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Sample Exam 1

Physics 361
Second Semester
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Q1. The values of γ when v_1=0.01000 c and v_2=0.9998 c are:

a) 0.01000, 0.99980 respectively
b) 1.00504, 223.6068 respectively
c) 1.00010, 2500.000 respectively
d) 1.00005, 50.00250 respectively
e) 0.00100, 5.000000 respectively

Q2. What is the velocity of a meter scale (1 m) if its length is observed to be 0.99 m?

a) 0.010 c
b) c
c) 0.859 c
d) 0.141 c
e) 0.001 c

Q3. How long does it take for a meter scale moving at v=0.60 c to pass by you (stationary) along the direction of its length?

a) 4.44×10^{-9} s
b) 0.8 s
c) 3.21×10^{-2} s
d) 5.42×10^{-4} s
e) 6.53×10^{-6} s

Q4. The Michelson-Morley experiment was designed to measure

a) The relativistic mass of the electron
b) The relativistic energy of the electron
c) The velocity of the earth relative to ether
d) The acceleration of gravity on the earth's surface
e) The conservation of linear momentum in elastic collisions

Q5. A boat travels 4 m/s in still water. With what speed, relative to the shore, does it move in a river that is flowing at 1 m/s if the boat is heading upstream, downstream, straight across the river?

a) 3 m/s , 5 m/s , 3.87 m/s respectively
b) 4 m/s , 4 m/s , 4 m/s respectively
c) 5 m/s , 3 m/s , 4 m/s respectively
d) 6 m/s , 10 m/s , 7.74 m/s respectively
e) 7 m/s , 3 m/s , 5 m/s respectively

Q6. The Gamma factor in relativity is defined as $\gamma = 1/\sqrt{1-(v/c)^2}$, therefore γ can be:

a) zero
b) a negative integer
c) any number greater than or equal to zero
d) any number greater than or equal to 1
e) not equal 1

Q7. A radar operator on earth sees two spaceships moving straight at each other, each with speed 0.40 c. With what speed does the pilot of one ship see the other ship approaching?

a) 0.80 c
b) 0.69 c
c) 0.88 c
d) 0.75 c
e) 0.62 c

Q8. What will be the mean lifetime of an elementary particle (muon) as measured in the laboratory if it is traveling at 0.60 c = 1.8 x108 m/s with respect to the laboratory? Its mean lifetime at rest is 2.2×10^{-6} s.

a) 2.2×10^{-6} s
b) 3.6×10^{-6} s
c) 4.8×10^{-6} s
d) 1.6×10^{-6} s
e) 2.8×10^{-6} s

Q9. Consider a light signal propagating in some arbitrary direction, with $v_x \neq 0$, $v_x \neq 0$, $v_x \neq 0$, and $v_x^2 + v_y^2 + v_z^2 = c^2$. Using Lorentz Transformation for the components of the velocity to show that $v_x'^2 + v_y'^2 + v_z'^2 = c^2$.

Q10. How fast must a space ship travel relative to earth so that exactly 10 years of earth time corresponds to exactly 1 year of space ship time?