

# **Locomotion: The Aquatic Environment**

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# Outline

- Aquatic Locomotion: Swimming
- Aquatic Locomotion: Rowing, Canoeing & Kayaking



## Aquatic Locomotion: Swimming

# Aquatic Locomotion: Swimming



- Not so different from moving on land
- To push against something in order to move the body from one place to another

# Differences between locomotion in water & land

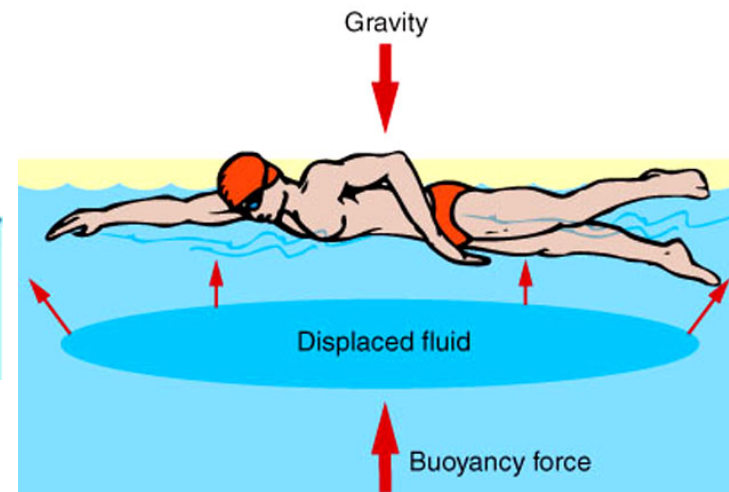
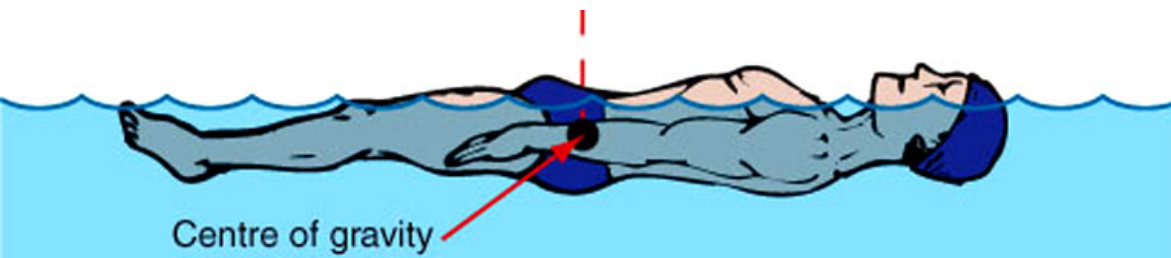
1. Body is concerned with **buoyancy** rather than with the force of gravity in water
2. **Less resistance** to push
3. The medium affords **more resistance to body**
4. Greatest benefits from **buoyancy** & reducing the resistance afforded by water (horizontal rather than vertical)

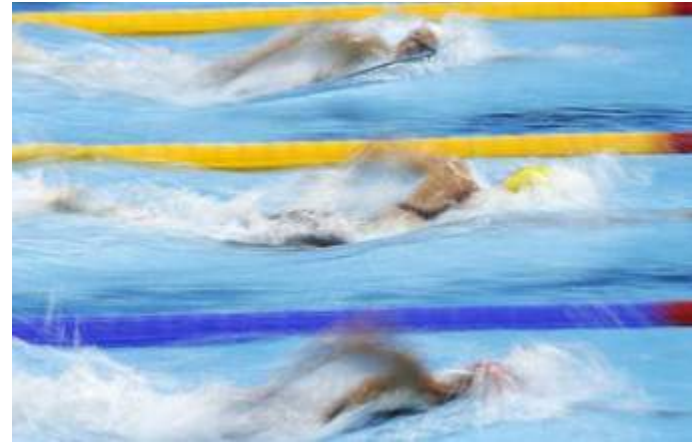


## FLOATATION

- Some people appear to float better in water than others.
- The ability to float — to maintain a stationary position on the surface of the water — varies from one person to another.
- Who can normally float the best? Why?
- Flotation impacts on swimming, survival in water and even our ability to learn to swim.

- Our body floats on water when: the forces created by its weight are matched equally or better by the buoyant force of the water.
- For an object to float, it *needs to displace an amount of water that weighs more than itself*.
- Conversely, if the object displaces a quantity of water that weighs less than itself, it sinks. Hence, wearing a personal flotation device (PFD) increases buoyancy because its size displaces a lot of water with only a minimal increase in weight.





## **Terrestrial locomotion**

- Forces of gravity & air resistance are the forces resisting the progress of the body.

## **Aquatic locomotion**

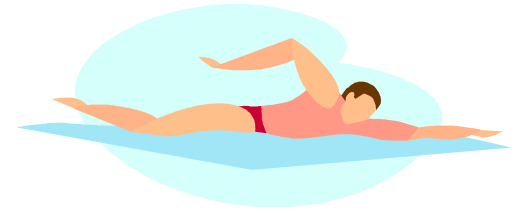
- Water is both supporting medium & source of resistance.



