

10. RELATIVITY THEORY

Answers to conceptual exercises

4. According to Galilean relativity, she observes the light beam to move at $0.5c$.
18. If the plane is speeding up, you will feel pressed backward, and dropped objects will fall toward the rear of the drop point. If the plane is slowing down, you will feel pulled forward and objects will fall toward the front of the drop point. If the plane is turning to the right, you will feel pressed toward the left and objects will fall toward the left.
23. The light leaves the star at speed c , and approaches Earth at speed c .
28. $0.25c$.
34. No, it would take more than 30,000 years as measured on Earth. Yes, a person traveling there at a high speed would get there in less than 30,000 years of his/her own time. This is because of the relativity of time.
40. No. Time always goes forward, never backward.
42. No, because time always goes forward, never backward.

Answers to problems

6. Time-dilation factor is 4, i.e. $T = 4T_0$. Thus

$$1 / \sqrt{1-s^2/c^2} = 4.$$

$$\sqrt{1-s^2/c^2} = 1/4$$

$$1-s^2/c^2 = 1/16$$

$$s^2/c^2 = 15/16 = 0.94, \text{ so } s/c = \sqrt{0.94} = 0.97.$$

Velma moves at 97% of lightspeed.