23GET276 - VQAR-II

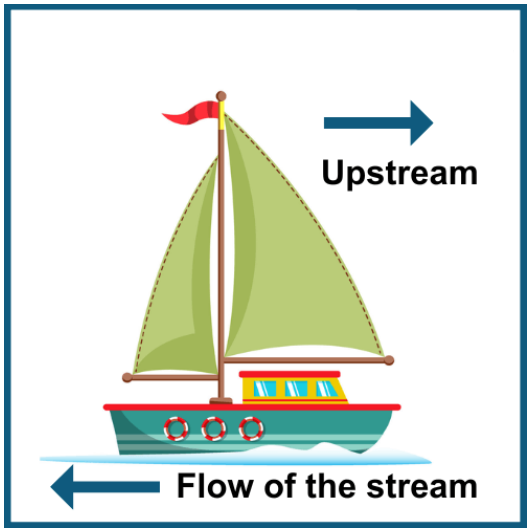
UNIT I - QUANTITATIVE ABILITY III

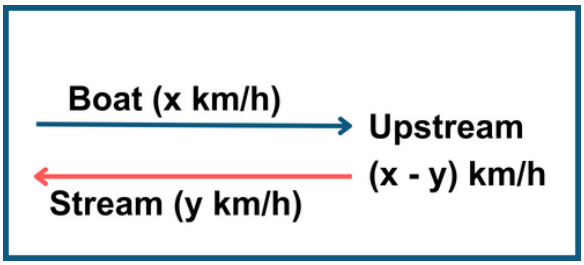
Terms Related to Boats and Streams

Stream: The term "stream" is used to describe the continuous movement of water in a river.

There are two types:-

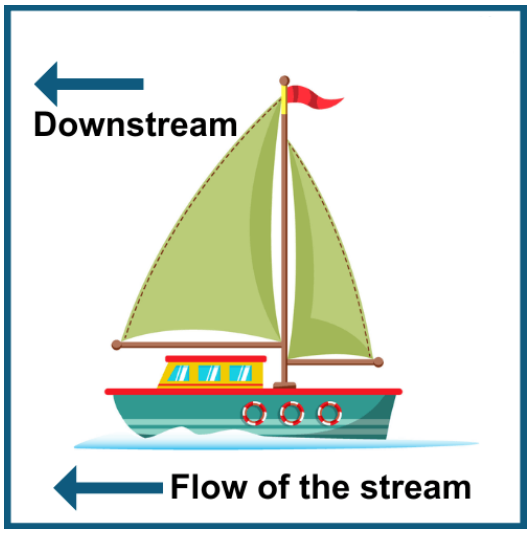
1. Upstream: When a boat or object is moving against the direction of the stream or current, it is said to be moving upstream.

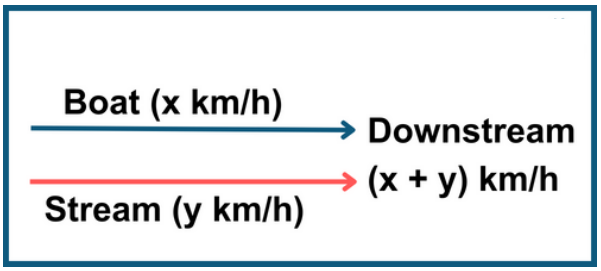




In this case, the speed of the stream is subtracted from the speed of the boat to determine the effective speed of the boat against the current.

2. Downstream: When a boat or object is moving in the same direction as the stream or current, it is moving downstream.





In this case, the speed of the stream is added to the speed of the boat to determine the effective speed of the boat with the current.

Still water: In this particular situation, the stream is treated as immobile and its speed is considered to be zero.

Formulas of Boats and Streams

1. Upstream Formula

Upstream: (x – y) km/h

where “x” is the speed of the boat in still water and “y” is the speed of the stream.

2. Downstream Formula

Downstream: (x + y) km/h

where “x” is the speed of the boat in still water and “y” is the speed of the stream.

