TOPIC
Fluids – Section X – Question 1

QUESTION
A boat floating on a lake (density of water $= 62.4 \text{ lb/ft}^3$) displaces 125cu-ft of water. The mass of the boat in tons most nearly is
   (A) 0.26
   (B) 1.4
   (C) 3.9
   (D) 998

HINTS
- Balance the forces in the vertical direction
- Apply Archimedes Principle

SOLUTION
Since the boat is floating, the buoyant force is equal to the weight of the boat. According to Archimedes Principle, the buoyant force on a floating object is equal to the weight of water displaced. Thus

$$\text{Mg} = V\rho g$$

where
   M is the mass of the boat,
   V is the volume of water displaced, and
   ρ is the density of water.
The acceleration due to gravity g cancels to give

$$M = V\rho$$
$$M = 125 \text{ ft}^3 \times 62.4 \text{lb/ft}^3 \times 1\text{ton}/2000\text{lb}$$
$$= 3.9 \text{ tons}$$

ANSWER
(C)

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