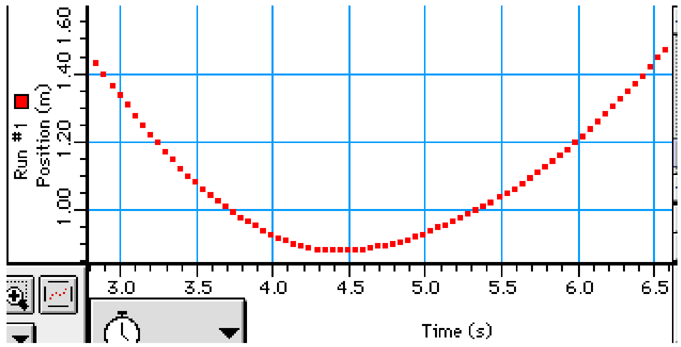
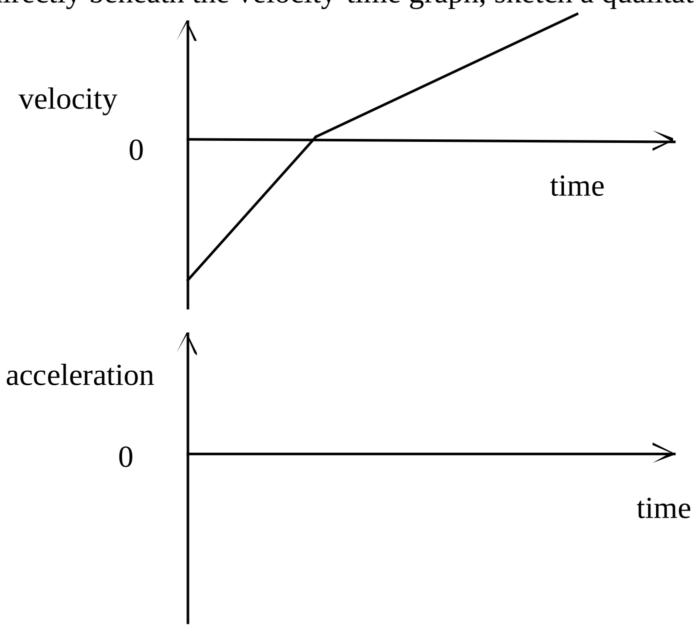
Some Example Questions for Exam II

Questions 1-3 refer to the Lab "Newton's Second Law of Motion."

1. The figure to the right shows an actual position versus time graph for the cart moving under the influence of the string and friction (but no hand). Which (*one*) of the following is true? (a) The acceleration of the cart is zero at about 4.5 s. (b) The acceleration of the cart is zero at about 3.0 s. (c) The acceleration of the cart is zero at about 6.0 s. (d) The acceleration of the cart is not zero at any time shown.



2. The velocity-time graph for the cart looks something like the sketch below. On the axes directly beneath the velocity-time graph, sketch a qualitatively correct acceleration-time graph.



3. When the cart moves up the track the tension in the string is measured to be about 0.467 N. When the cart moves down the track the tension in the string is measured to be about 0.479 N. If the standard deviations for both measurements are the same, what is the largest standard deviation that would permit one to say that the two tensions are (probably) different:
(a) 0.022 N, (b) 0.017 N, (c) 0.012 N, (d) 0.005 N?

Questions 4-6 refer to the Lab "Work and Energy."

4. Refer back to the graph of position-time associated with Question #1. Consider the round trip from $x_i = 1.4$ m at $t_i = 2.9$ s, to $x_f = 1.4$ m at $t_f = 6.4$ s. Consider the following differences over this round trip: (A) mechanical energy of the cart, (B) mechanical energy of the hanging mass, (C) kinetic energy of the cart, (D) kinetic energy of the hanging mass, (E) gravitational potential energy of the cart, (F) gravitational potential energy of the hanging mass. Which of these differences for the round trip are zero: (a) all of them, (b) A and B only, (c) C and D only, (d) E and F only.

5. The minimum position of the cart in the graph associated with Question #1 is about 0.9 m at $t = 4.5$ s. Consider the same round trip as in Question # 4. In calculating the work done by friction over this round trip, which displacement would be used? (a) 0 m, (b) 0.5 m, (c) 1.0 m, (d) 1.8 m.

