 Liter bucket in 1 min, Find the speed water?

"answer"

Flow rate $= \frac{30\ Liter}{1\ min} = \frac{30 \times 10^{-3}\ m^3}{60\ second}$

$= 0.5 \times 10^{-3}\ m^3/second$

$\therefore AV = 0.5 \times 10^{-3}$

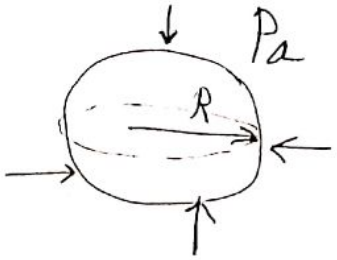
$\therefore V = \frac{0.5 \times 10^{-3}}{\pi (2.5 \times 10^{-2})^2} = \boxed{1.02\ m/s}$

Estimate the total mass of Earth's atmospheric if

$P_a = 1.013 \times 10^5$ Pa , $R = 6.37 \times 10^6$ m

"answer"

$W = mg = P_a A$



$A = 4\pi R^2$

$$\therefore m = \frac{P_a A}{g}$$

$$= \frac{1.013 \times 10^5 \times 4\pi (6.37 \times 10^6)^2}{9.8}$$

$$= \boxed{5.27 \times 10^{18} \text{ kg}}$$

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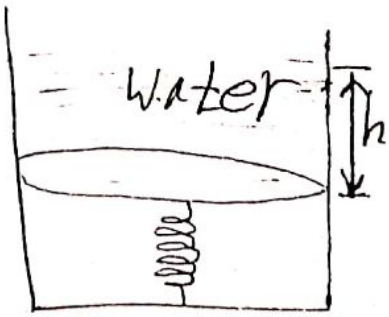
5 A spring with spring constant k 1250 N/m and a piston diameter 1.2 cm, as the spring lowered in water, what is the depth causes the spring moves x 0.75 cm ?



answer

$F = kx = PA$

$\therefore kx = (\rho_w g h)(\pi r^2)$ 10

$\therefore h = \frac{kx}{\rho_w g \pi r^2} = \frac{1250 \times (0.75 \times 10^{-2})}{1000 \times 9.81 \times \pi \times (\frac{12 \times 10^{-3}}{2})^2}$

$= \boxed{8.46 m}$

Prepared By
Eng/ Ismail Gomaa
0100 7970 675

6 An airplane has mass 1.6×10^4 kg and each wing has an area $40 m^2$, if the pressure on the lower wings is 7×10^4 Pa, Find the pressure on the upper wings.

answer

$W = (P_1 - P_2) A$

$\therefore mg = P_1 A - P_2 A$

$\therefore P_2 A = P_1 A - mg$

$\therefore P_2 = \frac{P_1 A - mg}{A}$

$P_2 = ??$

A

$P_1 =$ ←

جناحين

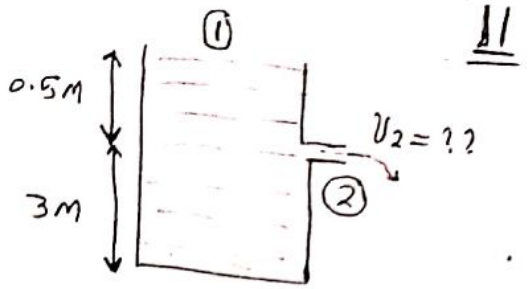
$\boxed{A = 2 \times 40 = 80}$

Note: $h_1 = h_2 = 0$

$P_1 + \frac{1}{2} \rho V_1^2 = P_2 + \frac{1}{2} \rho V_2^2$

$\therefore P_2 = \frac{(7 \times 10^4 \times 80) - (1.6 \times 10^4 \times 9.81}{80} = \boxed{68040 Pa}$

The top of the tank is opened and the water level is 0.5m the hole



(a) Find the speed of water when leaves the hole.

(b) Where does the water hits the ground if the hole is 3m above the ground.

~ answer ~

(a) $P_1 = P_2 = P_0$, $v_1 \simeq 0$, $h_2 = 0$, $h_1 = 0.5$

$$\therefore P_1 + \rho g h_1 + \frac{1}{2}\rho v_1^2 = P_2 + \rho g h_2 + \frac{1}{2}\rho v_2^2$$

$$P_0 + \rho g (0.5) + 0 = P_0 + 0 + \frac{1}{2}\rho v_2^2$$

$$\therefore v_2 = \sqrt{2gh} = \sqrt{2 \times 9.8 \times 0.5} = \boxed{3.13 \text{ m/s}}$$

(b) $y_2 - y_1 = \frac{1}{2} g t^2$

$$3 = \frac{1}{2} \times 9.8 \times t^2 \Rightarrow t = 0.782 \text{ s}$$

$$X = v_{ox} t = 3.13 \times 0.782 = \boxed{2.45 \text{ m}}$$