Archimedes Principle

An object floating or submerged in a fluid is buoyed up by a force equal to the weight of the fluid displaced

- IT IS WHY SHIPS AND BOATS FLOAT!!

Buoyancy

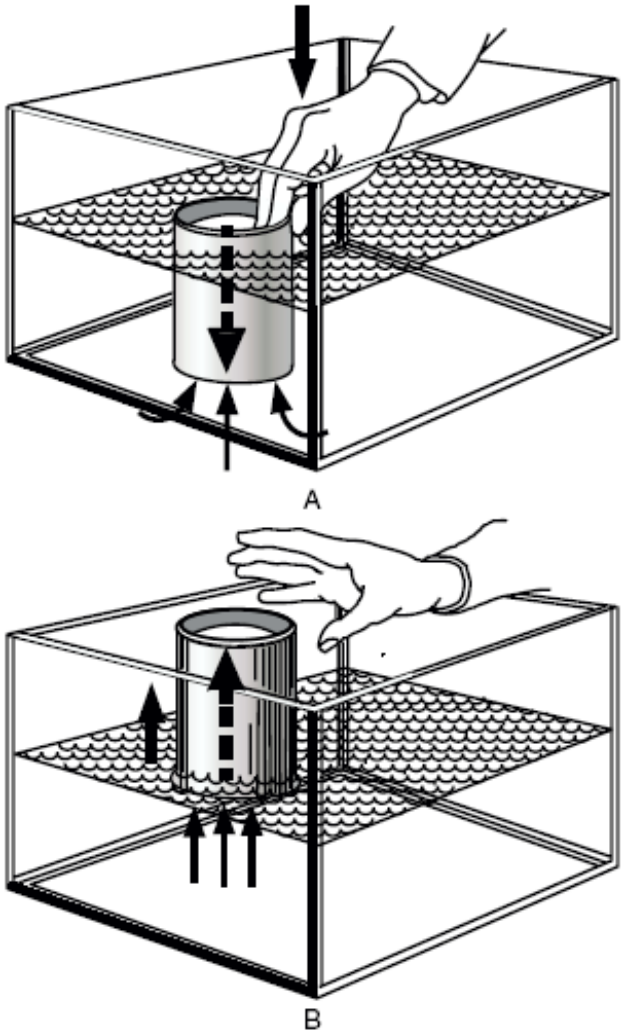
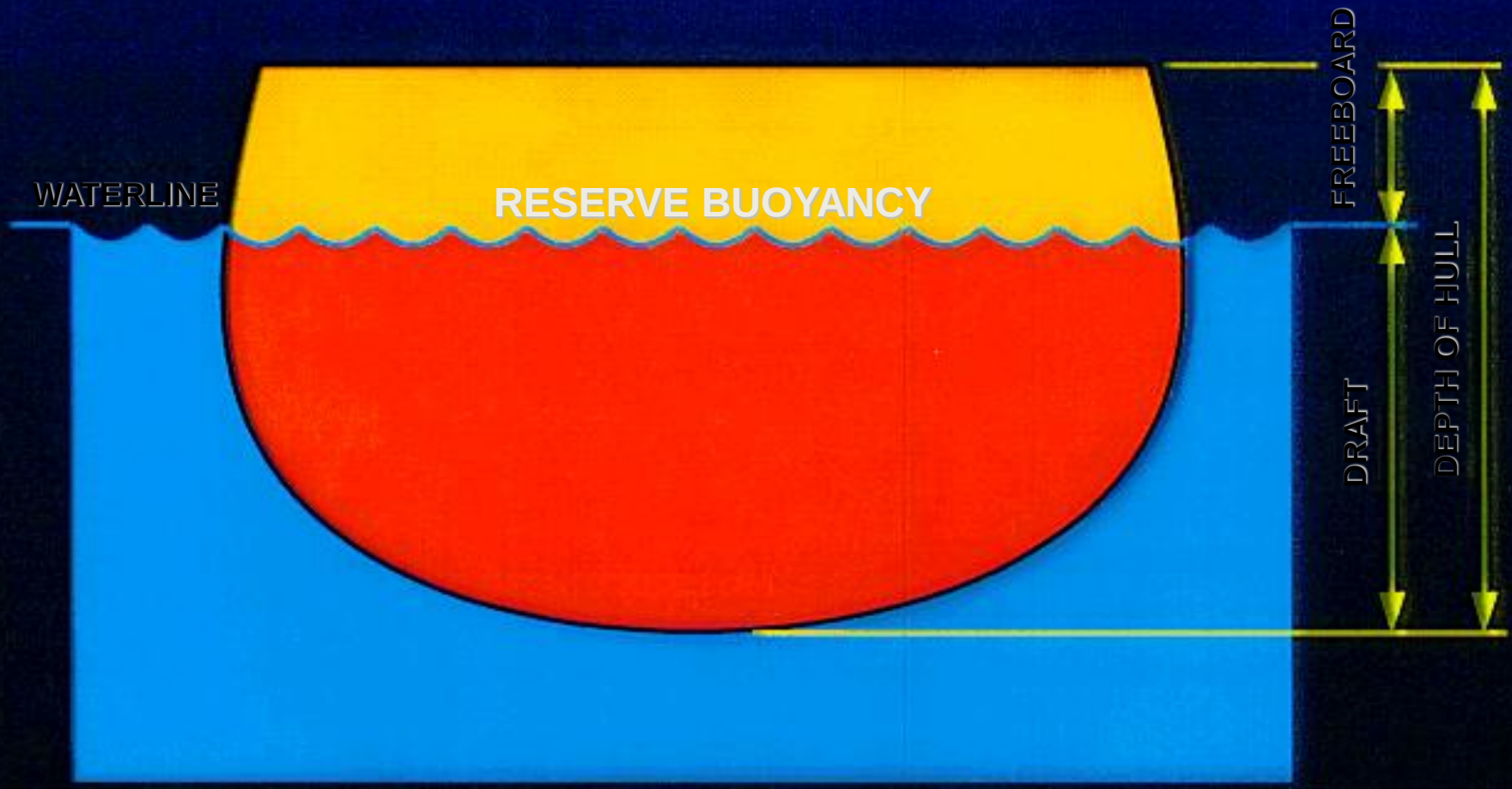


