PHY 113 A General Physics I 9-9:50 AM MWF Olin 101

Plan for Lecture 26:

Chapter 14: The physics of fluids

- 1. Density and pressure
- 2. Variation of pressure with height

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3. Buoyant forces

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22	10/29/2012	Kepler's laws and satellite motion	<u>13.4-13.6</u>	<u>13.28. 13.34</u>	10/31/2012
	10/31/2012	Review	10-13.15		
	11/02/2012	Exam	10-13,15		
23	11/05/2012	Fluid mechanics	14.1-14.4	14.8. 14.24	11/07/2012
24	11/07/2012	Fluid mechanics	14.5-14.7	14.39. 14.51	11/09/2012
25	11/09/2012	Temperature	19.1-19.5	19.1. 19.20	11/12/2012
26	11/12/2012	Heat	20.1-20.4		11/14/2012
27	11/14/2012	First law of thermodynamics	20.5-20.7		11/16/2012
28	11/16/2012	Ideal gases	21.1-21.5		11/19/2012
29	11/19/2012	Engines	22.1-22.8		11/26/2012
	11/21/2012	Thanksgiving Holiday			
	11/23/2012	Thanksgiving Holiday			
	11/26/2012	Review	14.19-22		
	11/28/2012	Exam	14,19-22		
30	11/30/2012	Wave motion	16.1-16.6		12/03/2012
31	12/03/2012	Sound & standing waves	17.1-18.8		12/05/2012
Ē	12/05/2012	Review	1-22		
\square	12/13/2012	Final Exam 9 AM	1		



The physics of fluids.	
•Fluids include liquids (usually "incompressible) and gases (highly "compressible").	
•Fluids obey Newton's equations of motion, but because they move within their containers, the application of Newton' laws to fluids introduces some new forms.	s
≻Pressure: P=force/area 1 (N/m ²) = 1 Pascal	
>Density: ρ =mass/volume 1 kg/m³ = 0.001 gm/ml	
Note: In this chapter P≡pressure (NOT MOMENTUM)	
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Substance	ho (kg/m ³)	Substance	ho (kg/m ³)	
Air	1.29	Iron	7.86×10^{3}	
Air (at 20°C and		Lead	11.3×10^{3}	
atmospheric pressure)	1.20	Mercury	13.6×10^{3}	
Aluminum	2.70×10^3	Nitrogen gas	1.25	
Benzene	$0.879 imes 10^3$	Oak	0.710×10^{3}	
Brass	$8.4 imes 10^3$	Osmium	22.6×10^{9}	
Copper	8.92×10^3	Oxygen gas	1.43	
Ethyl alcohol	0.806×10^3	Pine	0.373×10^{3}	
Fresh water	$1.00 imes 10^3$	Platinum	21.4×10^{2}	
Glycerin	$1.26 imes 10^3$	Seawater	1.03×10^{3}	
Gold	19.3×10^3	Silver	10.5×10^{3}	
Helium gas	$1.79 imes 10^{-1}$	Tin	7.30×10^{3}	
Hydrogen gas	$8.99 imes 10^{-2}$	Uranium	19.1×10^{3}	
Ice	0.917×10^{3}			







































iclicker question:

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Have you personally experienced the effects of atmospheric pressure variations?

- A. By flying in an airplane
 B. By visiting a high-altitude location (such as Denver, CO etc.)
- C. By visiting a low-altitude location (such as Death Valley, CA etc.)
- D. All of the above.
- E. None of the above.

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iclicker question:

- Suppose you have a boat which floats in a fresh water lake, with 50% of it submerged below the water. If you float the same boat in salt water, which of the following would be true?
- A. More than 50% of the boat will be below the salt water.
- B. Less than 50% of the boat will be below the salt water.
- C. The submersion fraction depends upon the boat's total mass and volume.
- D. The submersion fraction depends upon the barometric pressure.

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Summary: Application of Newton's second law to fluid (near Earth's surface) $\frac{dP}{dy} = -\rho g$ Incompressible fluid: $P = P_0 - \rho g (y - y_0)$ example: $\rho = 1000 \text{kg/m}^3$ (water) Compressible fluid: $P = P_0 e^{\frac{\rho_0 g}{P_0} (y - y_0)}$ $\approx P_0 - \rho_0 g (y - y_0)$ (for $\frac{\rho_0 g}{P_0} (y - y_0) <<1$) example: $\rho = 1.29 \text{kg/m}^3$ (air)















