

Problems discussed in the video series:

Videos (1) – (2)

The length of a spaceship is measured to be exactly $\frac{1}{4}$ its rest length.

(A) To three significant figures, what is the speed parameter β of the spaceship relative to the observer's frame?

(B) By what integer factor do the spaceship's clocks run slow, compared to clocks in the observer's frame?

Videos (3) – (5)

Light from a distant galaxy is observed with a diffraction grating. Given the data below, determine (a) direction and (b) magnitude of the radial motion of the galaxy relative to the Earth.

The grating has 500 lines/mm. A spectral line of hydrogen is observed in the first order at an angle of 20.2° . The same hydrogen line observed on Earth has a wavelength of 656nm.

Videos (10) – (11)

(A) Find the lens needed to correct the distance vision of a myopic person whose far-point is at 400 cm from the eye. The lens is 2 cm from the eye.

(B) If the person's near-point is 20 cm from the eye instead of the normal 25 cm, how close to the eye can this person see clearly with this lens? Explain the reasoning.

Video (12)

Suppose you are on a camping trip and desperately need to start a fire, but have no matches, cigarette lighter or phone to call for help. Your only source of energy is sunlight. You use some available objects. Explain which one(s) of these might possibly help you start the fire using sunlight:

(a) eyeglasses of a near-sighted (myopic) person

(b) eyeglasses of a far-sighted (hyperopic) person

(c) a cosmetics (aka, shaving) mirror

(d) the rear view mirrors of your car

(e) the bottom of a champagne bottle with water in it. (If you do not know what the shape is, ask the GSIs. They know.)

(f) anything else you think of that might work will get extra credit.