NEXT-TIME QUESTION

Buoyant force is greater on an empty ship when it is

a) floating on the surface.

b) capsized and sitting on the bottom.

c) Same either way.

Buoyant force is greater on a submarine when it is

d) floating.

e) submerged.

f) Same either way.

NEXT-TIME QUESTION

Buoyant force is greater on a ship when it

a) floating on the surface.
b) capsized and sitting on the bottom.
c) Same either way.

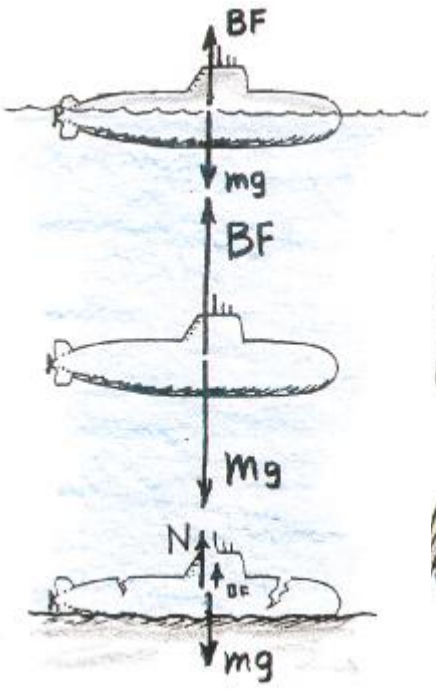
Buoyant force is greater on a submarine when it is

d) floating.
e) submerged.
f) Same either way.

Answers: a and e

When the barge is floating, buoyant force (*BF*) equals the weight of the barge. For the same barge sunk, *BF* is less, for it then displays only the volume of material of which it is made—and that volume of water weighs less than the barge. (Think of an iron block that sinks but can be made to float if fashioned into a boat.)

When a submarine is floating, *BF* equals its weight. And when it hovers while submerged at a fixed depth, *BF* again equals its weight—but a greater weight, due to the water added to its ballast tanks. Hence *BF* is greater for the submerged submarine.



Also think *volume*: A submerged submarine displaces a greater volume of water than when only partially submerged (floating), so *BF* is greater when submerged.

Two forces provide equilibrium for a submarine, whether floating or submerged — *mg* and *BF*. And when any sunken vessel rests on the ocean bottom, a third force acts — a normal force of support by the ocean floor. So *BF* on a sunken vessel is less than its weight because it displays water only equal to the volume of its material.

Hewitt Drew-it!

CONCEPTUAL Physics