*9/04/19* Assignment Set 2 - Read Unit 1 Ch. 3 thru Ch.5 *Due Wednesday 9/11/19* Name______________

*Basic IBM† Physics*

1. Many are surprised by a little "explosion" that occurs when a *90gm* superball is dropped with a *10gm* pen on top.
(a) Under ideal† conditions the pen is fired upward with a speed that is ______ †† times the speed with which the two hit the floor and rises ______†† times the height from which they were dropped. Verify with $\mathbf{V_1}$ vs $\mathbf{V_2}$ plot.
(They usually don't notice that the ball rises only ______†† times that drop height.)

† *"Ideal" means negligible internal friction and air drag and valid Independent Bang Model (IBM).*

†† *Use geometry or algebra to give factors to 2-figure precision.*

(b) Under less ideal conditions an evil student might spoil the professor's demo toy by putting a drop of *Sticky-Stuff*© between the ball and pen. Assuming that drop wastes as much energy as possible (but still separates), derive the final speed and height factors that may result.

$V_{BALL}$=______$\cdot v_{INIT}$ $V_{PEN}$=______$\cdot v_{INIT}$ $h_{BALL}$=______$\cdot h_{INIT}$ $h_{PEN}$=______$\cdot h_{INIT}$

*Essay: What about IBM?*

2. Discuss what is it that seems to make the IBM† work so well. (A question we take up in later Chapters.)

*Random Banging Around*

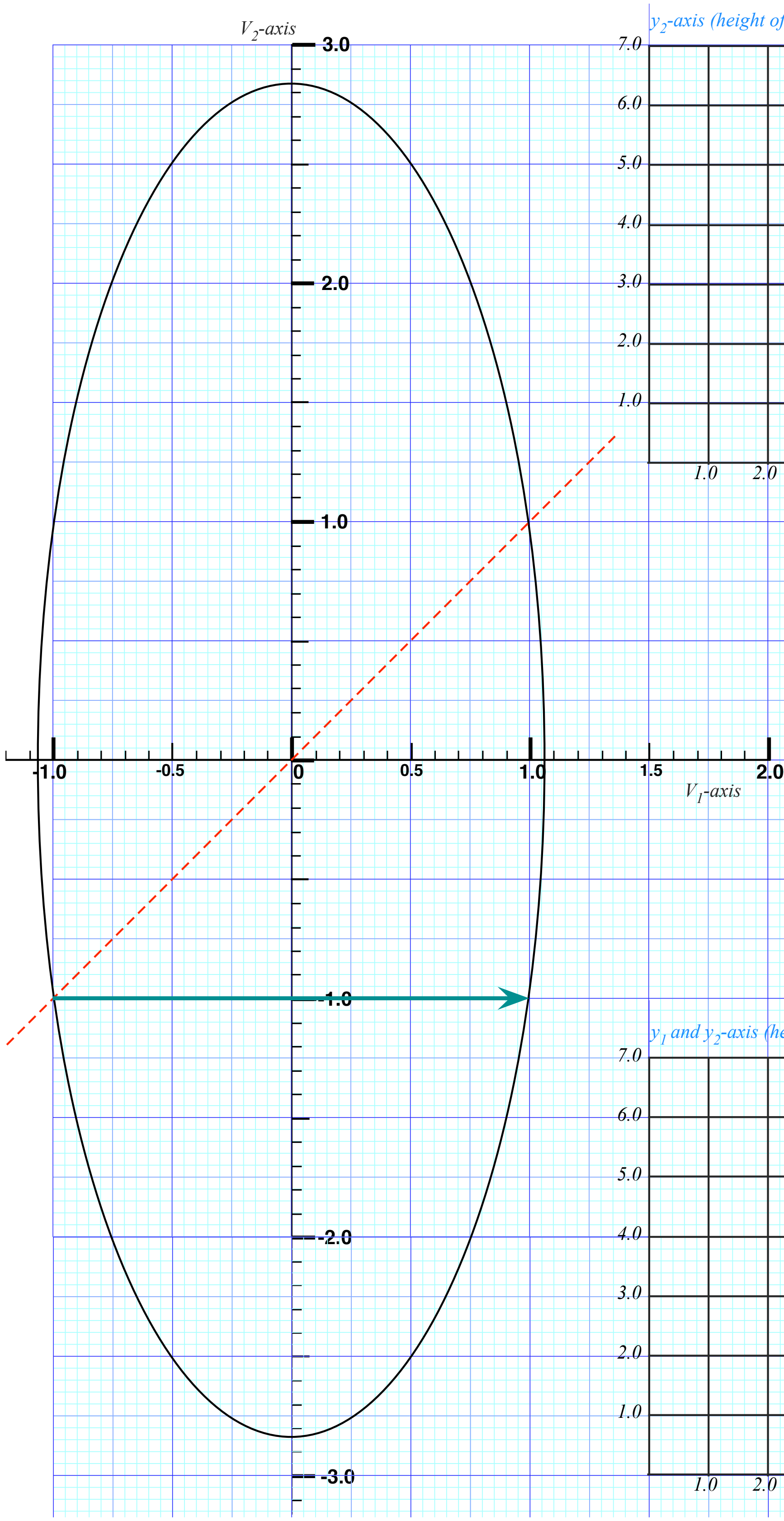
3. These same people might not be so surprised by what goes on in a low-temperature high-vacuum atomic vapor chamber that has a mixture of Hydrogen (atomic weight 1.0) and Beryllium (atomic weight 9.0). On the average the H atoms have a speed that is _______ times that of the Be atoms. If the chamber is opened to a large enclosing ultra-high vacuum chamber, then H atoms could rise _____ times as high as the Be atoms, on the average. Compare to answers in 1 and discuss briefly. (Discussion after text Fig. 5.2(d-e) is important here.)

