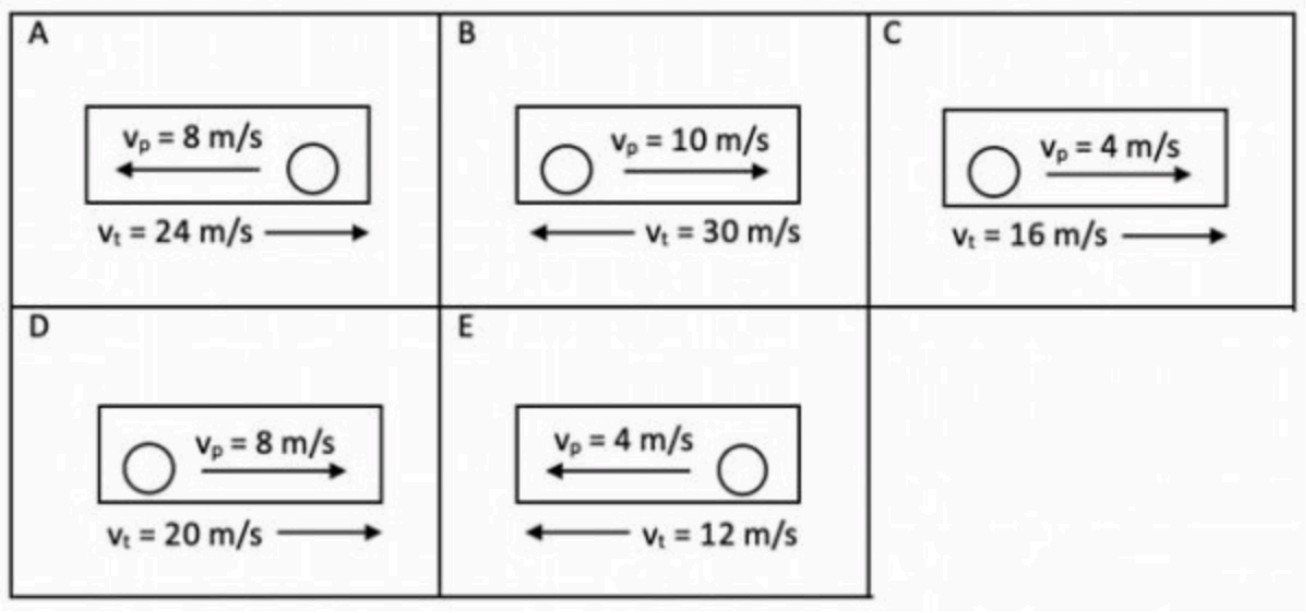
Question 1

10 out of 10 points

The five situations below represent the movement of passengers (circles) on trains (rectangles), with the direction of their speeds indicated by the arrows. The magnitudes are written next to the arrows.



An observer is standing beside the train track watching the train go by.
In which situation would the observer see the passenger moving the fastest?

Selected Answer: D

Correct Answer: D

Question 2

0 out of 10 points

In which situation would the observer see the passenger moving the slowest?

Selected Answer: E

Correct Answer: A

Question 3

10 out of 10 points

in which situations would the observer see the passengers moving at the same speed?