Figure 12-16. A. An immersed container; B. The container



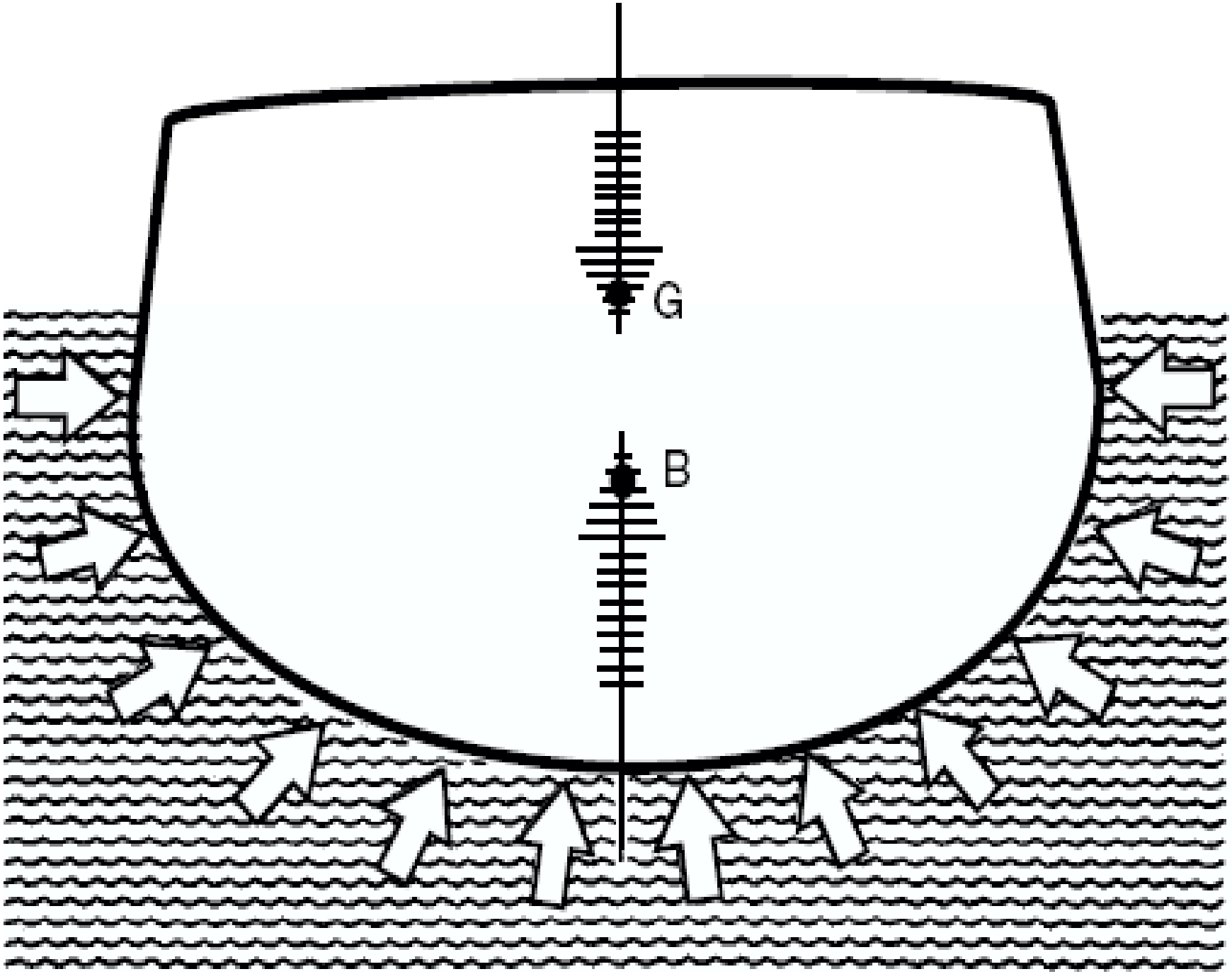
Reserve buoyancy, freeboard, draft, and depth of hull.

