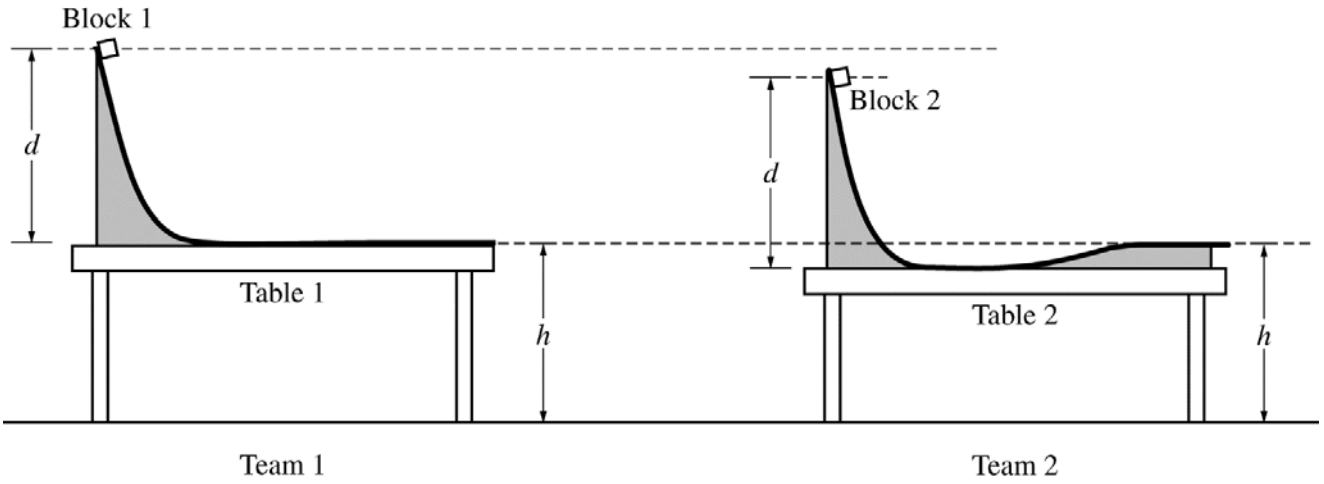

4. (7 points, suggested time 13 minutes)

A physics class is asked to design a low-friction slide that will launch a block horizontally from the top of a lab table. Teams 1 and 2 assemble the slides shown above and use identical blocks 1 and 2, respectively. Both slides start at the same height d above the tabletop. However, team 2's table is lower than team 1's table. To compensate for the lower table, team 2 constructs the right end of the slide to rise above the tabletop so that the block leaves the slide horizontally at the same height h above the floor as does team 1's block (see figure above).

(a) Both blocks are released from rest at the top of their respective slides. Do block 1 and block 2 land the same distance from their respective tables?

____ Yes ____ No

Justify your answer.

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Question 4

7 points total **Distribution of points**

(a) 3 points

Correct answer: "No"
Note: If the wrong answer is selected, partial credit can be earned for the justification.

For attempting to use conservation of energy to compare the two blocks — 1 point
For explicitly or implicitly indicating that the launch velocities are different — 1 point
For stating or implying that the time to reach the ground is the same for both blocks — 1 point

Example: The amount of potential energy converted to kinetic energy is different for the two blocks. The potential energy is proportional to the change in height, which is smaller for block 2. Therefore, at the edge of the table, block 1 will have more kinetic energy than block 2, and hence a larger speed. The launches are both horizontal and from the same height, so the blocks will spend the same amount of time in the air. Because $d = vt$, the distances will be different for the two blocks (as the speeds are different).

(b)

i. 2 points

Correct answer: "The two blocks land the same distance from their respective tables."

For indicating that the change in potential energy from release to launch is the same for the two cases — 1 point
For an indication (explicit or implicit) that the launch velocities are the same — 1 point

ii. 2 points

Correct answer: "Block 1"

For indicating that the average speed or velocity on the slide is higher for Team 1, OR that block 1 reaches its maximum speed in less time — 1 point
For a valid explanation of why the average speed or velocity is higher for team 1, OR why block 1 reaches its maximum speed in less time — 1 point

Example: Because the ramp on Table 1 is initially steeper, block 1 has a higher average speed while it's on the ramp so it launches off the table before block 2.