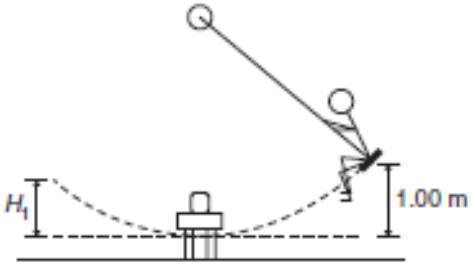
Sample Free Response Question

Short Answer



Note: Figure not drawn to scale.

2. A student of mass 50.0 kg swings on a playground swing, which is very light compared to the student. A friend releases the seat of the swing from rest at a height of 1.00 m above the lowest point of the motion. The student swings down and, at the lowest point of the motion, grabs a jug of water of mass 4.00 kg. The jug is initially at rest on a small table right next to the swing, so it does not move vertically as the student grabs it. The student keeps swinging forward while holding the jug, and the seat reaches a maximum height H_1 above the lowest point. Air resistance and friction are negligible.

   (a) Indicate whether H_1 is greater than, less than, or equal to 1.00 m.

   _____ Greater than 1.00 m

   _____ Less than 1.00 m

   _____ Equal to 1.00 m

   Justify your answer qualitatively, with no equations or calculations.

   (b) Explain how H_1 can be calculated. You need not actually do the calculations, but provide complete instructions so that another student could use them to calculate H_1.

   (c) The student now swings backward toward the starting point. At the lowest point of the motion, the student drops the water jug. Indicate whether the new maximum height that the seat reaches is greater than, less than, or equal to H_1.

   _____ Greater than H_1

   _____ Less than H_1

   _____ Equal to H_1

   Justify your answer.