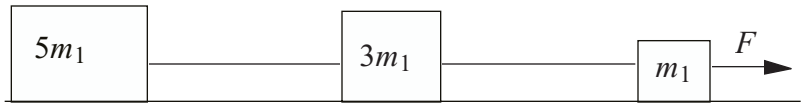
ISP209 Spring 2002 **Homework 12** Name: _____
Due:Thurs., Apr. 18, 2:40 pm, in Rm 118PA. ID:_____

1. Which condition is impossible:

   a) acceleration equal to zero, and velocity not equal to zero.
   b) acceleration not equal to zero, and velocity equal to zero.
   c) acceleration not equal to zero, and velocity not equal to zero.
   d) acceleration equal to zero, and velocity equal to zero.
   e) none of the above.

2. A mass weighs 10,000 N on the planet Mongo ($g_{\text{Mongo}} = 25\,\text{N/kg}$). What is its weight on the Earth?

   a) 250,000 N b) 400 N c) 2.5 N d) 4000 N e) 2500 N



Picture for problems 3-4

3. A force F accelerates three masses tied together with strings along a frictionless surface as shown in the figure above. What is the acceleration of each mass?

   a) $\frac{F}{3m_1}$ b) $\frac{F}{5m_1}$ c) $\frac{F}{8m_1}$ d) $\frac{F}{9m_1}$ e) $\frac{F}{10m_1}$

4. What is the net force acting on the middle mass?

   a) F b) $\frac{F}{2}$ c) $\frac{F}{3}$ d) $\frac{F}{4}$ e) $\frac{F}{6}$

A ball with a mass of 2kg is thrown up (+ direction) into the air (ignore air friction). (Draw this situation in the right margin, including the vectors asked for below)

5. What force acts on the ball at the highest point? magnitude _____, direction _____

6. What is the acceleration (both magnitude and direction) of the ball,

   at the highest point? (magnitude _____ and direction_____) ,
   on the way up? (magnitude _____ and direction_____),
   on the way down? (magnitude _____ and direction_____)

7. If the ball is thrown to a height of 20m above your hand, how long will it take to get back to your hand? _____
   (show work here)

8. What will be the speed of the ball when it hits your hand? _____
   (show work here)

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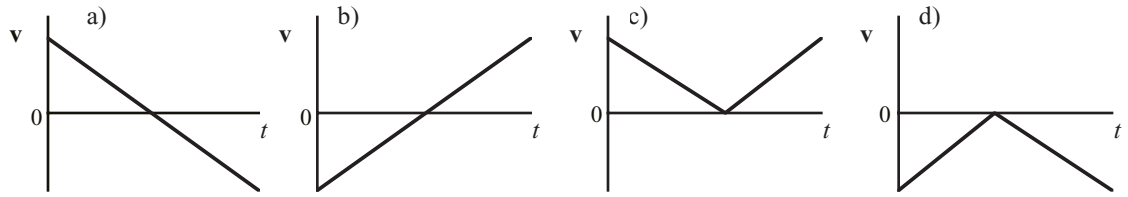
The Motion Eq. describing the velocity vs. time for a ball thrown straight upward is:

$$\mathbf{v} = \mathbf{v}_0 + \mathbf{a}t; \quad \text{with } \mathbf{a} = -g.$$

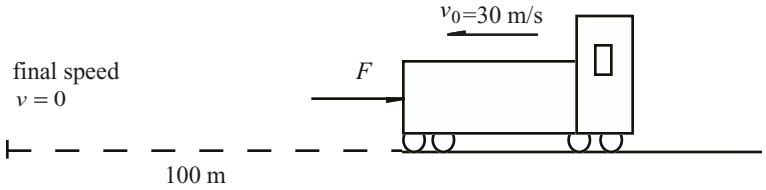
Compare this with equation for a straight line: $y = b + mx$, with slope m, intercept b.

9a) Which graph below describes the velocity (**v**) vs. time (t) for this motion?



e) none of the above

What are the slope (9b)_____ and intercept (9c)_____ of the line(s) on the graph?



A train weighing 10^6N, moving with a speed of 30 m/s, is slowed to $v = 0$, in a distance of 100 m, by a constant applied force, F .

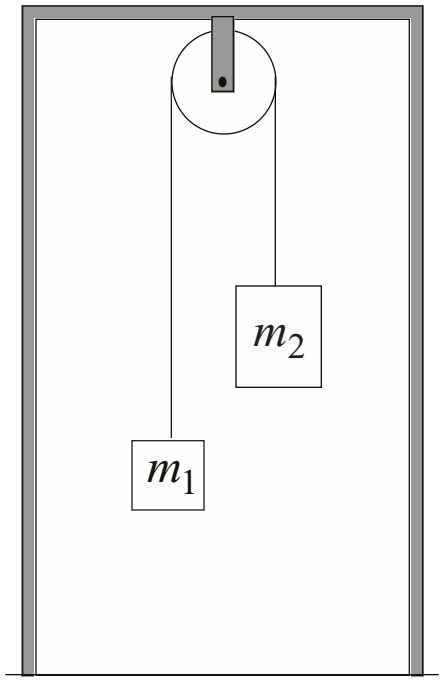
10. Name three sources of a non-conservative force that (likely or not) stops the train.

_____ _____ _____

11. What is the acceleration (with units) of the train? _____
12. What is the value (with units) of the force F ? _____
13. Is the force F an internal or an external force? _____
14. Is the momentum of the train conserved? _____
15. What other momentum must be considered to show that the total momentum is conserved and what is its magnitude, and direction? _____
16. To move as stated, a force must be applied to the train. To find its magnitude, F, use energy conservation, including the work done by that force on the train._____
(show work here)

17. Use the change in momentum of the train and the value of F to determine the time it takes for the train to reach $v = 0$. _____
(show work here)

Two masses are attached to a string that runs through the massless pulley as shown in the figure. Only gravity and the tension in the string act on the masses.



18. If the masses are equal, $m_1 = m_2 = m$, which statement below is true?

a) the tension in the string is mg.

b) the tension in the string is $2mg$.

c) the tension in the string is zero.

d) the masses must be at rest.

e) the speed of the masses can be different.

19. If the masses shown at the right are not equal to each other, which statement below is true:

a) the speed of the masses cannot be zero.

b) the two masses cannot have the same speed.

c) the magnitude of the acceleration of the masses can be zero.

d) the two masses can never have the same magnitude of the acceleration.

e) the two masses must have the same speed, the same magnitude of the acceleration, and the same tension acting on them.