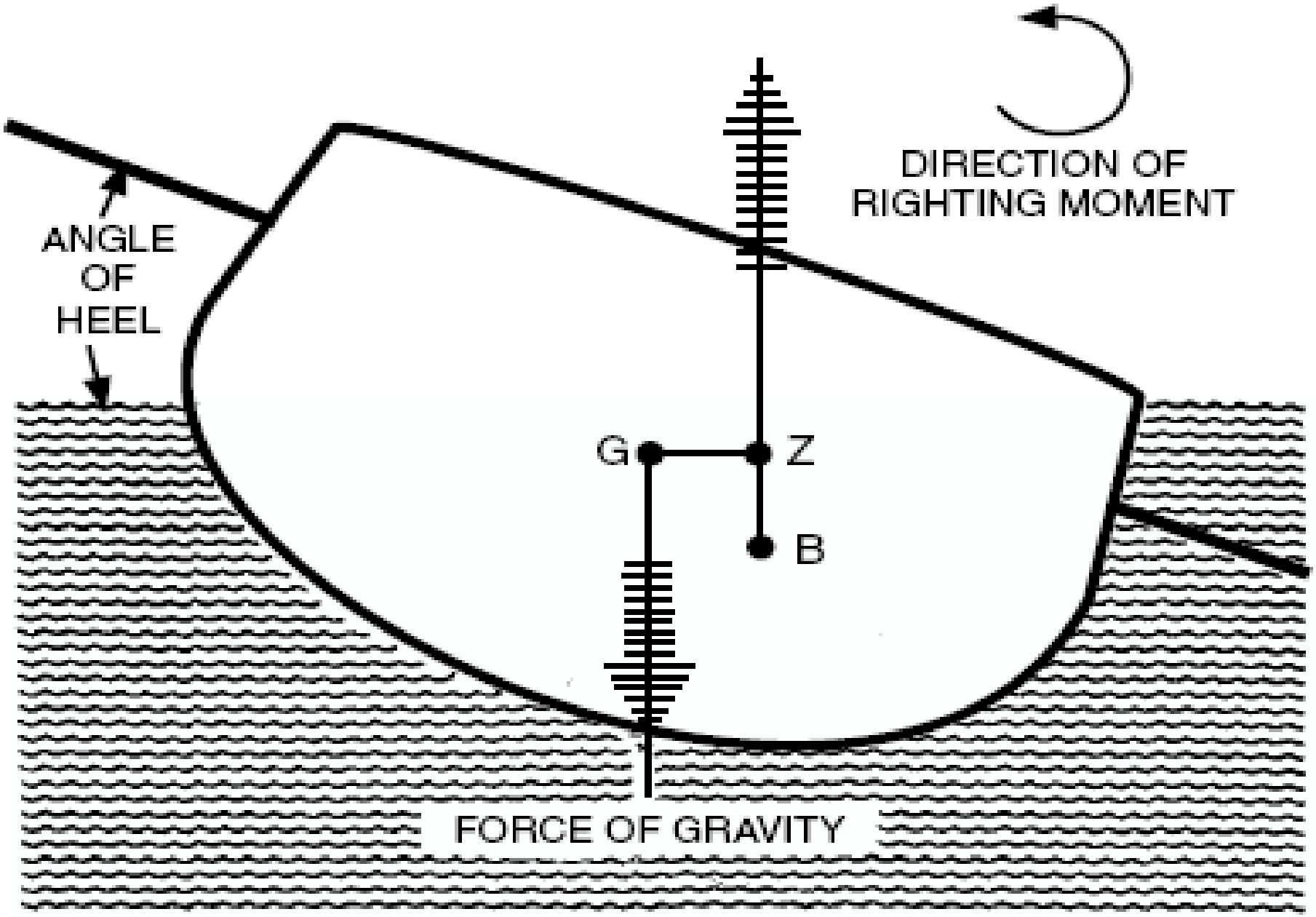
Terms

- Center of Gravity – “G”
  - An imaginary point within the ship through which all gravity can be seen to act
  - A spatially weighted average of smaller, individual weights around the ship
  - Is this fixed or can it move?
