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. You launch a ball vertically upward with an initial velocity of 10 m/s. The ball takes 2s to reach its maximum height.

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

Answer (2pts):

At the maximum height, the velocity of the ball is zero ($\vec{v} = 0\ m/s$)

   b. Use your answer in part a) to find g_{new} :

Set-up:
Algebra:
g_{new}:

   i. This is a "rate equation" problem: $v = v_0 + a\,t$ where a (the acceleration) is the rate-of-change of the speed.
   ii. Using $v = v_0 + a\,t, where\ a = g_{new}$ we can solve:
      1. $v = v_0 + g_{new}\,t$ and $v = 0\frac{m}{s}, v_0 = 10\frac{m}{s}, t = 2\ s$
      2. $v - v_0 = g_{new}t$
      3. $\frac{v-v_0}{t} = g_{new}$
      4. Thus $\frac{-10\ m/s}{2\ s} = 5\ m/s^2$

2. A train traveling at 30 m/s approaches a station stop. It starts slowing with constant deceleration 200 m away from the station.

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

Choice (2 pts):

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

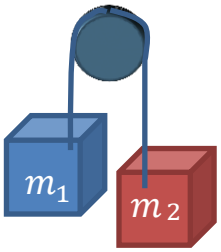
   i. $v^2 = v_0^2 + 2\,a\,\Delta x$

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

Information:
Solution (2 pts):

   i. Do you have all the information you need (yes/no)? yes
   ii. Solve for $\vec{a}$.
      1. $v = 0\frac{m}{s}, v_0 = 30\frac{m}{s}, \Delta x = 200\ m$
      2. $v^2 - v_0^2 = 2\,a\,\Delta x;\ \frac{v^2-v_0^2}{2\Delta x} = a$
      3. $\frac{(0\frac{m}{s})^2-(30\frac{m}{s})^2}{2(200\ m)} = \frac{9}{4}\frac{m}{s^2} = 2.25\ m/s^2$

3. Consider a system of two blocks connected by a light-weight, flexible cord over a massless, frictionless pulley as shown below:



a. If a_1 is the acceleration of m_1 and a_2 is the acceleration of m_2:

Answer:
Reasoning:

i. How are the magnitudes $|a_1|$ and $|a_2|$ related? $|a_1| = |a_2|$

ii. Explain your reasoning.

The two masses, m_1 and m_2 are connected by the cord. The tension in the cord must be the same at block 1 as at block 2. Thus, the accelerations must be equal.

b. Let $m_1 = 3\ kg$ and $m_2 = 5\ kg$:

a_1:
a_2:
Reasoning:

i. What is the ***sign*** of the acceleration of m_1? $+$ (make sure you watch the magnitudes of the masses)

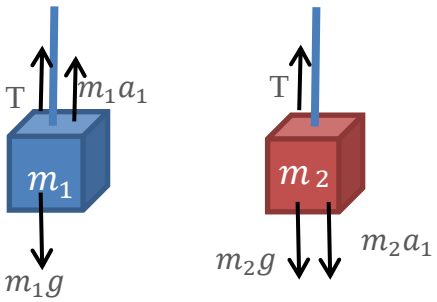
ii. What is the ***sign*** of the acceleration of m_2? $-$ (make sure you watch the magnitudes of the masses)

iii. Explain your reasoning.

The larger mass will experience a greater *force* caused by gravity and will tend to move in the negative y-direction.

c. Draw a free-body diagram for each block on the figures below. *Remember to label the forces and include a coordinate system (don't forget about the string!).*

Block 1:
Block 2:
Coordinate System:



d. Forces:

Forces on m_1:
Forces on m_2:

i. Write down the ***sum of the forces*** acting on m_1: $m_1a_1 = T - m_1g$

ii. Write down the ***sum of the forces*** acting on m_2: $-m_2a_1 = T - m_2g$