*Finding "Gameover" point (Construction we started in class 9/04)*

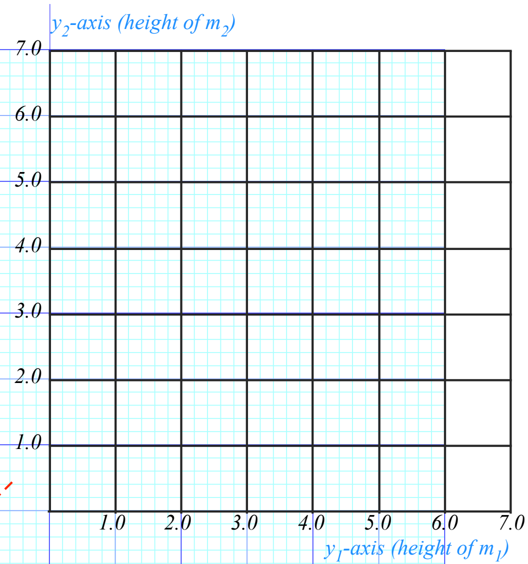
4. We began a complete space-time, velocity-velocity, and space vs. space plot construction for the pen-ball system with pen-mass $M_{pen} = 10gm = M_2$ and ball-mass $M_{ball} = 70gm = M_1$. We assumed initial positions $(y_1 = 1, y_2 = 3)$ and velocity $(v_1 = -1, v_2 = -1)$ headed toward floor. (See p. 9 to 18 in Lecture 3. Extra graph paper is on p.11.)
The objective is to plot the velocity-velocity, and space vs. space graphs assuming the ball has only a single floor bounce after which the floor is removed so both objects can fall through. (The ceiling at y=7 remains in tact.) Of particular interest is the final "gameover" bounce after which the two objects can never collide again.

The objective is to locate their last collision point and the final velocity. (As usual no gravity is present.)

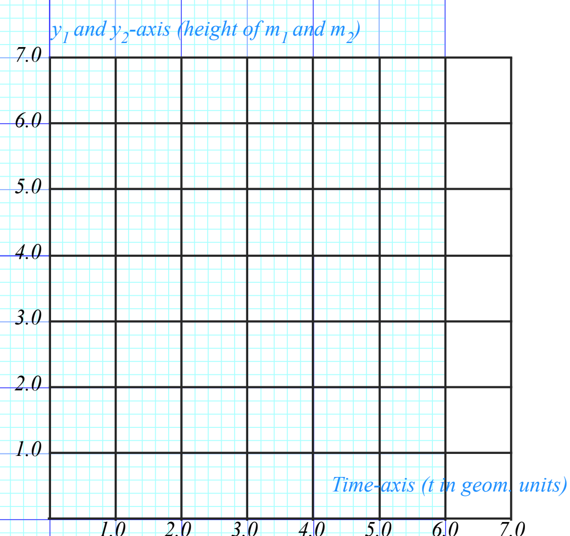
You may use the BounceIt program to estimate the results but only a old fashioned construction gets full credit!



$V_2$-axis
3.0
2.0
1.0
-1.0
-2.0
-3.0
-1.0
-0.5
0
0.5
1.0
1.5
2.0
$V_1$-axis

$y_2$-axis (height of $m_2$)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
$y_1$-axis (height of $m_1$)

$y_1$ and $y_2$-axis (height of $m_1$ and $m_2$)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Time-axis (t in geom. units)
1.0
2.0
3.0
4.0
5.0
6.0
7.0