Honors Exam Practice

1 Multiple Choice

1. You have two balls with different density, but the same mass. Which of these will be different if the balls are dropped off of a very high building in the presence of air resistance? The balls have not hit the ground after 10 seconds. **Select two answers.**

    A. The instantaneous acceleration of the balls after 10 seconds

    B. The gravitational force on the balls

    C. The terminal velocity of the balls

    D. The instantaneous acceleration when the balls are first released.

2. Two teams are playing tug of war. Team A is winning. Which of these must be true? Neglect the mass of the rope.

    A. The average force that team A applied to the rope is larger than team B.

    B. The total mass of team A is greater than team B.

    C. The average frictional force on team A from the ground is larger than for team B.

    D. The magnitude of the acceleration of team A is greater than team B.

3. Jupiter orbits the sun. When Jupiter is at it's furthest point from the sun, what is the direction of the sun's acceleration? Ignore the influence of other planets and stars, and take the reference frame that is static relative to the Jupiter-Sun system.

    A. The acceleration is 0.

    B. Directly away from Jupiter.

    C. Directly toward Jupiter.

    D. None of the above.

4. A student has measurements of an objects momentum and kinetic energy at various times. Which of the following should the student plot so that the slope gives the object's mass? Answers are in the form y vs x.

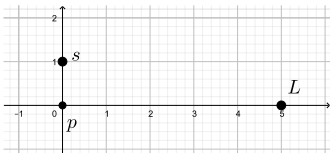
    A. KE vs p

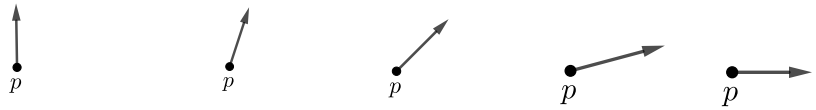
    B. p vs KE

    C. $\frac{p^2}{2}$ vs KE

    D. $\sqrt{2KE}$ vs p

5. Imagine that there is a system that consists of two equal mass stars that are labeled as s and L in the diagram. What direction should the net force on planet p point?





(a) (b) (c) (d) (e)

6. An object with speed v collides perfectly inelastically with an object of the same mass that was initially at rest. The masses then move together onto a surface with coefficient of friction μ_k. How far do the objects move before stopping.

   A. $\frac{v^2}{2g\mu_k}$

   B. $\frac{v^2}{8g\mu_k}$

   C. $\frac{2v^2}{g\mu_k}$

   D. The answer cannot be determined.

7. You have a mass on a frictionless table with a spring attached to it that oscillates with some period. If you create another system that has an identical spring, but a larger mass it should

   A. Not oscillate

   B. Oscillate with a longer period

   C. Oscillate with a shorter period

   D. Oscillate with the same period

2 Short answer

8. For this problem, consider the Earth. The Earth rotates, but that rotation is fairly slow. We want to explain the effects that would occur if we sped it up.

   (a) (4 pt) Explain (without equations) why the rocks on Earth's surface would eventually be flung off the surface if we increased the rotational speed of the Earth enough.

   (b) (2 pt) Find the approximate maximum rotational speed (aka angular speed ω) of the Earth before this would start to happen in terms of the radius of the Earth R_E and the surface gravity of Earth g.

   (c) (4 pt) If we doubled the mass of Earth (keeping radius constant), would the maximum rotational speed we found before increase, decrease, or stay the same? Explain your answer using words or equations.