

Chapter 10 Special Relativity: length, energy and momentum. Revision Questions page 295-297

– Multiple Choice Answers

Q	Ans	Explanation
1	D	The Twin Paradox is about the two ways of looking at the scenario of one twin staying on Earth and the staying in a rocket. The question of time dilation depends on which one experiences proper time, and which one experiences dilated time. The paradox is stated as that either twin could be saying that they themselves are at rest. The resolution to this paradox is found in noting that the rocketship twin must have accelerated to leave Earth and turn around so that they must be the travelling (moving) twin.
2	D	About the only things observers in different inertial systems agree upon is the speed of light and the laws of physics. When in uniform moving frames of reference (inertial frames) then they will disagree on simultaneity (as it is relative) and they will disagree on the timing of events (the rate at which clocks run), and the length of objects in different frames. Thus, they will agree on none of the ones mentioned.
3	B	Observers on the surface will measure proper length (L_0) as they are at rest to the measured distance. They will also measure the dilated time (t) as they are observing its position in two separate places from start to finish. $v = \frac{L_0}{t}$ $L_0 = vt = 0.8 \times 3 \times 10^8 \times 784 \times 10^{-6}$ $= 188160 \text{ m (188 km)}$
4	C	$p_v = \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}}$ $= \frac{1.62 \times 10^{-27} \times 0.92 \times 3 \times 10^8}{\sqrt{1 - 0.92^2}}$ $= \frac{4.47 \times 10^{-19}}{0.3919}$ $= 1.14 \times 10^{-18} \text{ kg m s}^{-1}$
5	C	$\Delta E = \Delta mc^2$ $= 9.11 \times 10^{-31} \times (3 \times 10^8)^2$ $= 8.20 \times 10^{-14} \text{ J}$

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