Physics 105 Sample Exam 2

$$< v >= \frac{\Delta x}{\Delta t}$$

$$< a >= \frac{\Delta v}{\Delta t}$$

$$v = v_o + at$$

$$x = x_o + \frac{1}{2}(v_o + v)t$$

$$x = x_o + v_o t + \frac{1}{2}at^2$$

$$v^2 = v_o^2 + 2a(x - x_o)$$

If $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$g=9.80\ m/s^2$

$\Sigma \mathbf{F} = m\mathbf{a}$ $w=mg$ $f_s \leq \mu_s N$ $f_k = \mu_k N$

$W_{net} = KE_f - KE_i$

$KE_i + PE_i = KE_f + PE_f$

$KE_i + PE_i + W_{nc,in} = KE_f + PE_f + W_{nc,out}$

$W = F\cos\theta\ s$ $KE = \frac{1}{2} mv^2$ $PE=mgh$

$PE=\frac{1}{2} kx^2$ $F= -kx$ $P = W/\Delta t = Fv\cos\theta$

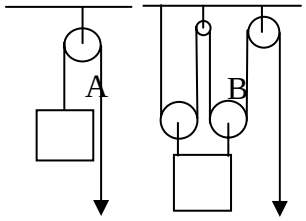
[?] with choices means simple multiple choice, **marked on the bubble sheet (scantron).**

When a numerical answer is required [S] with no choices means supply the <u>second</u> significant digit , **marked on the bubble sheet**. If the number itself is zero, mark 0. For answers 3.872, -0.003872, or 3.872×10^{-7} you would mark 8 if [S] (second digit) is displayed. For the answer 5.072, you would mark 0. Sometimes a range of answers is given (as in the homework). The correct answer is in that range. For example: {4.88, 6.48}m/s. If you got 6.275, you would mark 2 (the second digit) for your answer. If you got 3.823, try again (out of range).

Keep at least **four significant digits** throughout your calculations; do not round up to less than four. When data is given, assume it has at least four significant digits. For example "15 meters" means 15.00 meters.

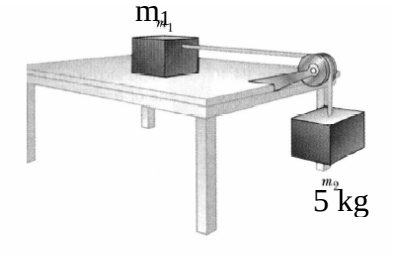
A rocket sled starts from rest and goes 300 meters in 8 seconds, under a net force of 7000 N. The mass of the sled is [1S]_____ kg. If the mass is smaller, and the force is the same, the time to complete the 300m will be [2?]_____ 1) more 2) less 3) the same.

A block weighing 2000 N is lifted by ropes on pulleys as shown. The minimum force on the rope (tension) needed to lift the box using system A is [3S]_____ N. The minimum force on the rope (tension) needed to lift the box using system B is [4S]_____ N.



A 2 kg mass is pushed horizontally against a spring a distance of 4 cm and is held still. The mass is released, and is later found to be going 24 m/s on a frictionless surface when it has left the spring. From energy conservation, it must have taken [5S]_____ J of work to originally compress the spring, so the spring constant k must be [6S]_____ N/m. If the 2 kg mass going 24 m/s now slides on a surface with kinetic friction of 0.4, it will slide [7S]_____ m on this surface before it stops. In physics we classify the spring force as [8?]_____ 1) conservative 2) nonconservative 3) destructive 4) nondestructive

Two blocks are connected by a massless string and a massless pulley.
Case I: If there is enough friction between m_1 and the table, the masses won't accelerate; in this case the tension in the string is [9S]_____N. If the *static* coefficient of friction between the block and the table is 0.6, m_1 needs to be at least [10S]_____ {6.27, 8.77}
kg for the blocks not to move.

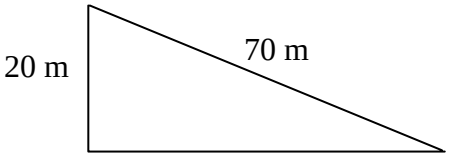


Case II: If there is *no friction*, and you want the masses to accelerate at 4 m/s^2, m_1 will have to be [11S]_____ {5.55, 7.72} kg. The tension in the string while the blocks are accelerating is [12S]_____ {28.3, 37} N.

Case III. If there is again friction, and the ***kinetic*** coefficient of friction between the block m_1 and the table **is 0.2**, and you want the masses to accelerate at 4 m/s^2, m_1 will have to be [13S]_____ {4.01, 5.46} kg.

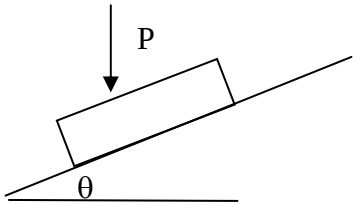
Fred is running horizontally down the field with the football, while dragging a tackler. Fred runs 30 meters at constant speed in 20 seconds while the tackler exerts a horizontal drag force on him. The amount of work Fred did to drag the tackler was 1550 J. The average power Fred expended was [14f_____] W. The horizontal drag force of the tackler on him was [15S]_____ N.

A conservative force does work that depends on [16?]_____ 1) the velocity 2) the beginning and ending positions 3) the particular path



A car of mass 750 kg initially going 22 m/s drives up a hill of height change 20 m and length 70 m. On one day, there was no friction and the car just "coasted" up the hill (no engine force), so the speed at the top was [17S]_____ m/s. Another day, while driving up the hill the car pushes backwards on the road with 700 N (by burning gasoline in the engine), and also there is a friction force of 100 N. The mechanical energy (work) that the engine delivers while driving up the hill is [18S]_____ J. The speed of the car at the top of the hill will be [19S]_____ {11.8, 16} m/s. Using the terms discussed in class, the kind of work the engine does is [20?] _____ 1) W_{in} 2) W_{out} 3) kept track of by potential energy 4) zero. The work expended against friction goes [21?]_____ 1) into potential energy 2) into heat 3) out of the universe

A block of ice, 80 kg, is on a frictionless inclined plane with $\theta = 25^o$. You push with your hands on the ice with a downward force P of 500 N (as the arrow shows). The component of the force of gravity along the incline is [22S]_____N. The normal force of the incline on the block is [23S] _____ . The block will move down the slope with acceleration of [24S] _____{6.47, 8.5} m/s^2.



A 500 kg sculpture hangs by a chain from the ceiling of a museum elevator. The elevator starts at rest. It accelerates *upward* at 2 m/s^2 for 3 seconds, and during this time the tension in the chain is [25S] _____ N. At the end of the three seconds the elevator is going [26S] _____ m/s. Now the elevator moves at constant speed for 10 seconds, and during this time the tension in the chain is [27S] _____ N.

Block 1 is thrown upward from an icy cliff with a speed v_o. Block 2 is thrown horizontally from the cliff with the same speed v_o . Block 3 is given the same speed v_o and then it slides without friction down the icy cliff. They all reach the bottom of the cliff. The speed at the bottom will be greatest for [28?]_____1) block 1 2) block 2 3) block 3 4) none…same speed

Joe and Sergio are in a boxing match. Sergio punches Joe, and Joe accelerates backwards, while Sergio stays still. The force Sergio put on Joe is [29?]_____ 1) less than 2) more than 3) the same as the force Joe put on Sergio during the punch.