

Section 1 - Definitions - Give a brief definition of each term, and give an appropriate metric unit for each. (4 pts. Each)

1. Velocity
2. Acceleration
3. Momentum
4. Force
5. Kinetic Energy

Section 2 - Unit Conversions - Show all of your work, including all conversion factors, and be sure to include units in your answers. (4 pts. Each)

1. Convert 225 in to ft.
2. Convert 25 mi/hr to ft/s
3. Convert 43 lb/in² to N/ft²
4. Your friend has a 30 cm² chocolate brownie. You have a 4 in² brownie. Whose brownie is bigger?
5. Joe claims that he can run 25 mi/hr. Sally claims she can run 2,000,000 ft/day. Who can run faster?

Section 3 - Spring Questions - Show all of your work, and be sure to include units in your answer. (5 pts each)

1. Please write Hooke's Law, and identify each variable. Give an example unit for each variable.
2. If you had a spring with an initial tension of 15N and a spring constant of 45N/cm. How much force would you have to apply to it in order to stretch it 20cm?
3. A spring has an initial tension of 50N and an unstretched length of 15cm. It takes 100N to stretch it to 30cm. What is its spring constant?
4. Spring A has a spring constant of 10N/cm and spring B has a spring constant of 20N/cm. What is their combined (equivalent) spring constant if used in *parallel*?
5. Spring A has a spring constant of 50N/cm and spring B has a spring constant of 10N/cm. What is their combined (equivalent) spring constant if used in *series*?

Section 4 - Energy and Conservation of Energy - Show all of your work, and be sure to include units in your answers. (5 pts each)

1. A 2,000kg roller coaster starts from rest at the top of a 18m-tall hill. What is the speed of the roller coaster at the bottom of the hill, assuming no friction?
2. A 2kg pendulum bob swings at the end of a 2m-long rope from some initial height so that its speed at the bottom of the swing is 1.0 m/s. From how many degrees from vertical was the pendulum bob released?
3. The spring constant of a spring is 200N/m, and its initial tension is 15N. If it is compressed 0.1m, how much energy is stored in the spring?

4. If the spring in problem 3 is used to launch a 1kg object, what is the speed of the object the instant it leaves the spring?
5. What is the maximum possible height the object in problem 4 could reach if it were released vertically from the spring?
6. An ambitious Physics student runs up a flight of stairs. The student has a mass of 75kg, and the vertical height of the stairs is 4m. If the student is capable of producing 850Watts while running, how long will it take the student to go from the bottom of the stairs to the top?

Section 5 - Take Home Problem - Show all of your work neatly and completely, and be sure to include units in your answer. (10 pts)

1. Mr. Cote' wishes to find out how fast his new bow can shoot an arrow, so he sets up a little experiment. He hangs a 15kg target from the ceiling, stands in front of the target, and fires a 28g arrow into it. The arrow sticks, and the target swings through a vertical displacement of 9cm. Calculate the velocity with which the arrow left the bow.