3. Speed of Boat in Still Water

Speed of Boat in Still Water

$$= \frac{1}{2}(\text{Downstream Speed} + \text{Upstream Speed})$$

4. Speed of Stream

Speed of Stream

$$= \frac{1}{2}(\text{Downstream Speed} - \text{Upstream Speed})$$

5. Average Speed of Boat

$$\text{Average Speed of Boat} = \frac{\text{(Downstream Speed x Upstream Speed)}}{\text{Boat's Speed in Still Water}}$$

6. The formula for calculating the time taken when moving upstream is:

$$\text{Time} = \frac{D}{(x - y)}$$

where "D" is distance and "x" is the speed of the boat in still water and "y" is the speed of the stream.

7. The formula for calculating the time taken when moving downstream is:

$$\text{Time} = \frac{D}{(x + y)}$$

where "D" is distance and "x" is the speed of the boat in still water and "y" is the speed of the stream.

8. If it takes "t" hours for a boat to reach a point in still water and comes back to the same point then, the formula for the distance will be:

$$\text{Distance} = \frac{\{(x^2 - y^2) * t\}}{2x}$$

where "x" is the speed of the boat in still water and "y" is the speed of the stream.

9. If it takes "t" hours more to go to a point upstream than downstream for the same distance, the distance formula will be:

$$\text{Distance} = \frac{\{(x^2 - y^2) * t\}}{2y}$$

where "x" is the speed of the boat in still water and "y" is the speed of the stream.

10. If a boat travels a distance downstream in "t1" hours and returns the same distance upstream in "t2" hours, then the speed of the man in still water will be:

Speed of Man in Still Water

$$= \left[y \times \left\{ \left(\frac{(t_2 + t_1)}{(t_2 - t_1)} \right) \right\} \right] \text{km/h}$$

Where "y" is the speed of the stream

How to Solve Problems Based on Boats and Streams?

To solve boat and stream questions, you can follow these general steps:

a. **Understand the given information:** Read the problem carefully and identify the given information such as the speed of the boat, speed of the stream, distance to be covered, and any other relevant details.

b. **Determine the direction:** Determine whether the boat is moving upstream (against the stream) or downstream (with the stream). This will help you identify the relative speeds.

c. **Calculate the effective speed:** For upstream movement, subtract the speed of the stream from the speed of the boat to obtain the effective speed. For downstream movement, add the speed of the stream to the speed of the boat.

d. **Calculate time or distance:** Depending on the information given in the problem, you may need to calculate either the time taken to cover a certain distance or the distance covered in a given time. Use the appropriate formula based on the given information.

e. **Apply relevant formulas:** Use the appropriate formulas, such as time = distance/speed or distance = speed × time, depending on the specific problem requirements.

f. **Solve the equation:** Substitute the known values into the formulas and solve the equation to find the unknown variable (time or distance).

1. A boat can travel 60 km downstream in 5 hours and can cover the same distance upstream in 10 hours. What is the speed of the boat in still water?

a) 9 km/h
b) 15 km/h
c) 12 km/h
d) 20 km/h

Answer: a) 9 km/h

Explanation: Let the speed of the boat be x km/h. The speed of the stream is given by the formula:

Speed of boat in still water = (Speed downstream + Speed upstream)/2.
So, (60/5 + 60/10)/2
= (12 + 6)/2
= 18/2
= 9 km/h.

Therefore, the speed of the boat in still water is 9 km/h.

2. A boat takes 4 hours to travel 24 km upstream and 3 hours to travel 36 km downstream. What is the speed of the stream?

a) 2 km/h
b) 3 km/h
c) 4 km/h
d) 5 km/h

Answer: b) 3 km/h

Explanation: Let the speed of the boat be x km/h. The speed of the stream is given by the formula:

Speed of stream = (Speed downstream - Speed upstream)/2.
So, (36/3 - 24/4)/2 = (12 - 6)/2 = 6/2 = 3 km/h.

Therefore, the speed of the stream is 3 km/h.

3. A boat travels 90 km downstream in 6 hours. What is the speed of the boat in still water if the speed of the stream is 5 km/h?

a) 5 km/h
b) 10 km/h
c) 15 km/h
d) 20 km/h

Answer: b) 10 km/h

Explanation: Let the speed of the boat be x km/h. The speed of the stream is given as 5 km/h. The speed downstream is (x + 5) km/h,

From the given information,

90 / (x + 5) = 6

Solving this equation, we get x = 10 km/h.

