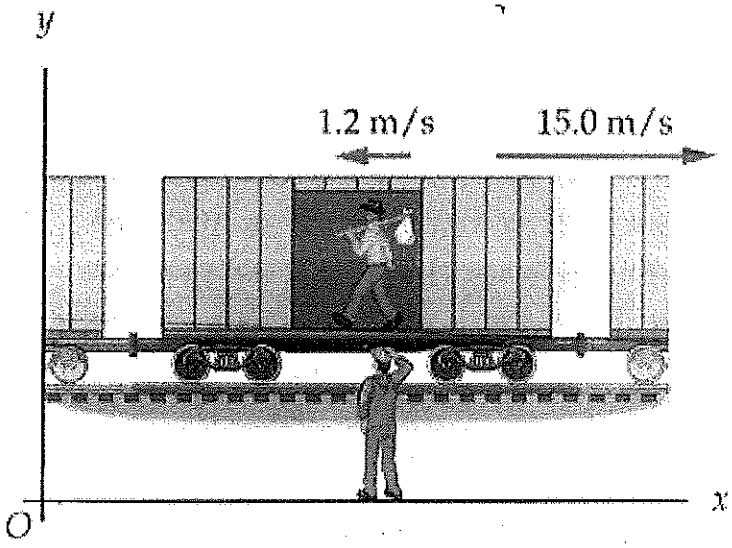
Question:

A hobo is walking in a train car at 1.2 m/s to the left relative to the car while the train moves at a velocity of 15.0 m/s to the right relative to the Earth. What is the velocity of a railroad worker relative to the hobo if the worker is stationary on the Earth?

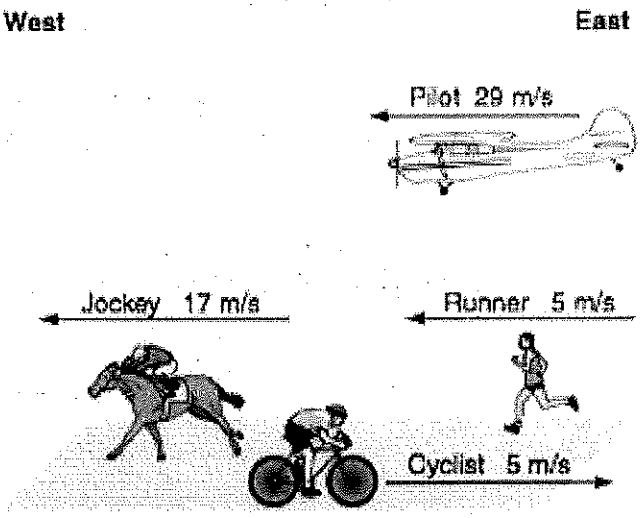


Answer:

13.8 m/s Left

Question:

Consider the velocities of the objects shown in the figure below. The velocities given are those relative to the Earth.



Determine:

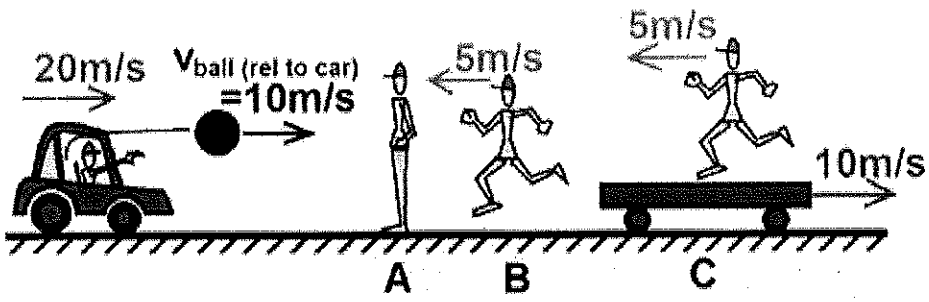
1. **the Jockey's velocity relative to the Pilot.**
2. **the Runner's velocity relative to the Jockey.**
3. **the Jockey's velocity relative to the Cyclist.**

Answer:

1. **12 m/s East**
2. **12 m/s East**
3. **22 m/s West**

Question:

In the figure below, the relative motion of several objects and their relative velocities are shown. Applying the correct concepts and principles, determine the velocity of the ball relative to persons **A**, **B** and **C**.



$V_{ball\ (relative\ to\ A)} = ?$

$V_{ball\ (relative\ to\ B)} = ?$

$V_{ball\ (relative\ to\ C)} = ?$

Answer:

$V_{ball\ (relative\ to\ A)} = +30\ m/s$

$V_{ball\ (relative\ to\ B)} = +35\ m/s$

$V_{ball\ (relative\ to\ C)} = +25\ m/s$

Question:

Imagine that you're a passenger in the back seat of a car moving at constant speed along a straight road. You toss a ball straight up.

