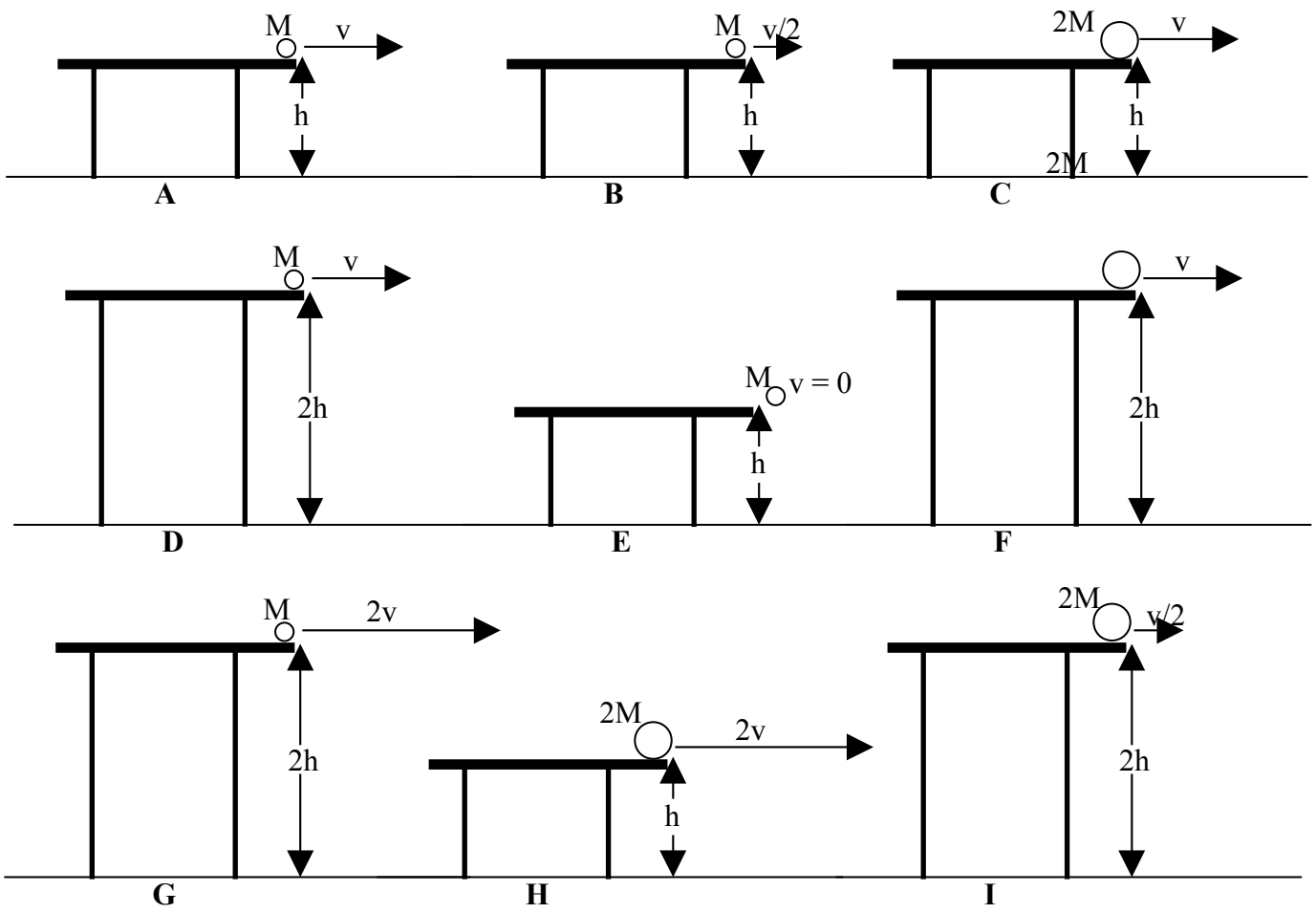
Name_____ Pd_Date_____

Physics Whiteboard Problems – 2D Motion

The following two ranking tasks refer to the set of diagrams below, showing a sphere of mass, m rolling off of the side of a table of height, h with an initial velocity, v. *You may assume air resistance and friction to be negligible.*

