

Measurement of Motion Extra Practice Worksheet

Name: _____

Show all your work!

1. An airplane is aiming east at 42m/s , but a wind is blowing from the north at 25m/s . What is the airplane's velocity over the ground?
2. A river flows south at 2.0km/h . A boat that moves at 5.5km/h in still water, wants to cross to the west side. What direction should the boat aim so it travels straight across?
3. An astronaut is travelling at a speed of $0.785c$ relative to Earth. The astronaut's timing device indicates that the trip takes 2.45 years. How long would an observer on Earth see the trip as taking?

4. You are travelling through space at a speed of 2.8×10^8 m/s relative to Earth. If your friend, who stayed back on Earth, aged 15 years during your trip, how many years did you age?
5. An observer on Earth measures a spacecraft's trip to take 6.5 years. On the spacecraft, the timing device only measures 1.2 years. How fast was the spacecraft travelling? (Show your rearrangement of the formula.)
6. A spaceship is travelling at $0.87c$ parallel to a brick wall. If this wall appears to be 103 m long to the astronaut in the spaceship, how long would an observer standing next to the wall see it as?
7. A spacecraft is travelling to Alpha Centauri, which is 4.2 light years away from Earth. The astronauts measure the distance as only 2.1 light years. At what speed must the spacecraft be travelling? (Show your rearrangement of the formula.)

8. What is the length and height of a brick wall as seen by a vehicle moving along the ground at 2.84×10^8 ? The wall was built to be 3.50 m tall and 86.7 m long.
9. How much energy would be produced from a medium sized orange (154g) if there were a way to convert the entire thing into energy?
10. What would the relativistic mass of an electron be if it is moving at 2.9×10^8 m/s?
11. If a proton has a relativistic mass of 2.56×10^{-26} kg, how fast is it moving? (Show your rearrangement of the formula.)

12. What is the rest mass of an object with a relativistic mass of 563 kg if it is travelling at $0.93c$?
13. A spacecraft travelling away from Earth at a velocity of $0.94c$ emits a flash of light. What is the velocity of the light flash as seen by an observer on Earth?
14. A person moving at $0.65c$ away from a stationary observer throws an object backward at a velocity of $0.73c$ (relative to the moving person). What is the velocity of the object with respect to the stationary observer?
15. A person moving at 3.0 m/s away from a stationary observer throws an object forward at a velocity of 2.0 m/s (relative to the moving person). What is the velocity of the object with respect to the stationary observer?