Homeowrk#11

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Started: September 22, 2009 2:21 PM

Questions: 16

Finish Save All Help

1. HW11 Q1 (Points: 1)

****Vista Homework11 will be due next Friday, July17th*****

The material covered in this HW is special relativity. It's important that you start this HW early and take time to completely understand it; you will be tested on the same material a few days after it is due, on the final exam.

Select one problem from the previous HW for which you had the wrong answer.

In the text box below:

i) identify the question number you are correcting
ii) state (copy) your original wrong answer,
iii) explain where your original reasoning was incorrect, the correct reasoning for the problem, and how it leads to the right answer.
If you got all the answers correct!!! Great ... then state which was your favorite / most useful homework problem and why.

New Insert equation

Save Answer

2. HW11 Q2 (Points: 2)

Consider a head on collision between two bodies whose masses are m and M, with m<<M. It is well known that if m has speed v and M is initially at rest, m will bounce straight back with its speed unchanged, while M will remain at rest (to an excellent approximation...prove it yourself by using conservation of momentum and energy -- it's o.k. to assume non relativistic here).

Use this fact to predict the final velocities if instead M approaches with speed v and m is initially at rest. [Hint: consider the reference frame attached to M.]

What is the final speed for M? Give your answer in terms of v,m, and M.

If the answer is 2*m*M*v (I just made that up), write "2mMv".
1.

Save Answer

3. HW11 Q3 (Points: 2)

What is the final speed of m? Again, if the answer is "7*M*v* (just made that up), answer "7Mv".

1.

Save Answer

4. HW11 Q4 (Points: 2)

Find the speed relative to Earth of a uniformly moving spaceship whose clock runs 5sec slow per hour compared with an Earth-based clock. [answer to two sig fig in units of m/sec. For example, write 3.3E3, or 1.0E1, etc]

1.

Save Answer

5. HW11 Q5 (Points: 3)

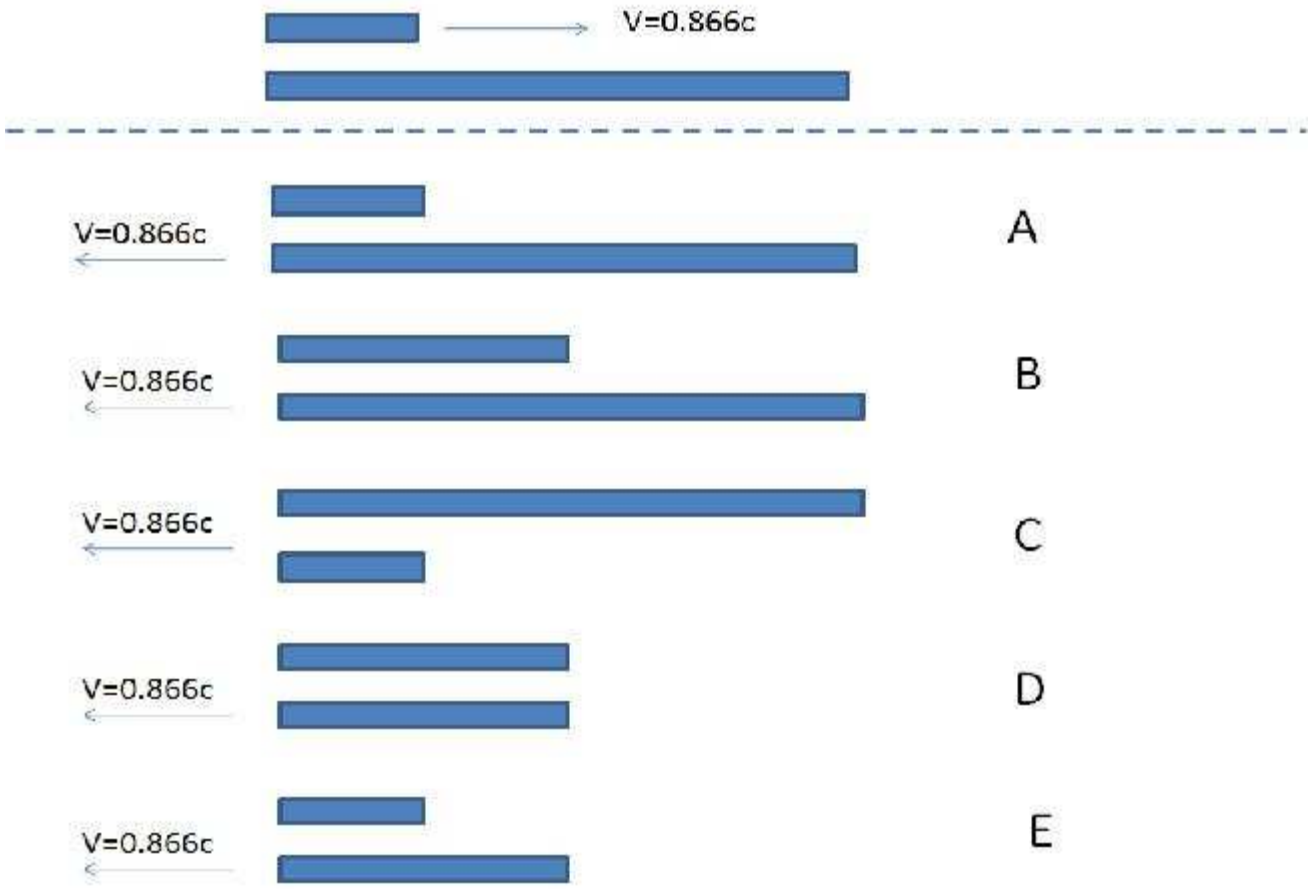
In the previous question (Q4), did you use time dilation or the Lorentz transformations? Imagine a fellow student asks you:"Hey, I am confused...I would like to know when it's safe to use the time dilation formula". Explain to him/her the conditions where the time dilation formula can be used. Explain in terms of Q4.