# Propulsion of swimmer

- Speed in swimming depends on stroke length & stroke frequency.
- In front crawl, arms are primary source of power
- In breast stroke, legs dominate.
- Propulsive force is increased with improvements in technique & conditioning.

# Propulsion



- In water based activities such as swimming, life saving and canoeing, movement through the water is called propulsion.
- Propulsion in swimming is caused by using the arms and legs as levers.
- In canoeing, propulsion is caused by the paddle or oar pulling/pushing against the water.

# Four different types of water resistance

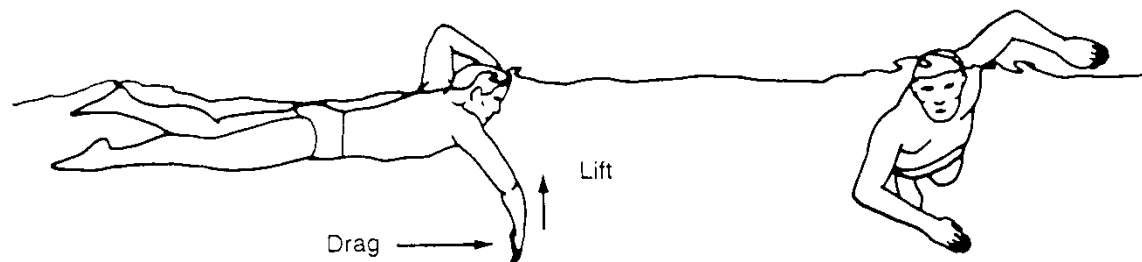
- Form drag
- Surface drag
- Wave drag
- Turbulence behind the body

# Michael Phelps



# Mechanical principles applied to Swimming

1. **Less force** is needed to keep an object moving than to overcome its inertia.
2. Body will move in the **opposite direction** from that in which the forces applied.
3. Forward motion in swimming is produced through a combination of **drag force & lift force**.



## Mechanical principles applied to Swimming(Contd.)

4. Maximum force is attained by presenting **as broad a surface as possible** in the propulsive movements of limbs & **by exerting a backward pressure** through as great a distance as possible, provided undesirable forces are not inadvertently introduced.



## Mechanical principles applied to Swimming(Contd.)

5. **Momentum** may be transferred from one body or part to another body or part as momentum is conserved.
6. The **height od body position** in water depends upon the swimmer's buoyancy & speed of moving through the water.
7. When a body is free in a fluid, movement of a part in one direction results in movement of the rest of the body in the **opposite direction**.

## Mechanical principles applied to Swimming(Contd.)

8. A rapidly moving body in the water leaves a low pressure area immediately behind it.
9. The more streamlined the body, the less the resistance to progress through the water.
10. The drag on a body in any fluid increases approximately with the square of the velocity.



## Mechanical principles applied to Swimming(Contd.)

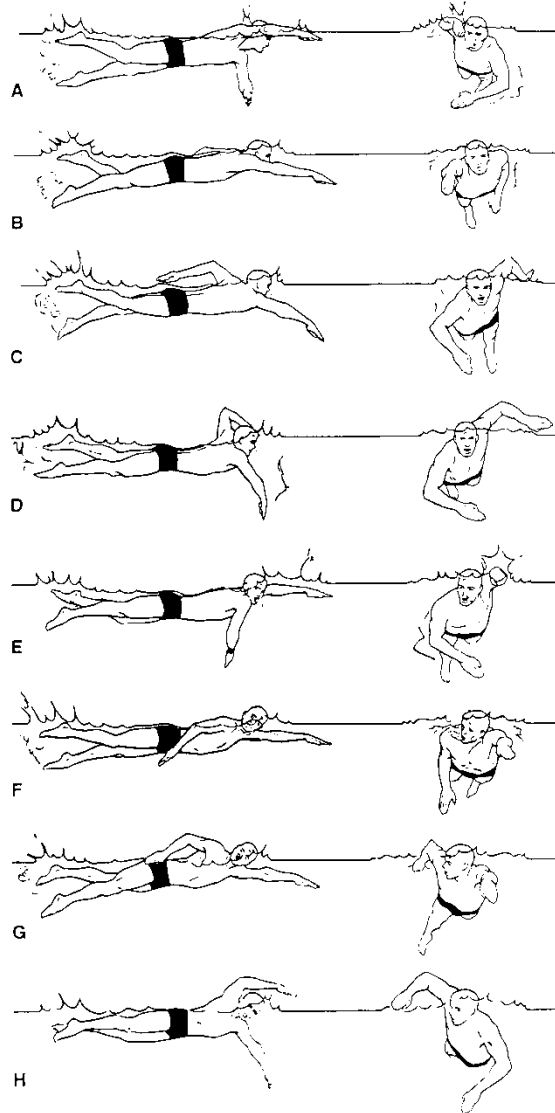
11. The sudden or quick movement of a swimmer's body, or one of its parts, at the surface of the water tends to cause **whirls and eddies**.