1. **What direction does the ball seem to move**
   a) **as seen from your viewpoint riding in the car?**
   b) **to an observer at rest on the sidewalk?**

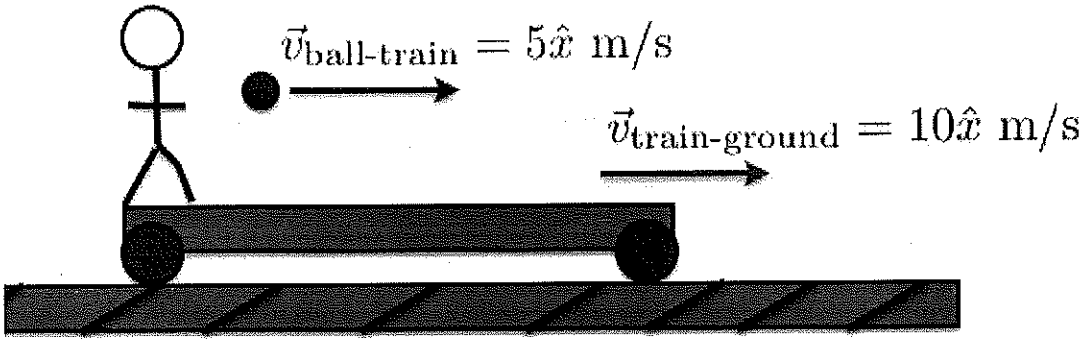
   For each of the cases above, explain your reasoning and draw a diagram that supports your analysis.

Answer

a) **As seen from the passenger in the car (car's frame of reference), the ball will move in a linear path (move in a straight line up and straight line down).**
b) **As seen from the observer at rest on the sidewalk (Earth's frame of reference), the ball will move in a curved path with projectile trajectory.**

Question:

Consider the one-dimensional motion situation shown in the figure below. A railroad worker stationary on a flatbed train throws a ball to the right as the train moves along the tracks to the right. A second worker, not shown, is standing on the ground observing the motions.



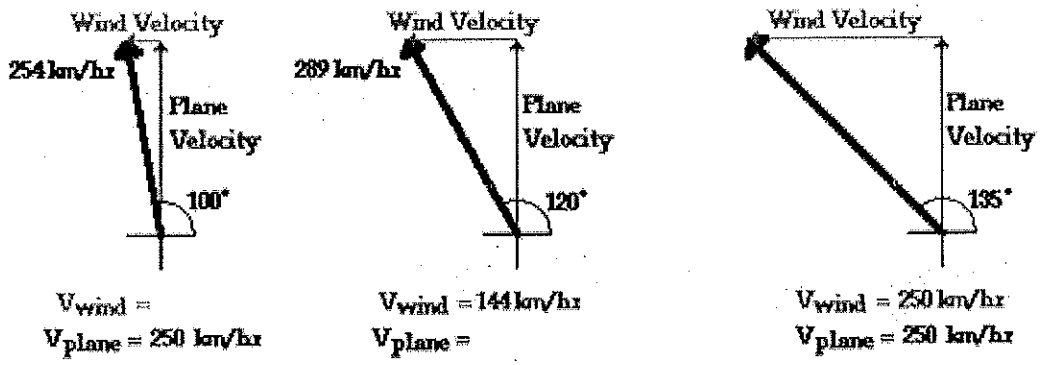
1. **What is the velocity of the ball relative to the second worker who is walking to the right at 7 m/s?**
2. **What would be the velocity of the ball relative to the second worker if the second worker is walking to the left at 6 m/s?**
3. **What would the second worker's velocity have to be in order for the ball to appear at rest relative to him?**

Answer:

1. **8 m/s Right**
2. **21 m/s Right**
3. **15 m/s Right**

Question:

In each of the three examples shown below a plane heads North on a flight to its destination, but the wind blows it off course. In each case, one of the relative velocity vectors is missing. Applying the correct concepts and principles, calculate the missing relative velocity vectors.



