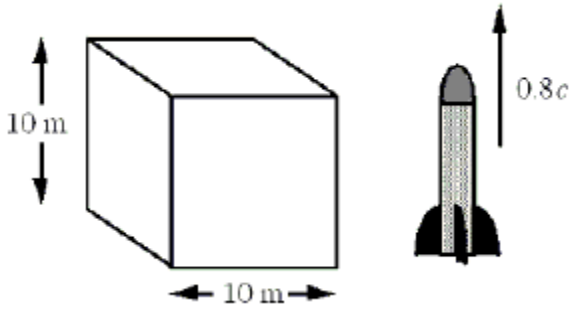
Question 1 2 / 2 points

A cubic asteroid with proper side length 10.0 m is stationary in an inertial reference frame S. A rocket ship moves along one side of the asteroid as shown in the figure with speed 0.80c relative to frame S. An astronaut in the rocket ship measures the volume of the asteroid. What volume does the astronaut measure?



a) 1000 m^3
b) 600 m^3
c) 360 m^3
d) 300 m^3
e) 220 m^3

Question 2 2 / 2 points

The starship *Enterprise* approaches the planet Risa at a speed of 0.8*c* relative to the planet. On the way, it overtakes the intergalactic freighter *Astra*. The relative speed of the two ships as measured by the navigator on the *Enterprise* is 0.5*c*. At what speed is *Astra* approaching the planet?

a) 0.92*c*
b) 0.3*c*
c) 0.6*c*
d) 0.99*c*
e) 0.5*c*

Question 3 2 / 2 points

Mars rotates about its axis once every 88 642 s. A spacecraft comes into the solar system and heads directly toward Mars at a speed of 0.800*c*. What is the rotational period of Mars according to the beings on the spaceship?

a) 53 100 s
b) 88 600 s
c) 181 000 s
d) 148 000 s
e) 105 000 s

Question 4 2 / 2 points

The starship *Enterprise* approaches the Klingon home world with speed 0.6*c* relative to the planet. To announce its arrival, the *Enterprise* sends a message in a projectile that travels toward the planet with

speed 0.4*c* relative to the *Enterprise*. At what speed does a Klingon at the surface of the planet see the projectile approach?

a) 0.2*c*

b) 0.5*c*

c) 0.4*c*

d) 0.8*c*

e) 0.6*c*

Question 5 2 / 2 points

Which one of the following systems would constitute an inertial reference frame?

a) a rocket undergoing uniform acceleration

b) a weather balloon descending at constant velocity

c) a roller coaster traveling around a corkscrew turn at constant speed

d) a rotating merry-go-round

e) an orbiting space station

Question 6 2 / 2 points

A spaceship leaves our solar system at a constant speed of 0.920*c* and travels to a point in the Andromeda galaxy. According to astronomers in an inertial reference frame on Earth, the distance to the galaxy is 2.081×10^{22} m. What distance does the crew on the ship measure on its journey?

a) 8.16×10^{21} m

b) 1.91×10^{22} m

c) 9.07×10^{21} m

d) 4.77×10^{22} m

e) 9.85×10^{21} m

Question 7 2 / 2 points

Spaceship **A** travels at 0.400*c* relative to an earth observer. According to the same observer, spaceship **A** overtakes a slower moving spaceship **B** that moves in the same direction. The captain of **B** sees **A** pass her ship at 0.114*c*. Determine the speed of **B** relative to the earth observer.

a) 0.625*c*

b) 0.100*c*

c) 0.214*c*

d) 0.700*c*

e) 0.300*c*

Question 8 2 / 2 points

Calculate the ratio of the relativistic kinetic energy to the classical kinetic energy, KE_{rel}/KE_{class}, for an electron (mass = 9.109×10^{-31} kg) moving with a constant speed of 0.75*c*.

a) 1.6

b) 1.8

c) 1.4

d) 0.74

e) 0.56

Question 9 2 / 2 points

Which one of the following statements concerning the *proper length* of a meter stick is true?

a) The proper length is always one meter.

b) The proper length depends upon the reference frame in which it is measured.

c) The proper length is the length measured by an observer who is moving with respect to the meter

stick.

d) The proper length depends upon the speed of the observer.

e) The proper length depends upon the acceleration of the observer.

Question 10 2 / 2 points

Complete the following statement: To measure the proper length of an object moving relative to the surface of the earth, one must note the coordinates of points on the front and back ends

a) at the same time with respect to a clock on the moving object.

b) at different times with respect to a clock on the moving object.

c) at the same time with respect to a clock at rest on the earth.

d) at different times with respect to a clock at rest on the earth.

e) at the same time with respect to a clock moving at the same speed on the surface of the earth.