

NAME: <hr/>	Quiz #7a: Phys270
----------------	----------------------

1. [10 pts] A 2m long cow is running at relativistic velocity towards a 1m long shed.
 - a. [5 pts] From the cow's reference frame, is it possible for the cow to fit inside the barn? If so, what minimum speed must the cow be moving? [leave your answer in terms of the speed of light c]

 - b. [5 pts] From the barn's reference frame, is it possible for the cow to fit inside the barn? If so, what minimum speed must the cow be moving? [leave your answer in terms of the speed of light c]

NAME: _____	Quiz #7b: Phys270
--------------------	----------------------

2. [10 pts] A cow is running at a relativistic velocity towards a shed. The shed has two doors opposite one another. The cow is 2m long as measured in the cow's rest frame and the shed is 1m long as measured in the shed's rest frame. A farmer in the shed's reference frame observes the cow fit into the shed, and closes the two paper thin doors and traps the cow momentarily before the cow plows through the backdoor.

a. [3 pts] At what minimum speed is the cow running [leave your answer in terms of the speed of light c]?

b. [4 pts] From the cow's perspective, how long is the barn (that is, the spacing between the doors) based on your answer to part a?

c. [3 pts] Order the following events in the cow's reference frame (and state which events occur at the same time):

- event a: Cow breaches the back door
- event b: Cow's nose reaches back door
- event c: Cow's tail reaches front door
- event d: Cow's tail reaches back door
- event e: Farmer closes back door
- event f: Farmer closes front door

NAME: <hr/>	Quiz #7c: Phys270
----------------	----------------------

1. [10 pts] A muon is at rest traveling inside of a rocket moving at $(1/2)c$ with respect to the earth. In the rocket's reference frame, the muon is measured to have a decay time of $(3/2) \mu\text{s}$. [$1 \mu\text{s} = 10^{-6} \text{ sec}$]

a. [5 pts] What is the muon's decay time as measured on earth?

b. [5 pts] What is the muon's decay time as measured by the muon?

NAME: _____	Quiz #7d: Phys270
--------------------	----------------------

1. [10 pts] A rocket with an astronaut travels at relativistic speeds to and from a distant star with respect to Mission control workers on earth .
 - a. [3 pts] Who measures the proper time, Mission control workers or the astronaut?
 - b. [4 pts] How fast must the rocket travel on the journey so that upon the astronaut's return he has aged 10 years while the mission control workers on earth have aged 20 years?
 - c. [3 pts] As measured by Mission control, how far away is the distant star?[leave your answer in terms of the speed of light c times the units of "years"]