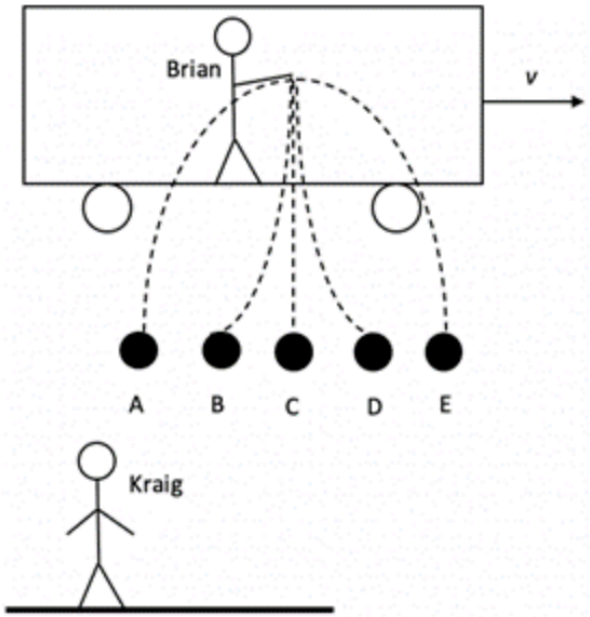
Selected Answer: B & C

Correct Answer: B & C

Question 4

10 out of 10 points

Brian is standing in a train moving at a velocity *v* from left to right relative to Kraig, who is standing on the track outside the train. As Brian passes Kraig, Brian drops a bowling ball out of the train's window:



Ignoring air resistance, what path of the bowling ball would Kraig observe?

Selected Answer: E

Correct Answer: E

Question 1

10 out of 10 points

SN1604 is the remnant of a star that went supernova a long time ago. When a heavy star reaches the end of its lifetime, it collapses, building up the pressure in its core. This causes a big explosion - what we see as a very bright star in the sky. The light of this particular star reached us in 1604 (hence the name).
The star is a distance of 1.88*10^17 km (6.1 kiloparsecs) away from us. When did the supernova occur?

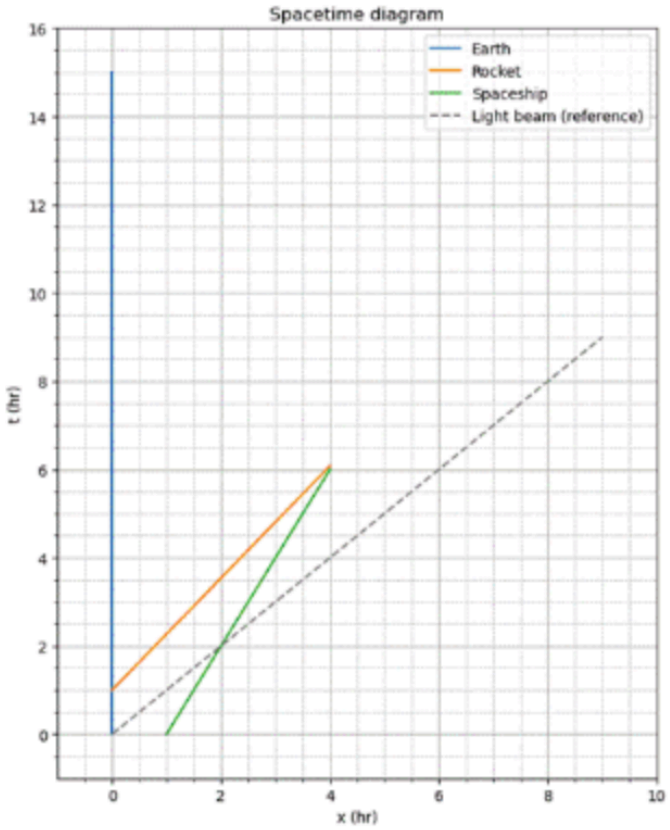
Selected Answer: 18 300 B.C.

Correct Answer: 18 300 B.C.

Question 2

10 out of 10 points

Earth's humans and aliens from a spaceship trade materials near the earth. After a conflict, where the aliens stole some of our finest goods, they try to escape. Their ship leaves at a velocity of ½ in the +x direction. (Assume instant acceleration.) Earth launches a rocket at a velocity of ⅘ in the +x direction to take down the alien ship. What is the coordinate time difference between the rocket exploding and earth receiving the light of the explosion?