# Example

## The Sprint Crawl

- **The head & trunk**
- **The arm stroke**
  - Entry & support
  - Catch, pull & push
  - Brief anatomical analysis of propulsive phase of arm stroke
  - Release & recovery
  - Brief anatomical analysis of recovery phase of arm stroke
- **The kick**
  - Nature of movement
  - Downstroke
  - Brief anatomical analysis of downstroke
  - Upstroke
  - Brief anatomical analysis of upstroke

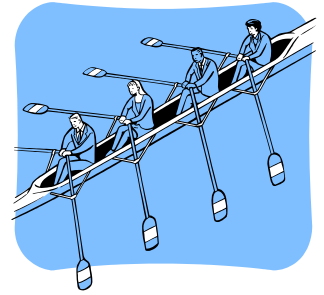
# The Crawl Stroke





# **Aquatic Locomotion: Rowing, Canoeing & Kayaking**

# Rowing



- Much of the propulsive force is generated **by legs**.
- Two phases
  - Pull phase
  - Recovery phase
- Oars are held by an **oarlock**.
- Oarlock provides **axis of rotation**.
- Rowers row with their **back** to the direction of forward motion.

# Rowing



# Canoeing

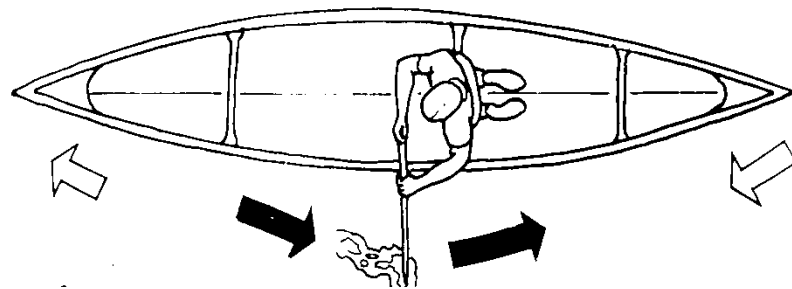
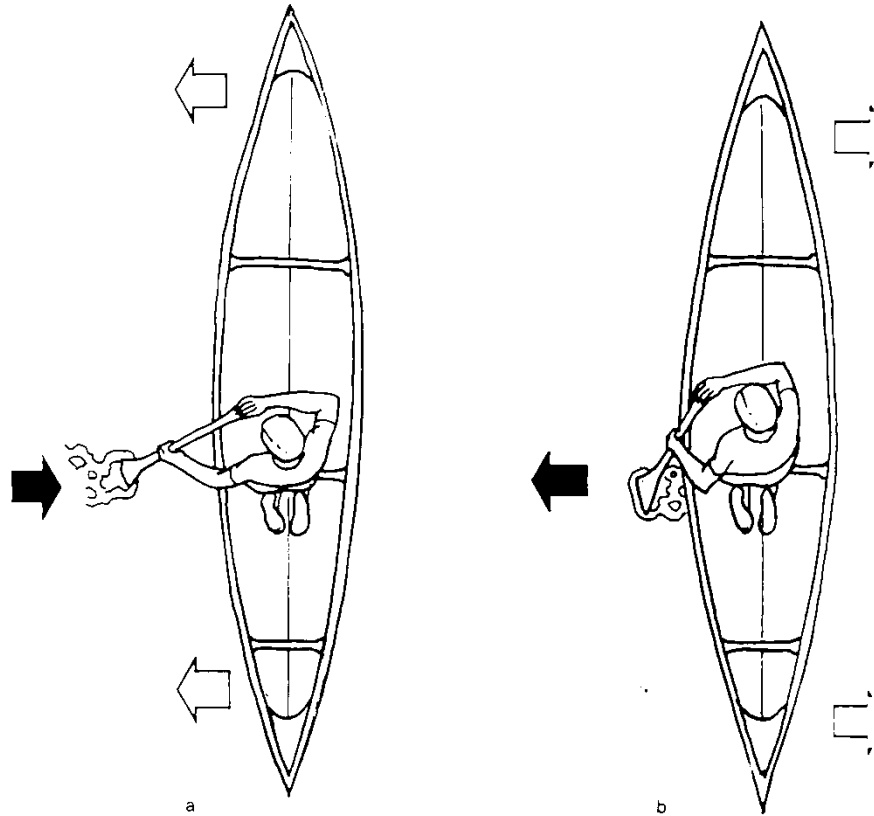
- Paddle is held in both hands, free of external support.
- Paddler in a canoe faces in the direction of canoe motion.
- Avoid too much force for movement of canoe

# Canoeing





# Movement in a canoe



# Kayaking

- Kayak rides lower in the water than either the rowboat or the canoe
- **Has covered decks** rather than open hull
- Often used in rough water such as oceans & whitewater rivers
- **Double bladed paddle**
- Kayaker strokes **on both sides** of the boat in a cyclic fashion.

# Kayaking



# Review

- Aquatic Locomotion: Swimming
- Aquatic Locomotion: Rowing, Canoeing & Kayaking

# Questions

**Thank you**