New Insert equation

Save Answer

6. HW11 Q6 (Points: 1)

The picture shows two rods, as observed in the frame of the lower rod. Which of the pictures below represents an observation of the same rods in the frame of the upper rod?



1. A
2. B
3. C
4. D
5. E

Save Answer

7. HW11 Q7 (Points: 3)

In the previous question (Q6), did you use length contraction or the full Lorentz transformations? Again, imagine a fellow student asks you:"Hey, I am confused...I would like to know when it's safe to use the length contraction formula". Explain to him/her the conditions where the length contraction formula can be used. Explain in terms of Q6. Be explicit! It's important to realize when you can(not) use these special case formulas.

New Insert equation

Save Answer

8. HW11 Q8 (Points: 4)

The official (ground) commentator of the Ascot Galactic Race gives the following intermediary results: "At this moment, the Red Ship is in front, at a distance of 10 light minutes from arrival, moving at vR = 0.25c. The Green Ship is just 2 light minutes behind, but it is catching up, with a relative speed (compared to the Red Ship) of +0.2c. Finally, the Blue Ship is trailing at 10 light minutes behind the leader, however its speed relative to the leading ship is +0.5c. Assuming that all
ships maintain their current speeds, which one wins the race?

[Hints: (1) make sure you have a clear drawing of the ships with frames, (2) can you simply add/subtract the velocities?]

1. Red Ship wins the race
2. Blue ship wins the race
3. Green ship wins the race

Save Answer

9. HW11 Q9 (Points: 2)

In the previous question, which ship arrives last?

1. Red ship arrives last
2. Blue ship arrives last
3. Green ship arrives last

Save Answer

10. HW11 Q10 (Points: 2)

Joe and Moe are travelling in the same direction. Each has a spaceship of proper length L = 40m. Joe is travelling with speed vJ = 0.6c and Moe is travelling with vM = 0.8c with respect to the ground. Choose the initial moment in all three reference frames (ground, Moe's and Joe's) to be t = t′ = t′′ = 0 when the back of Joe's ship is aligned with the nose of Moe's ship and also with x = 0 (origin of ground reference frame).

Make sure to draw a picture of the ships as observed by a ground observed. After how much time (as measured on the ground) does Moe overtake Joe, i.e., the back of Moe's ship is aligned with the front of Joe's ship?

1. 0.33333 usec
2. 0.63333 usec
3. 0.93333 usec
4. 1.33333usec

Save Answer

11. HW11 Q11 (Points: 2)

In the previous question, at what distance (in the ground frame) will the event "overtake" occur?

1. 40m
2. 100m
3. 150m
4. 200m

5. 300m

Save Answer

12. HW11 Q12 (Points: 2)

In the previous question (Q10), what is Moe's speed w.r.t. Joe?

1. 0.200c
2. 0.315c
3. 0.385c
4. -0.200c
5. -0.315c
6. -0.385c

Save Answer

13. HW11 Q13 (Points: 2)

Assume that we could convert all the energy of 1g of sand (at rest) into kinetic energy of a tennis ball (of rest mass 20 g). How fast would the tennis ball be moving?

1. 0.20c
2. 0.31c
3. 0.5c
4. 0.6c

Save Answer

14. HW11 Q14 (Points: 2)

A particle of rest mass M=1 (unit of mass) decays into two identical particles, each of rest mass m=1/4 (unit of mass). If the initial particle was at rest, find the momenta of the two final particles.

1. 0.04c
2. 0.27c
3. 0.35c
4. 0.43c
5. 0.65c

Save Answer

15. HW11 Q15 (Points: 2)

The radioactive element radium (Ra) decays by a process known as alpha decay, in which it emits a helium nuclei (these high-speed He nuclei were named "alpha particles" when first discovered, because at the time people had no idea what this "new" form of radiation is made of. Later they discovered it was just He nuclei, but by this time the name "alpha radiation" had already stuck). The reaction is 226Ra --> 222Rn + 4He, where Rn is radon. The accurately measured masses of the three atoms are 226.025u, 222.017u and 4.003u, respectively, where u = 1.66×10−27kg is the atomic mass unit.

How much energy is converted kinetic energy of the 222Rn and 4He atoms in this reaction?

1. 1.5E-10 Joules
2. 1E-10 Joules

- 3. 3.1E-12 Joules
- 4. 4.5E-13 Joules
- 5. 7.5E-13 Joules

Save Answer

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16. HW11 Q16 (Points: 0)

How long did it take you to complete the Vista HW + finish the Friday tutorial?

- 1. <1hr
- 2. 1 hr
- 3. 2hr
- 4. 3hr
- 5. 4hr
- 6. 5hr
- 7. 6hr
- 8. 7hr
- 9. >7hr

Save Answer

Finish **Save All** **Help**