- Center of Buoyancy – “B”
  - An imaginary point within the ship through which the buoyant force can be seen to act
  - Is this fixed or can it move?
  - How would you want your “B” to be positioned relative to “G”?

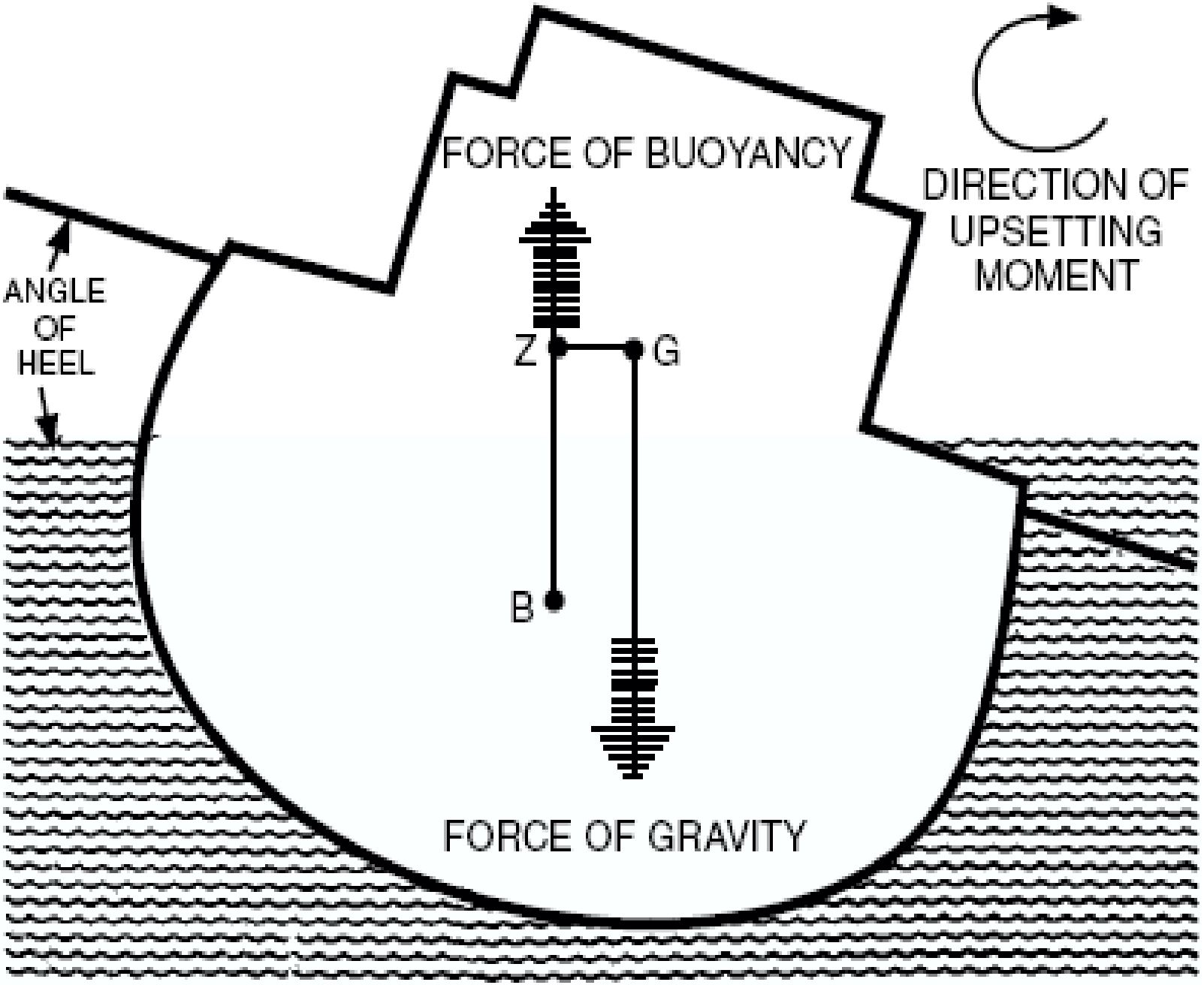
Terms (cont)

