Physics 1010 Homework 3 (18+ Points)
Due Monday night 9/17 at Midnight

1.) (2 pts): HOMEWORK CORRECTION ESSAY: Each week you should review both your answers and the answer key for the previous week's homework. Occasionally you will get to correct an essay from a prior week. Select one problem for which you had the wrong answer. In the text box below, 1) identify the question number you are correcting, 2) state (copy) your original wrong answer, 3) explain where your original reasoning was incorrect, the correct reasoning for the problem, and how it leads to the right answer. If you had no incorrect answers, which problem(s) did you find most useful to your understanding and why?

(Questions 2-6) Springs are all around us! We weigh our veggies and ourselves on spring scales. Our cars and mountain bikes have springs in the suspension. There are springs on clothes pins, in door stops and in our mattresses. In the next few problems, you will use the Springs and Masses PhET exploration to help make sense of the forces exerted by springs and how springs can be used as scales. BE CAREFUL WITH UNITS! For example, pay attention to the difference between kg and g, and between m and cm.

2.) (0.5 pt) Place the 250g mass on spring #1. When it has finished oscillating, how far is the spring extended from its equilibrium length? Hint: Use the moveable ruler and the dashed line to help make this measurement.

3.) (1 pt) For the 250 g mass in question 1, what is the force exerted by gravity on this mass? **Careful with units!**

4.) (0.5 pt) When at rest, what is the **net** force acting on the mass in Question 2?

5.) (0.5 pt) How far does spring 1 stretch from its equilibrium position when you hang the 50 g mass so that it is stationary on the spring?

6.) (1 pt) It's relatively simple to make your own scale – just like we did in class. With just some springs and a few objects for which you know the masses (here the 250 g and 50 g objects), you can make your own scale. Using what you know about spring 1, measure the **mass** of the gold object.

(Questions 7-11) Now let's take our masses and springs to the moon (check the moon box in the PhET), and measure the acceleration due to gravity on the moon (g_m which can also be typed as g_m).

7.) (0.5pt) What is the extension of spring #1 when the 250g mass is hung on it on the moon?

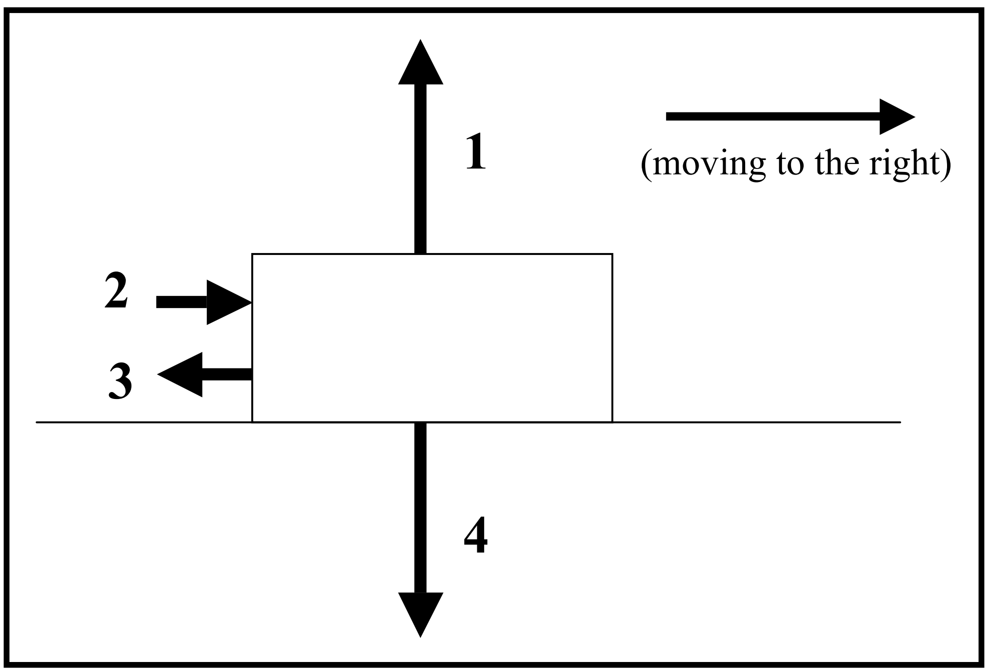
8.) (0.5pt) What is the spring constant of spring #1 on the moon?

