

# Sink or swim?

Help Captain Eco. to develop his new super ship!



Archimedes states  
"An object in a fluid  
experiences an  
upward force equal  
to the weight of the  
fluid *displaced* by  
the object"

What is the object/material you are testing for buoyancy and stability?

Sketch your object: Label the front (bow) back (stern)  
Left hand side (portside) and right hand side (starboard side)

Diagram

What do you think about the... of your object/material

a) Size?

(hint: think about its weight AND its mass. Is it heavy / large?)

b) Volume?

(hint: think about the space it takes up. Does it take up lots of space or very little?)

## Sideline Science...

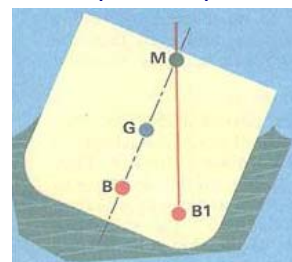
### The science of buoyancy:

If the weight of water displaced by the boat equals the upward force of the water then the boat will float!



### The science of stability:

Ship stability is affected by moments. Moments are forces applied to levers or pivots. In the case of a ship, if a moment is applied beyond its pivot (centre of buoyancy and centre of gravity) the ship will capsize!



Sources of moments on ships include waves, strong winds, moving cargo and liquids moving inside the ship itself such as ballast water.

**c) Density?**

(hint: think about how close together the particles are likely to be in the object? Is it hollow or solid?)

**d) Centre of gravity**

(hint: think about its stability)

**e) Centre of buoyancy**

(hint: think about which way round it is likely to float)



**Captain Eco.**

**1 – Sink or swim?**

**Do you think your object will sink or swim based on what you have just written?**

(tick one box)

**Sink**       **Swim**

**If you think it will swim (float) which way up will it float?**

(hint: this is looking at your objects stability)

**Approximate how much of the object do you think may be under water?**

(hint: this is looking at your objects buoyancy)

**The experiment**

**Place your object into a tray of water.**

**Does it:**

**Sink**       **Swim**

If it floats, which way up does it float?

How much of the ship approximately is underwater?

## 2 – Testing moments

What happens when you roll your floating object to approximately a... angle and then let it go? (rights means stay the right way up, capsizes means turns on its side or upside down)

a) 45°

Rights  Capsizes

b) 90°

Rights  Capsizes

c) 180°

Rights  Capsizes

What does this tell you about the likely stability of your object/material if Captain Eco. were to develop it into a super ship?

(Hint: you want the most stable design, i.e. one that rights itself when dropped at the greatest angle)

### Conclusions

Did the object/material do what you thought it would?

What else do you think you would need to know about the object to let you make better judgements? (Perhaps using some maths from the presentation would help)

Write down the key words that you think are most important to floating ships.