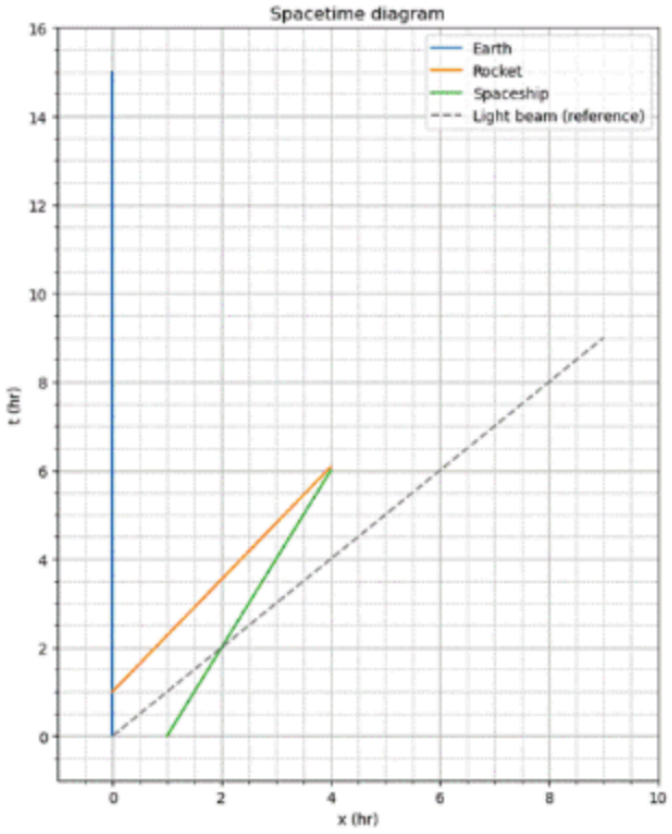
Selected Answer: t= 4 hr

Correct Answer: t= 4 hr

Question 3

10 out of 10 points

Earth's humans and aliens from a spaceship trade materials near the earth. After a conflict, where the aliens stole some of our finest goods, they try to escape. Their ship leaves in the +x direction. (Assume instant acceleration.) Earth launches a rocket to take down the alien ship. What is the velocity difference between the rocket and the spaceship?



Selected Answer: 3/10

Correct Answer: 3/10

Question 4

Hide Course Menu

10 out of 10 points

Using the radar method, we determine the distance from the earth to a comet to be 492 600 km. We shoot a laser at the comet at t=0. At what time do we observe its reflection?