9.) (1pt) What is the weight (the gravitational force = mg_m) on the 250g mass on the moon?

10.) (0.5pt) What is g_m?

11.) (1pt) Use physics principles (clearly identified) and your answers above to explain why astronauts on the moon jump much higher than on earth, even while wearing cumbersome space suits.

(Questions 12-16) I slide a heavy box (200kg) across the carpet at a steady velocity by pushing horizontally. My speed is a constant 0.2m/s, and I'm moving to the right.



12.)(1 pt) Which of the force arrows in the diagram match which of the following forces?

_____ gravitational force

_____ frictional force

_____ weight of the box

_____ pushing force

_____ normal force

13.) (0.5pt) What is the net force on the box?

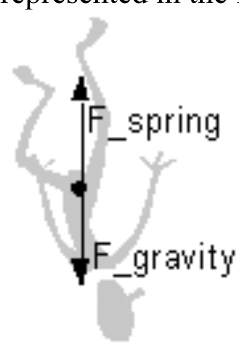
14.) (1pt) Approximately what is the size of the friction force in N? (Remember from class – if you're sliding a block on a smooth-ish floor, then the force of friction is about 0.3 x weight.)

15.) (0.5pt) Therefore approximately how hard must I be pushing (horizontally) in N?

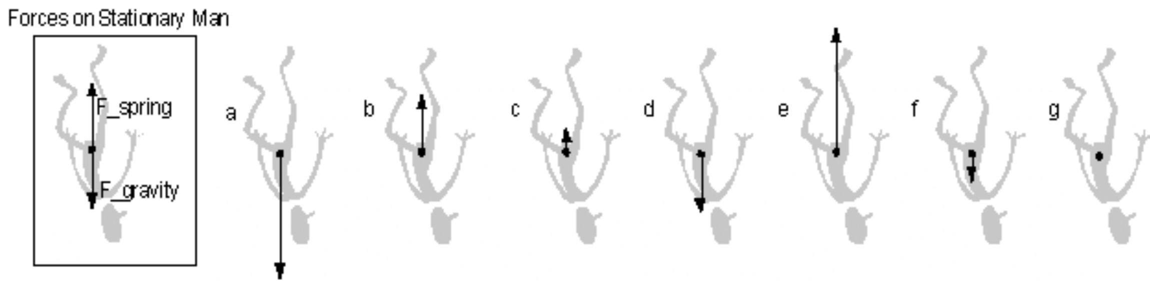
16.) (1pt) How would the friction force change if my dog jumped on top of the box as I was pushing? (Would it increase/decrease/stay the same? Use physics principles to justify your answer.)

~~17.) (2pt) Briefly explain what a 'crumple zone' is on a car, and (using clearly identified physics principles) explain why the crumple zone is important for keeping the driver and passengers safe in a crash.~~
This question was deleted from the homework.

(Questions 18-21) A local bungee jumping company has set up shop where a bridge crosses high above a slow moving river. They use a bungee cord that is 40 m long when completely relaxed. When a bungee cord stretches, it behaves just like a spring. The first jumper of the day has a mass of 130 kg. He jumps. When the bungee cord stops oscillating, the bungee cord is stretched to be 50 m long. In this stretched but stationary position, the **direction and magnitude** of the forces exerted **on** the bungee jumper by gravity and by the bungee cord are represented in the following diagram:



18.) (1pt) Suppose the jumper has jumped off the bridge and is heading down towards the water when the bungee cord measures 45 meters in length. Which of the pictures (a-g) best represents the force exerted on the jumper **by the bungee cord**? Consider both the direction and magnitude of the force. For comparison, the forces when the jumper is hanging stationary are given in the box on the left.



19.) (1 pt) Same situation as above. The bungee cord is stretched to 45 m in length. Which arrow (a-g) best represents the force exerted on the jumper **by gravity**?

20.) (1 pt) Same situation as previous 2 questions, with the bungee cord at 45m. Which arrow best represents the **net force** on the bungee jumper?

21.) (1 pt) Same situation as above, with the bungee cord at 45m. At this moment, the direction of acceleration of the bungee jumper

a. is in the upward direction
b. is in the downward direction
c. the acceleration is zero

22.)(1 pt + bonus point for creativity!!!) Make up your own question (that we might use for the Mid-Term) that applies the ideas of mass, force, acceleration – you can choose to pose a question about springs, friction, or some other application of F, m, a. Pose the question and the solution.