

Astronomy 405: Homework #7 (Radiation)

For each question, focus on the critical motivating physics. Give counter examples, sketch figures, and make your arguments as thorough and convincing as possible.

1. Which of the launch plans listed below is most energy efficient for sending a spaceship to the Moon? Head (1) south from New Mexico, (2) north from California, (3) east from Florida, or (4) east from Moscow. (3 pts)
2. One piece of metal is at the temperature of melting ice, while a second piece is twice as hot. What are their temperatures, in degrees Celsius? (3 pts)
3. Two bullets of equal size, mass, and speed are fired at a block of wood. One is made of rubber, and one of aluminum.
 - (a) Which is more likely to knock over the block? (2 pts)
 - (b) Which is more likely to damage the block? (2 pts)
4. As you empty a gallon jug of liquid, it gurgles. As it empties, how will the frequency of the sound change? (4 pts)
5. A metal disk with a central hole is heated until it expands. What will be the effect on the diameter of the central hole? (5 pts)
6. Consider the four sailboats shown below (numbered one through four, from left to right), noting the orientation of the sails with respect to both the wind and the keels. Which boat will move forward with the greatest speed? (8 pts)

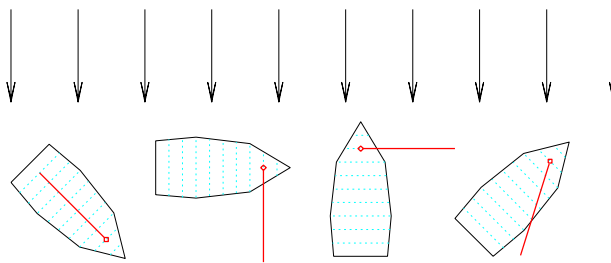


Figure 1: Four little sailboats, on a windy day.

7. You order a cup of coffee at a sidewalk cafe in winter, and once it arrives you realize that you must now wait till a friend arrives before drinking it. If you take cream with your coffee, should you add it now or later in order to have as hot a drink as possible in twenty minutes? (8 pts)