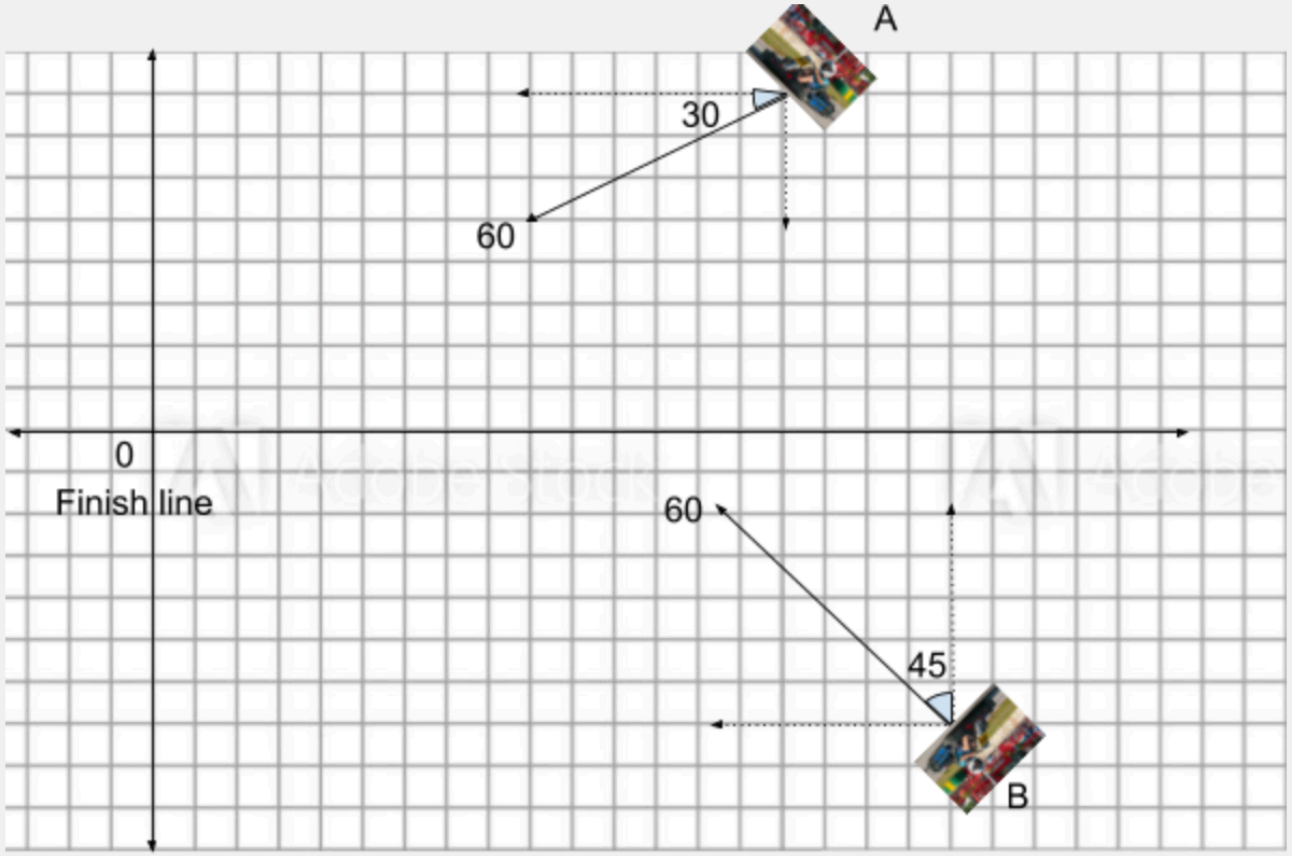
Selected Answer: 3.286 s

Correct Answer: 3.286 s

Question 1

1 out of 1 points

Two siblings are at a go-kart park, out to get each other. Sibling A is driving at 60 km/hr at an angle of 30 degrees south of east and Sibling B is driving at 60 km/hr at an angle of 45 degrees west of north towards A. We choose the race track as the Home Frame and kart A as the Other Frame. The relative velocity of kart B from the perspective of sibling A is $\begin{bmatrix} v'_{x,B} \\ v'_{y,B} \end{bmatrix} = \begin{bmatrix} -30\sqrt{3} + 30\sqrt{2} \\ -30 - 30\sqrt{2} \end{bmatrix}$



Each square has side 10 m

Selected Answer: False

Correct Answer: False

Question 2

1 out of 1 points

Assume we have a particle at rest in a lab. At t=0 the particle decays into particle C and particle D, which shoot away in opposing directions. If we take the Lab as our Home Frame and particle D as our Other Frame we will be dealing with solely positive velocities for beta and v_C'.

Selected Answer: False

Correct Answer: False

Question 3

0 out of 1 points

Suppose that the Galilean concept of relativity were valid. Two observers, both in a different inertial frame, synchronize their clocks. They see a firecracker going off. One of the observers is at rest from the firecracker's frame of reference, while the other is not. Both observers see the firecracker going off at the same time.