4. A boat covers a certain distance upstream in 5 hours, while it takes 3 hours to cover the same distance downstream. If the speed of the boat in still water is 12 km/h, what is the speed of the stream?

a) 12 km/h
b) 5 km/h
c) 3 km/h
d) 2 km/h

Answer: c) 3 km/h

Explanation: Let the speed of the stream be y km/h. The speed downstream is (12 + y) km/h, and the speed upstream is (12 - y) km/h.
From the given information, we can write two equations:

Distance / (12 + y) = 3 and Distance / (12 - y) = 5.

Dividing these equations, we get (12 - y) / (12 + y) = 3/5.

Solving this equation, we get y = 3 km/h.

5. A boat can travel at a speed of 14 km/h in still water. If the speed of the stream is 4 km/h, find the time taken by the boat to go 72 km downstream.

a) 5 hours
b) 4 hours
c) 3 hours
d) 2 hours

Answer: b) 4 hours.

Explanation: The boat's speed in still water is 14 km/h, and the speed of the stream is 4 km/h. When going downstream,
Effective speed downstream = Speed of boat in still water + Speed of stream
= 14 km/h + 4 km/h
= 18 km/h

Now, we can use the formula Time = Distance / Speed

Time is taken in downstream = 72 km / 18 km/h
= 4 hours

Practice Problems

1. A boat travels downstream at a speed of 20 km/h and upstream at a speed of 15 km/h. If the distance of the upstream journey is 45 km and the downstream journey is 80 km, what is the total time taken for the round trip?

a) 5 hours
b) 6 hours
c) 7 hours
d) 8 hours

Answer: c) 7 hours.

2. If the speed of the stream is 5 km/h, and the boat can travel at a speed of 30 km/h in still water, what is the boat's speed when travelling downstream?

a) 35 km/h
b) 25 km/h
c) 30 km/h
d) 20 km/h

Answer: a) 35 km/h.

3. A boat travels downstream for 15 km in one hour. The return journey upstream takes two hours. What is the speed of the stream?

a) 1.5 km/h
b) 2.45 km/h
c) 3.75 km/h
d) 4.15 km/h

Answer: c) 3.75 km/h.

4. If a boat travels 60 km upstream in 6 hours, and the speed of the boat in still water is 15 km/h while the speed of the stream is 5 km/h, how much time will it take for the boat to travel the same distance downstream?

a) 1 hour
b) 3 hours
c) 5 hours
d) 7 hours

Answer: b) 3 hours.

5. A boat can travel 120 km downstream in 4 hours. If the speed of the stream is 15 km/h, what is the speed of the boat in still water?

a) 15 km/h
b) 22 km/h
c) 25 km/h
d) 30 km/h

Answer: a) 15 Km/h

6. A boat takes 8 hours to travel 96 km downstream and 12 hours to travel the same distance upstream. What is the speed of the stream?

a) 4 km/h
b) 3 km/h
c) 2 km/h
d) 1 km/h

Answer: c) 2 km/h

7. A boat takes 2 hours to travel 50 km downstream and 10 hours to travel the same distance upstream. What is the speed of the stream if the speed of the boat in still water is 15 km/h?

a) 5 km/h
b) 7 km/h
c) 8 km/h
d) 10 km/h

Answer: d) 10 km/h

8. A boat covers 72 km downstream in 3 hours. If the speed of the boat in still water is 18 km/h, what is the speed of the stream?

a) 2 km/h
b) 4 km/h
c) 6 km/h
d) 8 km/h

Answer: c) 6 km/h

9. A motorboat, whose speed is 15 km/h in still water goes 84 km downstream and comes back in a total of 4 hours. What is the speed of the stream (in km/h)?

a) 5 hours
b) 6 hours
c) 7 hours
d) 8 hours

Answer: b) 6 hours.

10. A man has a speed of 15 km/hr with the current, and the speed of the current is 2.5 km/hr. What is the man's speed against the current?

a) 10 km/h
b) 15 km/h
c) 20 km/h
d) 25 km/h

Answer: a) 10 km/h