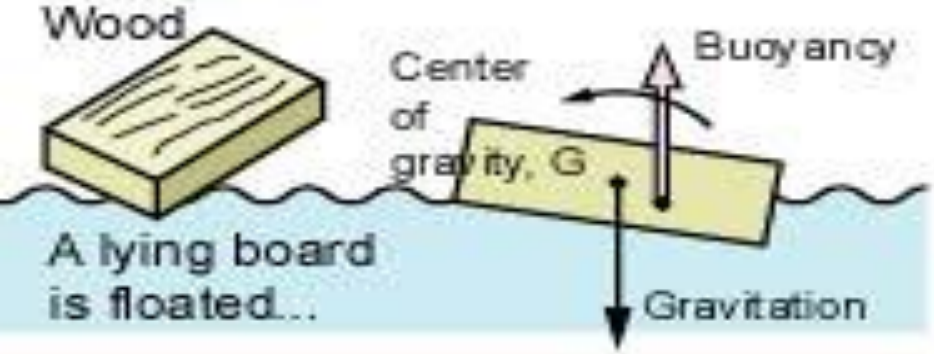
- Metacenter – “M”
  - Intersection of two successive lines of action of the buoyant force as the ship heels through a very small angle
  - What does this tell us?
    - It’s position with respect to “G” (“GM” or metacentric height) gives us an indication of stability
- “Z”
  - A point along the line forming the metacenter that creates a right triangle with “M” & “G”