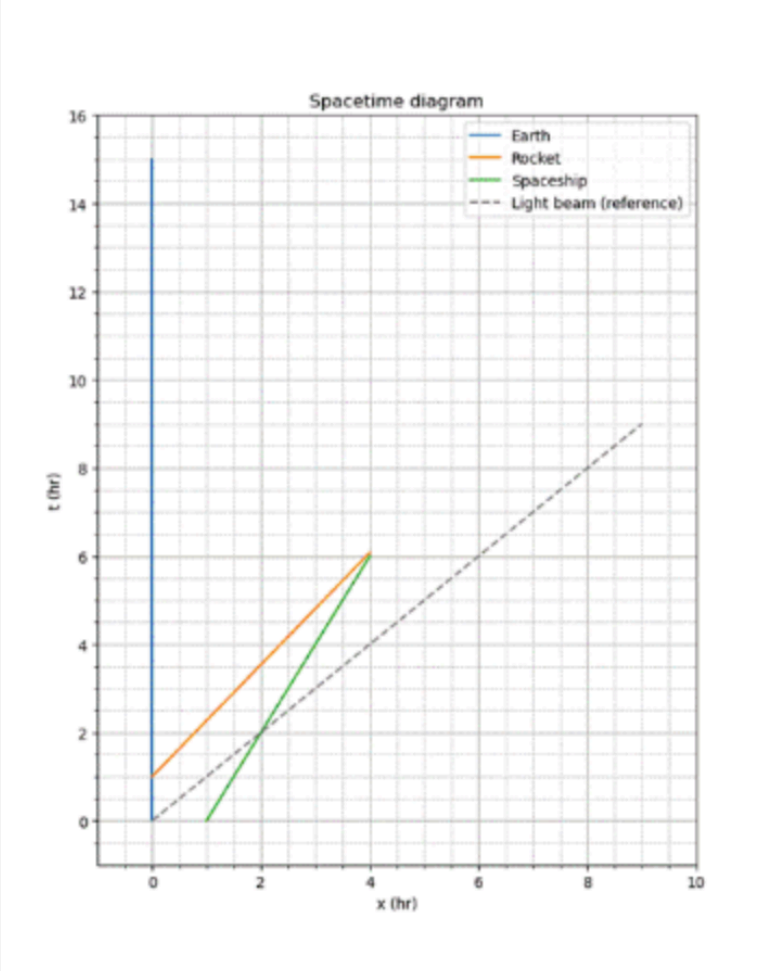
Selected Answer: True

Correct Answer: False

Question 4

1 out of 1 points

Take the rocket to be the Home Frame and the spaceship in this diagram to be the Other Frame.



The sign of beta is positive.

Selected Answer: False

Correct Answer: False

Question 5

1 out of 1 points

Consider a conventional spacetime diagram and an object A that moves in the +x direction. As object A is moving, its worldline in the diagram curves upwards. This means that object A has a positive acceleration.

Selected Answer: False

Correct Answer: False

Question 6

0 out of 1 points

A worldline connects two events in a spacetime diagram.

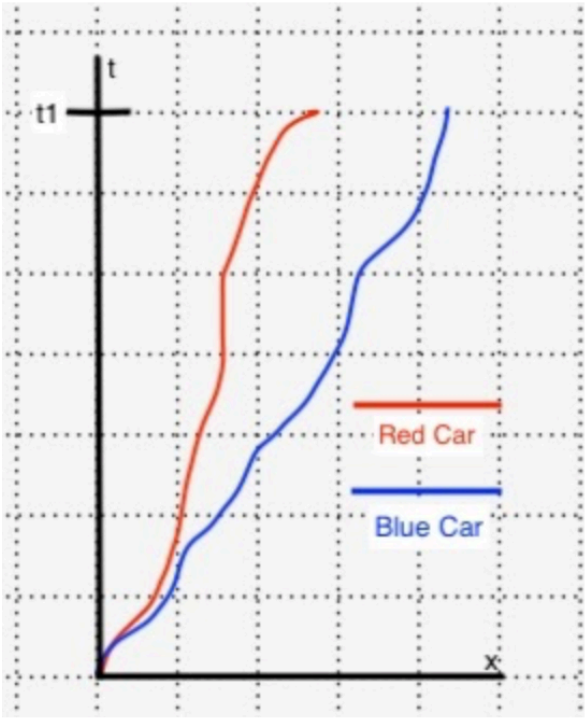
Selected Answer: False

Correct Answer: True

Question 7

1 out of 1 points

The red car and the blue car are having a race. Their worldlines are shown on the diagram.



At time t1, the blue car is going faster than the red car.

