Name: ______________________________ DISC: ____________ Score: _____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
5	5	5	5

1. You have just arrived on a new planet and wish to find its acceleration of gravity, g_{new}. You throw a ball vertically upward with an initial velocity, $v_0 = 10\ m/s$. The ball reaches a maximum height $y_{max} = 3\ m$. Assume $y_0 = 0\ m$. **(Lecture 5, p. 8)**

   a. What happens to the *velocity* of the ball at its maximum height?

   Answer (2pts):

   When the ball reaches its maximum height, it will have $v(y_{max}) = 0\ m/s$.

   b. Of the following expressions, which would you use to find g_{new} the acceleration of gravity on the new planet:

   Expression (1 pt):

   i. $y(t) = y_0 + v_0 t + \frac{1}{2} a t^2$

   ii. $v^2 = v_0^2 + 2\,a\,\Delta y$

   iii. $v = v_0 + at$

   c. Use your result in part a) and your chosen expression in part b) to find g_{new} :

   g_{new} (2 pts):

$$v^2 = v_0^2 + 2a\Delta y$$

$$\left(0\frac{m}{s}\right)^2 = \left(10\frac{m}{s}\right)^2 + 2a(3\ m)$$

$$-\left(10\frac{m}{s}\right)^2 = a(6\ m)$$

$$-\frac{100\ \left(\frac{m}{s}\right)^2}{6\ m} = a = -16.67\ m/s^2$$

2. A train traveling in a straight line at 30 m/s needs to make an emergency stop. It takes 60 s for the train to come to a complete stop. **(Lecture 4, p. 7)**

   a. Select the equation you would use to find the acceleration of the train?

   Choice (2 pts):

   i. $x(t) = x_0 + v_0 t + \frac{1}{2} a t^2$

   ii. $v = v_0 + at$

Information:
Solution (2 pts):

b. Use your chosen equation to find the *acceleration* (remember acceleration is a vector):

i. Do you have all the information you need? ***choose one:*** yes/no

ii. Solve for $\vec{a}$.

$$v = v_0 + at$$

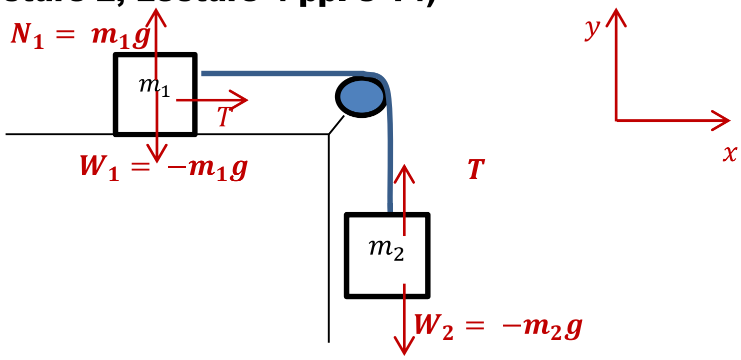
$$v - v_0 = a\,t$$

$$\frac{(v - v_0)}{(t)} = a$$

$$\frac{\left(0\frac{m}{s} - \frac{30m}{s}\right)}{(60\ s)} = \frac{-30}{60}\frac{m}{s^2} = -\frac{1}{2}\frac{m}{s^2} = -0.5\ m/s^2$$

3. Two blocks are attached to each other by a massless cord as shown in the diagram below. Both the table and pulley are *frictionless*: **(Lecture 2; Lecture 4 pp. 8-14)**

Coord. System (1 pt.):
Forces (2 pts):



a. Finish the free-body diagram by including all of the forces acting on the blocks. *Include a coordinate system*.

b. Can this system be in equilibrium? Explain your reasoning.

Answer:
Reasoning:

This system cannot be in equilibrium.

Because the table is frictionless, there is no force which can oppose the tension in the string attached to box m_1. The tension is caused by the box m_2 which experiences the force of gravity pulling it down. Thus the two masses must accelerate with constant acceleration as box m_2 is pulled down.

4. You are standing on a scale in an elevator. You read the weight on the scale. **(Lecture 5, pp. 11-14)**

a. The reading is *less* than your weight outside the elevator. Which of the following is true:

Answer (2 pts):

i. The elevator is undergoing negative acceleration.
ii. The elevator is undergoing positive acceleration.
iii. Neither of these is true.
iv. Both of these are true.

b. You look at the scale again. The scale now reads your weight as *the same* as outside the elevator. Explain in your own words what has happened.

Explanation (3 pts.):

I recall Newton's 2nd Law: $ma = N - mg$ or the sum of the forces I experience. This force $ma = N - mg$ is the force I experience from the elevator. The normal force is: $N = m(a + g)$ where the acceleration will have a sign I must find to answer the question. Thus, if the scale reads a different value from my "true weight" then the elevator must be accelerating.

The question tells me that the normal force I experience makes the scale read *the same as* my "true weight". Thus the elevator must not be accelerating.