

4. Boats and Streams

Time, Speed & Distance — Study Notes (Part 4 of 6)

Effective Speed

When two forces act on the same moving object — like a boat's engine and a river's current — the result is called effective speed. This idea also applies to a person walking on an escalator or running inside a moving train.

Upstream (against the current)

$$\text{Upstream Speed} = \text{Speed of Boat} - \text{Speed of Stream}$$

Example 1

Speed of boat = 6 km/hr, Speed of stream = 4 km/hr.

Upstream (effective) speed = $6 - 4 = 2$ km/hr

Downstream (with the current)

$$\text{Downstream Speed} = \text{Speed of Boat} + \text{Speed of Stream}$$

Example 2

Speed of boat = 6 km/hr, Speed of stream = 4 km/hr.

Downstream (effective) speed = $6 + 4 = 10$ km/hr

💡 If you're given downstream speed ($u+v$) and upstream speed ($u-v$), the boat's still-water speed u is their AVERAGE, and the stream's speed v is HALF their difference.

Worked Examples

Example 3

Speed of boat = 13 km/hr, speed of stream = 4 km/hr. How long to cover 68 km downstream?

Effective (downstream) speed = $13 + 4 = 17$ km/hr

Time = $68 / 17 = 4$ hrs

Example 4

A boat covers 40 km downstream in 5 hrs, and 30 km upstream in 6 hrs. Find the boat's speed in still water and the stream's speed.

Downstream speed = $40/5 = 8$ km/hr. Upstream speed = $30/6 = 5$ km/hr.

Boat's speed = $(8+5)/2 = 6.5$ km/hr. Stream's speed = $(8-5)/2 = 1.5$ km/hr

Practice Questions

1. A boat covers 42 km downstream in 7 hours and 60 km upstream in 12 hours. Find the speed of the boat in still water.
2. A boat's downstream speed is 14 km/hr and its upstream speed is 9 km/hr. Find the speed of the stream.
3. A boat's speed in still water is 16 km/hr and the stream's speed is 8 km/hr. The boat travels from A to an island and back in 5 hours total. Find the distance between A and the island.
4. In still water, a man's rate is 3 times the rate of the current. His downstream speed is twice his upstream speed. If his still-water speed is 6 km/hr, find the speed of the current.

✓ Answer Key

1. 5.5 km/hr
2. 2.5 km/hr
3. 30 km
4. 2 km/hr