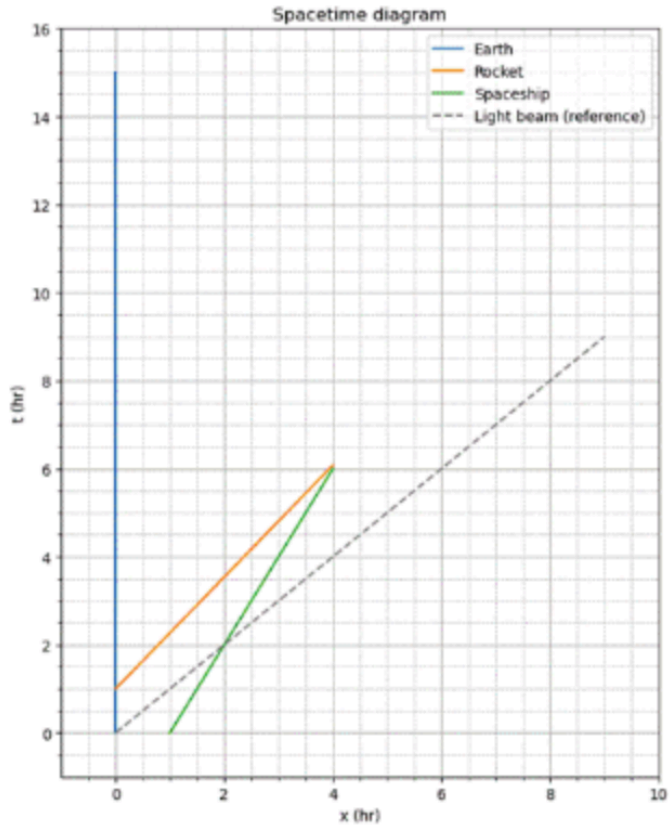
Selected Answer: False

Correct Answer: False

Question 8

1 out of 1 points

The spaceship in this diagram travels faster than light.



Selected Answer: False

Correct Answer: False

Question 9

1 out of 1 points

The choice of a coordinate time does not imply the choice of an entire frame of reference.

Selected Answer: False

Correct Answer: False

Question 10

1 out of 1 points

Alice measures the coordinates of two events A and B. She finds that they occurred simultaneously and that $x_A = -x_B = 2s$. Bob moves in the -x direction relative to Alice. This means that Bob will measure event B to occur after event A.

Selected Answer: False

Correct Answer: False

Question 11

1 out of 1 points

Two events are considered to be simultaneous in a reference frame if the coordinate time is the same for both events.

Selected Answer: True

Correct Answer: True

Question 12

1 out of 1 points

Two observers have carefully synchronized their clocks. They will only agree that the others' clocks are properly synchronized if they're not moving relative to each other.

Selected Answer: True

Correct Answer: True

Question 13

1 out of 1 points

A student determines the kinetic energy of a train to be 3 kg in SR units. To find the kinetic energy in Joules, they must multiply this number by c.

Selected Answer: False

Correct Answer: False

Question 14

1 out of 1 points

The average height of a Dutch man is approximately 6 ns in SR units

Selected Answer: True

Correct Answer: True

Question 15

1 out of 1 points

1 kg of energy is approximately 10^{18} J

Selected Answer: False

Correct Answer: False

Question 16

1 out of 1 points

A frame moving with an acceleration of 3 m/s^2 is an inertial frame.

Selected Answer: False

Correct Answer: False

Question 17

0 out of 1 points

A frame moving along the trajectory of a proton in a linear collider can be an inertial frame.

Selected Answer: True

Correct Answer: False

Question 18

1 out of 1 points

Consider a collision between two particles. Bob and Alice are in two different inertial frames moving relative to each other. Both measure the total momentum before the collision. Since the laws of physics are the same in all inertial frames, Bob and Alice should find the exact same result for the total momentum before the collision.

Selected Answer: False

Correct Answer: False

Question 19

1 out of 1 points

The principle of relativity is a postulate (pre-supposed rule) of special relativity. Therefore, it cannot be proven by experiments, only disproven.

Selected Answer: True

Correct Answer: True

Question 20

1 out of 1 points

Coulomb's formula for the net force between two point charges is a law of physics. Therefore, it holds in all inertial reference frames.

Selected Answer: True

Correct Answer: True