6. Which (*one*) of the following is true about the work done by tension on the hanging mass for the same round trip as in Question #4? (W_{up} is the work done by tension when the mass goes up and W_{down} is the work done by the tension when the mass goes down.)
(a) $W_{up} > 0$, $W_{down} < 0$, and $W_{up} + W_{down} < 0$, (b) $W_{up} > 0$, $W_{down} < 0$, and $W_{up} + W_{down} > 0$,
(c) $W_{up} > 0$, $W_{down} > 0$, and $W_{up} + W_{down} > 0$, (d) $W_{up} < 0$, $W_{down} < 0$, and $W_{up} + W_{down} < 0$.

Questions 7-10 refer to the Lab "Harmonic Oscillations."

7. The First Prediction states that $x = mg/k$. In this prediction (a) x is the length of the spring and mg is its weight, (b) x is the amount of stretch of the spring and mg is its weight, (c) x is the length of the spring and mg is the weight of an added mass, (d) x is the amount of stretch of the spring and mg is the weight of an added mass.

8. For the position-time and force-time data taken in this lab which (*one*) of the following is the same: their (a) frequencies only, (b) amplitudes only, (c) amplitude offsets only, (d) frequencies *and* amplitudes.

9. A plot of acceleration as a function of position in this lab should be a straight line with a slope whose magnitude is equal to (a) angular frequency, (b) ordinary frequency, (c) angular frequency squared, (d) ordinary frequency squared.

10. In the lab ω^2 is *not* equal to k/m, as predicted. That is primarily because (a) the spring does not obey Hooke's Law, (b) there is considerable friction present, (c) the spring has mass, (d) human error.

Questions 11 and 12 refer to: A particle executes uniform circular motion around a circle of radius equal to 1 m with a speed of 2 m/s.

11. The period of the motion is (a) 2π, (b) 2, (c) π, (d) 1 seconds.

12. The acceleration of the particle is (a) zero, (b) 2 m/s, pointing toward the center of the circle, (c) constant, with a magnitude of 4 m/s^2, (d) 4 m/s^2, pointing toward the center of the circle.

14. The ordinary frequency of harmonic motion of a 1 kg mass attached to a simple spring is 1 Hz. The spring constant (a) is 1 N, (b) is 2π kg/m, (c) is $4\pi^2$ N/m, (d) cannot be determined from the information given.

15. The fundamental dimensions of work are (a) MLT^{-1}, (b) MLT^{-2}, (c) ML^2T^{-1}, (d) ML^2T^{-2}.

16. A skier of mass M skis along an irregularly shaped, *rough* slope from point A to point B. The total distance along the slope from A to B is D and the magnitude of the vertical drop from A to B is H. The skier's kinetic energies at A and B are equal. The work done by friction during this trip (a) must be exactly $-MgH$, (b) must be exactly $+MgH$, (c) must be exactly $-MgD$, (d) cannot be calculated because the shape of the slope and the coefficient of kinetic friction are not given.

17. A 1 kg mass initially compresses a vertical spring by 0.1 m. The mass is not attached to the spring and, after being released from rest, it leaves the spring and eventually reaches a maximum height above its starting point of 0.5 m. There is no friction during this motion. The change in the mass's mechanical energy during this process (a) must be about +5 J, (b) must be zero, (c) must be about –5 J, (d) cannot be calculated because the spring constant is not given.

18. A damped, driven oscillator has an equation of motion given by $ma = -kx - bv + F_0 \cos(\omega_d t)$, where ω_d is the angular frequency of the driving force. At resonance ma must equal (a) $-kx$, (b) $-bv$, (c) $+F_0\cos(\omega_d t)$, (d) zero.

20. An 80 kg man and a 40 kg girl are skating on smooth, level ice. Initially, they are in contact and at rest. The man pushes the girl away from him with a force of 30 N. Immediately after they are no longer in contact the girl's speed is 2 m/s. At the same instant the man's speed (a) must be zero, (b) must be 2 m/s also, (c) must be 1 m/s, (d) depends on how much force the girl exerts on the man.