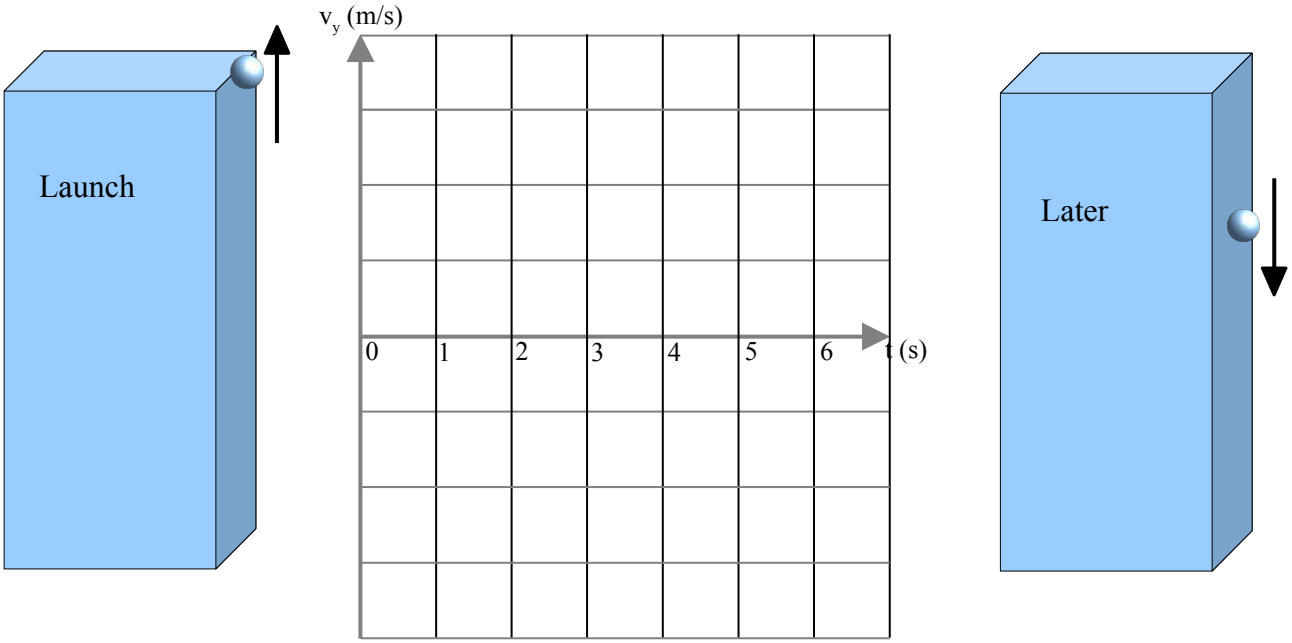


1. (a) Rank these situations from greatest to least based on the *time for the sphere to hit the ground*. Use the > and = signs, but do not use the < sign. Ties are possible.

(b) Explain the reasons behind your ranking in part (a). Try to give a brief explanation that covers all the cases rather than explain or calculate each case individually.

2. (a) Rank these situations from greatest to least based on the *horizontal distance of the sphere from the edge of the table* at the time it hits the floor. Use the > and = signs, but do not use the < sign. Ties are possible.

(b) Explain the reasons behind your ranking in part (a). Try to give a brief explanation that covers all the cases rather than explain or calculate each case individually.

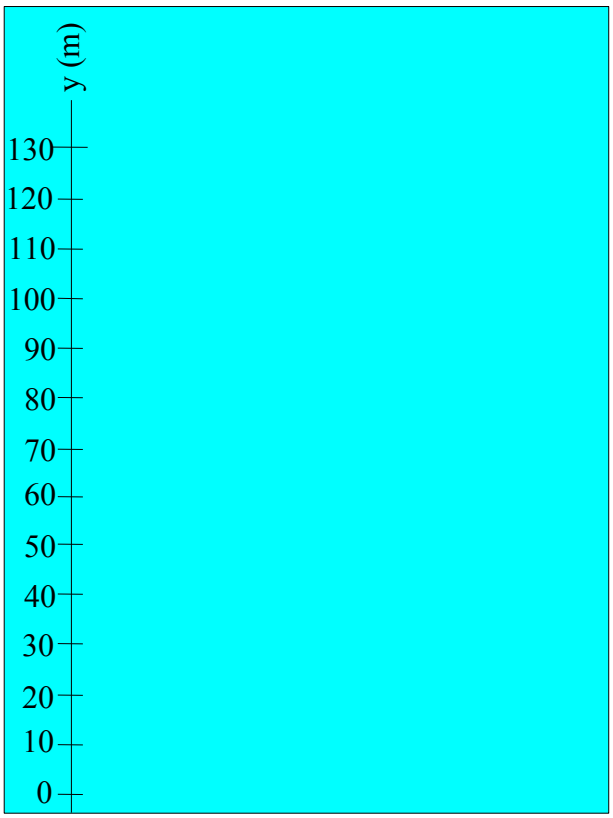


3. A ball at the edge of a 50m tall platform is fired upwards with a velocity of 30m/s. (a) Draw a quantitatively accurate velocity vs. time graph for the first seven seconds of the fall. From this graph and the ball's initial height of 50m, determine the ball's position at each second. Show your method with a visual aid and at least one sample calculation.

arrows should start at or near the dot showing the ball's position at that instant in time. Use half arrow-heads and a different color for acceleration arrows.

(c) Lay out a y axis on your whiteboard using a scale of 5cm represents 10m, as shown at right. Then plot the position of the ball at each second, . (d) Add a velocity arrow at each point, using a scale of 5cm represents 10m/s. (e) Add an acceleration arrow at each point, using a scale of 5cm represents 10m/s^2.

(f) Show how to obtain the velocity arrow for t = 2s by vector adding the velocity and acceleration arrows for t = 1s. (g) Show how to obtain the velocity arrow for t = 6s by vector adding the velocity and acceleration arrows for t = 5s. (h) Show how to obtain the velocity arrow for t = 4s by vector adding the velocity and acceleration arrows for t = 3s. Draw your vector addition diagrams to scale.



Goalless problem practice:

Here is the points system for goalless problems:

- Stating a model that applies AND WHY IT APPLIES = 1 pt

- Drawing a diagram or graph = 3 pts
  –> annotating the diagram or graph = +2 pts
  –> using the diagram or graph to calculate something = +2 pts
  –> using a graph to derive a symbols-only equation that you later use in a calculation = +2 pts

- Stating a fundamental principle before you use it = 1pt

- Doing a calculation = 1 pt
  –> an especially clever or complicated calculation = +1 pt
  –> carrying units throughout your calculation = +1 pt

Of course, a diagram, graph or calculation must be correct to receive points.

4. A hot air balloon is ascending with a velocity of 5.0 m/s when a 5.0 kg sand bag is dropped from this balloon at a height of 80 m. *You may neglect all forces from the air.*