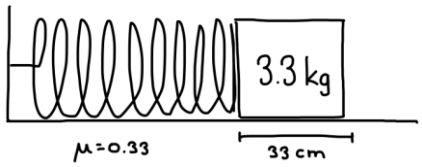
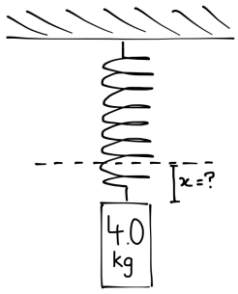
Review - Springs & Gravitation

1. A 3.3 kg mass is on a rough horizontal surface. It is pressed against a spring (spring constant 333 N/m) so that it is 33 cm from its equilibrium position as shown. What is its acceleration immediately after it is released?



2. A 4.0 kg mass is hanging from a spring with a spring constant of 350 N/m. How far is the spring displaced from its equilibrium position?



3. Jason is trying to shoot an apple off the head of Connor using a bow and row. He pulls back on the bowstring with a force of 240N, moving the arrow 60. cm. What is the spring constant of the bow?

4. A giant space slug weighs 420 N when it is far from the Earth.
   a. What is its weight when it is twice as far from the centre of Earth?
   b. What is its weight when it is 50 times closer to the Earth?

5. The giant space slug from question 5 has a weight of 5.4 N when it is 1.5×10^{13} m from the centre of Earth. What is its mass?

6. Geosynchronous satellites orbit the Earth once every 24 hours so that they remain fixed above one spot on the surface. These satellites are 42 000 km from the centre of Earth. One of these satellites has a mass of 1.0×10^{4} kg.
   a. What does one of these satellites weigh on Earth?
   b. What is the force of gravity on the satellite when it is orbiting Earth?
   c. What is the gravitational field strength 42 000 km from the centre of Earth?

7. Two identical objects are placed on planets X and Y. Planet Y has three times the mass and twice the radius as Planet X.
   a. On which planet does the object weigh more?
   b. How many times greater is its weight on this planet compared to its weight on the other?

8. Pluto has a mass of 1.31×10^{22} kg and a radius of 1.18×10^{6} m.
   a. What is the gravitational field strength on Pluto?
   b. A 60.0 kg space machine is pushed on Pluto with a force of 90 N. If the coefficient of friction between the space machine and the surface of Pluto is 0.70, what is its acceleration?