

Masses and Springs Homework SIM

1) Springs are a large part of our everyday lives. We sleep on a spring mattress, we weigh our vegetables and our selves on spring scales, springs are used as shocks in our cars, etc. In this problem, you will use the Masses and Springs PhET exploration to help make sense of the forces exerted by springs and how springs can be used as scales. BE CAREFUL WITH UNITS!

a) First, orient yourself to the tools you have available in the program. Begin by placing the 50 g mass on spring #1.

i) (0.5 pt) How much does the spring stretch from its equilibrium position when you hang the 50 g mass so that it is stationary on the spring? Hint: Use the moveable ruler, dashed line to help make this measurement.

ii) (1 pt) In this configuration, what is the force exerted by gravity on this mass?
Be careful with units

iii) (0.5 pt) When at rest, what is the **net** force acting on the mass?

iv) (0.5 pt) How far does the spring stretch from its equilibrium position when you hang the 100 g mass so that it is stationary on the spring?

v) (1 pt) Explain your reasoning for **ii** and **iii** in the context of what it is that determines how far the spring will stretch. Identify the physics principles you used and explain how you applied them to the situation to arrive at your answer.

b) It's amazing how simple it is to put together your own scale. With just some springs and a few objects for which you know the masses (here the 50 g, 100 g, and 250 g masses), you can make your own scale.

i) (1 pt) Using this apparatus, measure the **mass** of the red object.

ii) (2 pt) Describe the approach you used to determine the mass of the red object. Be sure to include the physics principles that support your approach.

c) Spring 3 lets you adjust its stiffness. With a mass on the spring, investigate how the stationary position of the hanging mass changes as you change the stiffness of the spring.

i) (0.5 pt) When the hanging mass is stationary, the force that a very stiff spring exerts on the hanging mass is ... the force that is exerted on the same hanging

mass by a very soft spring?

- greater than equal to less than
 there is not enough information to reason an answer

ii) (1 pt) The spring constant measures the stiffness of the spring. Use the tools available to determine the spring constant of Spring 3 for the **softest setting** on the slider. What is the value of this spring constant?

iii) (0.5 pt) Given your observations, is the spring constant for the “hard” spring smaller than, larger than, or the same as that for the “soft” spring setting.

- smaller larger same as

d) Classic footage of the Apollo 11 astronauts show them taking large leaps bounding around the surface of the moon. By transporting this simple springs and mass system to the moon, we can measure the force of gravity exerted by the moon on people at its surface and compare it to the force of gravity exerted by the earth on people at its surface.

i) (1 pt) Use the apparatus to measure the force of gravity exerted by the moon on the 50 g mass. What is the value of this force? **Be careful with units**

ii) (1 pt) If this mass is dropped from 10 m high, at what rate does this mass accelerate towards the surface?

iii) (1 pt) If you can jump to a height of 2 ft on earth, explain why the change in gravity enables you to jump much higher on the moon? Be sure to identify the physics principles you use and how you apply them to the situation.