Review for the final exam, Tuesday week 9, 1:00 p.m. LH 5

Electromagnetism
Page 514, #1
Page 521, # 4 and 5
Page 526, # 10
Pages 538-539, # 16 and 17
Page 551, # 1
Page 552, # 3
Page 555, # 5
Page 556-557, # 6 and 7
Page 581, # 2
Page 582, #3
Page 589, # 8
Page 592, # 9
Page 594, # 11
Page 598, # 14
Page 610-611 Concept Summary

Rotational Dynamics
Page 235, # 3
Page 236, # 4
Page 240, # 6
Page 246, # 11

Fluids
Page 301, # 1
Page 305, # 4
Page 309, # 7
Page 310, # 8

Also, review problems solved in class, workshop and homework (solutions posted in webpage)

Last problem in class. Page 332, # 47.

The height of the cylinder that is in the oil is given by $h_{\text{oil}} = V_{\text{oil}} / (\pi r^2)$, where V_{oil} is the volume of **oil displaced** by the cylinder and *r* is the radius of the cylinder. We must, therefore, find the volume of oil displaced by the cylinder. After the oil is poured in, the buoyant force that acts on the cylinder is equal to **the sum of the weight of the water displaced by the cylinder and the weight of the oil displaced by the cylinder.** Therefore, the magnitude of the buoyant force is given by $F = \rho_{\text{water}} g V_{\text{water}} + \rho_{\text{oil}} g V_{\text{oil}}$. Since the cylinder floats in the fluid, the net force that acts on the cylinder must be zero. Therefore, the buoyant force that supports the cylinder must be equal to the weight of the cylinder, or

$$\rho_{\text{water}} gV_{\text{water}} + \rho_{\text{oil}} gV_{\text{oil}} = mg$$

where m is the mass of the cylinder. Substituting values into the expression above leads to

$$V_{\text{water}} + (0.725)V_{\text{oil}} = 7.00 \times 10^{-3} \text{ m}^3 \qquad (1)$$

From the figure in the text, $V_{\text{cylinder}} = V_{\text{water}} + V_{\text{oil}}$. Substituting values into the expression for V_{cylinder} gives

$$V_{\text{water}} + V_{\text{oil}} = 8.48 \times 10^{-3} \text{ m}^3 \qquad (2)$$

Subtracting Equation (1) from Equation (2) yields $V_{\text{oil}} = 5.38 \times 10^{-3} \text{ m}^3$.

SOLUTION The height of the cylinder that is in the oil is, therefore,

$$h_{\text{oil}} = \frac{V_{\text{oil}}}{\pi r^2} = \frac{5.38 \times 10^{-3} \text{ m}^3}{\pi (0.150 \text{ m})^2} = \boxed{7.6 \times 10^{-2} \text{ m}}$$
