

## AP2-PREX1 SOLUTIONS

1. [D] FBD has  $F_t$  pointing down  $F_b$  pointing up and weight ( $mg$ ) down.  $F_{net} = 0 \quad F_b - F_t - mg = 0$   
 The buoyant force is given by the weight of the displaced water. Since the water's displaced volume is equal to the cork's displaced volume and the water weight for the same volume would be 4 times heavier (based on the given cork weight = 25% water weight) compared to the cork, the buoyant force is equal to 4 x the cork weight =  $4mg$ . Using the force equation created initially.  $F_t = F_b - mg = 4mg - mg = 3mg$
2. [A] Using fluid continuity.  $A_1v_1 = A_2v_2 \quad \pi R^2v_1 = \pi(2R)^2v_2 \quad v_1 = 4v_2$
3. [D] A  $1 \text{ m}^3$  volume cube under water displaces  $1 \text{ m}^3$  of water. This weight of water =  $\rho Vg = 1000(1)(10) = 10000 \text{ N}$  which is equivalent to the buoyant force. The apparent weight in water is  $m_{app}g = 18300(10) = 183000 \text{ N}$ . This apparent weight is lessened by the buoyant force pulling up with  $10000 \text{ N}$  of force. So outside of the water, this upwards force would not exist and the actual weight would be  $193000 \text{ N}$  which equal  $19300 \text{ kg}$  of mass.
4. [E] Same as #2: Using fluid continuity.  $A_1v_1 = A_2v_2 \quad \pi R^2v_1 = \pi(2R)^2v_2 \quad v_1 = 4v_2$
5. [B] This is based on two principles. 1 – Bernoulli's principle says that when speed increases pressure drops. Second, continuity says more area means less speed based on  $A_1v_1 = A_2v_2$   
 So the smallest area would have the largest speed and therefore most pressure drop.
6. [E] Since A and B have the same mass and density, they have the same volume. C has the same volume as A and B since it's the same shape as B. So all three objects have the same volume. When submerged, they will all displace the same amount of water and therefore all have the same buoyant force acting on them. *Note: if the objects were floating instead of submerged than the heavier ones would have larger buoyant forces.*
7. [A] Pascals principle of equal pressure transfer in a fluid allows for hydraulic lifts to function.
8. [C] Pascals principle says  $P_1 = P_2 \quad F_1/A_1 = F_2/A_2 \quad F_2 = F_1A_2 / A_1 = 500(40)/(2)$
9. [D] Buoyant force is equal to weight of displaced fluid. Since the density is constant and the volume displaced is always the same, the buoyant force stays constant
10. [B] The wood is floating and is only partially submerged. It does not displace a weight of water related to its entire volume. The iron however is totally submerged and does displace a weight of water equal to its entire volume. Since the iron displaces more water, it has a larger buoyant force acting on it.