V_{wind} =
V_{plane} = 250 km/hr

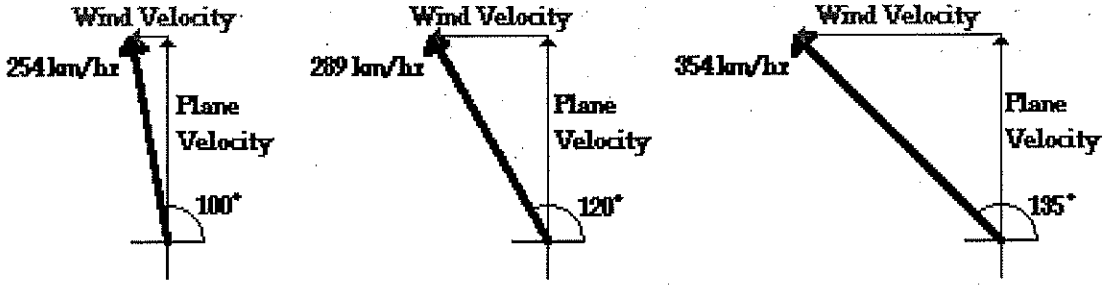
V_{wind} = 144 km/hr
V_{plane} =

V_{wind} = 250 km/hr
V_{plane} = 250 km/hr

The resulting motion of a plane in the presence of a wind is dependent upon the velocity of the crosswind. An alteration of the wind velocity affects the resulting motion but does NOT affect the velocity at which the plane flies northward. Perpendicular components of motion are independent of each other.

Answer:

Apply the Pythagorean theorem or the trigonometric functions to calculate each of the unknown values. The correct values are shown below.



V_{wind} = 44 km/hr
V_{plane} = 250 km/hr

V_{wind} = 144 km/hr
V_{plane} = 250 km/hr

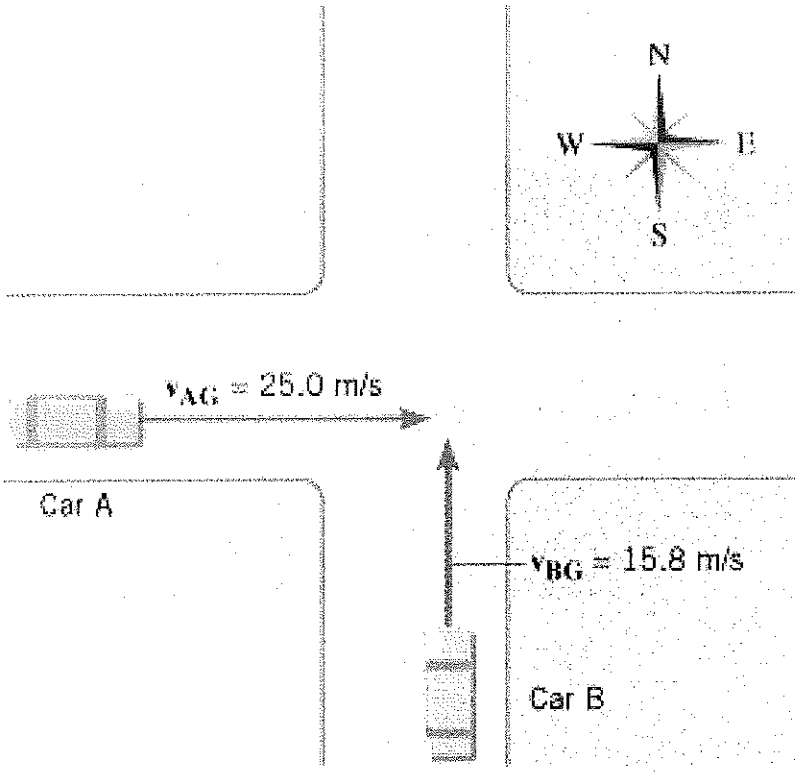
V_{wind} = 250 km/hr
V_{plane} = 250 km/hr

The resulting motion of a plane in the presence of a wind is dependent upon the velocity of the crosswind. An alteration of the wind velocity affects the resulting motion but does NOT affect the velocity at which the plane flies northward. Perpendicular components of motion are independent of each other.

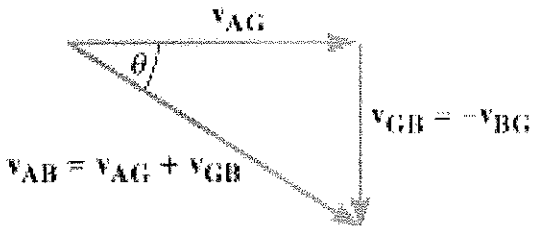
Focus Question

In the situation below, two cars approach an intersection at different speeds.

True or False: The vector diagram to the right shows the correct description of the velocity of Car A relative to Car B.



(a)



(b)

Answer: True

- **The relative velocity is the vector difference between the two velocities.**