G
B

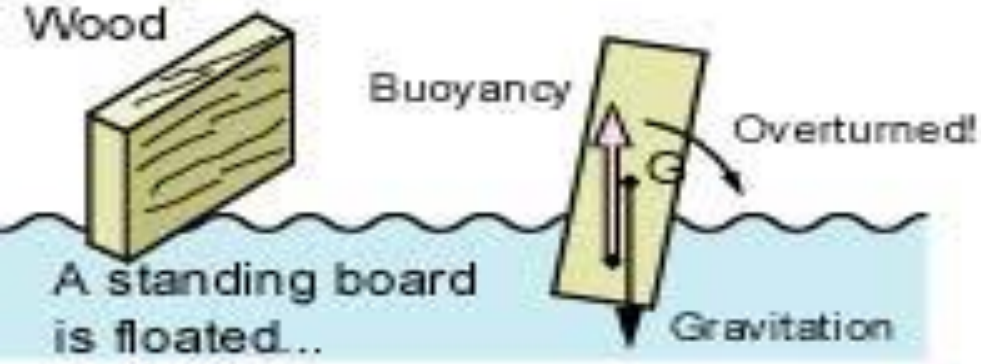

DIRECTION OF
RIGHTING MOMENT
ANGLE
OF
HEEL
G
Z
B
FORCE OF GRAVITY

DCf1220

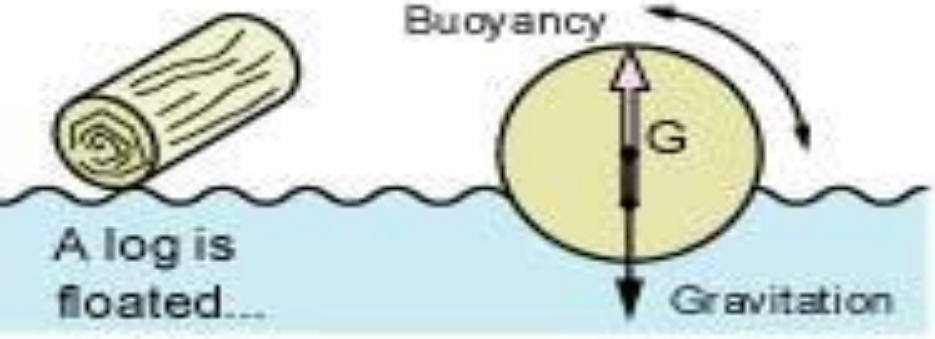

FORCE OF BUOYANCY
DIRECTION OF UPSETTING MOMENT
ANGLE OF HEEL
Z
G
B
FORCE OF GRAVITY
DCf1221



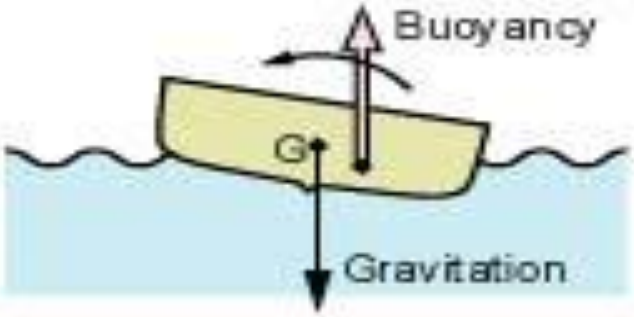
(a) Stable shape



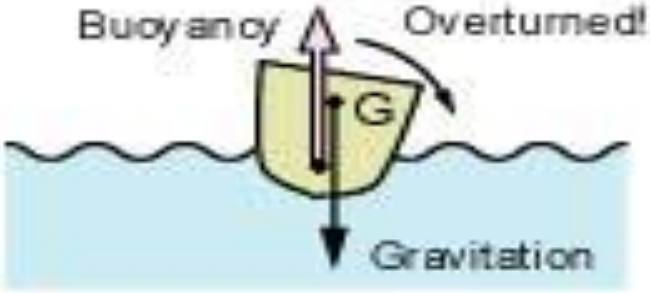
(b) Unstable shape



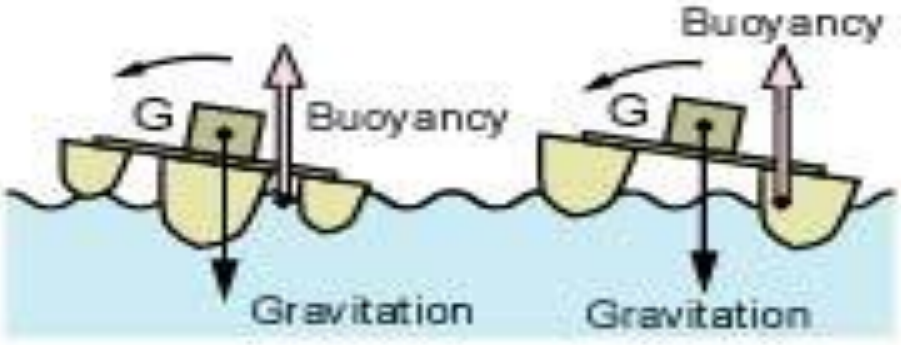
(c) A log is rolling



(d) Wide body and low position of gravity has good stability



(e) Narrow body and high position of gravity has bad unstability



(f) Additional floats help stability