Practice questions Final Review

The questions are based on all the topics that have been covered during the school year. The focus is on constant velocity, Uniform acceleration, Forces balanced and Unbalanced, Projectile motion, circular motion, energy, and Momentum, Impulse.

During the school year we have used different representations to analyze, infer and understand the physics. Representations are tools that can help visualize the problems. The topics are related to each other.

In Momentum we talk about mass in Motion. Motion can be constant velocity or uniform acceleration. A simple **FBD** can help us decide if the object is Constant velocity model or uniform acceleration model.

Similarly throughout the school year we have used many line graphs to determine the relations between different variables. The intention was to derive a relation rather than memorize a formula. When you solve a problem always relate to FBD, energy bar graphs, graphs, or motion diagrams to get a basic idea and then proceed.

I have complied problems from different units that should stimulate the thought process and make connections.

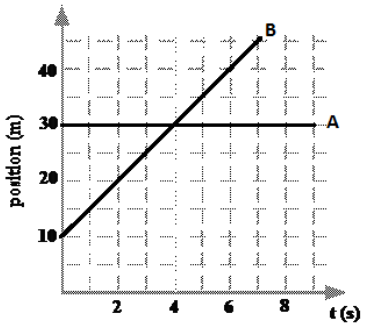
Another suggestion is to revisit the test copies you have check your mistakes, Use the correct answers that we went over in class including the rubric. Redo those problems with different values. Once again get the main idea for example if a object is lifted does this have to do with energy, work if so how is energy stored so on.

We will go over the problems and review for the final. I strongly encourage you to come up with questions. Don't wait until the last day to study everything. It won't work.

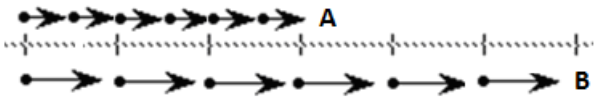
RB

1. For all responses be sure to start by stating the basic equation used and to include units in your answers.

Use the graph below to answer the following:



a) Student A makes the following motion diagram for the graph above.

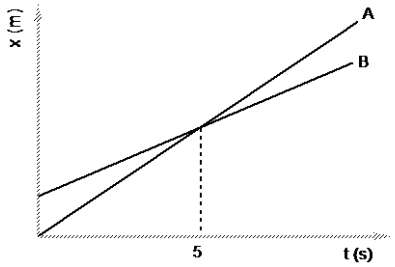


Find any error(s) and correct them. Explain what, if anything, is wrongs with Student A's motion map and how you corrected the error(s).

b) Determine the average velocity of object B. Show all work.

c) Determine the position at t = 10 s for object B. Show all work or explain your answer.

2. Consider the position vs. time graph below for cyclists A and B.



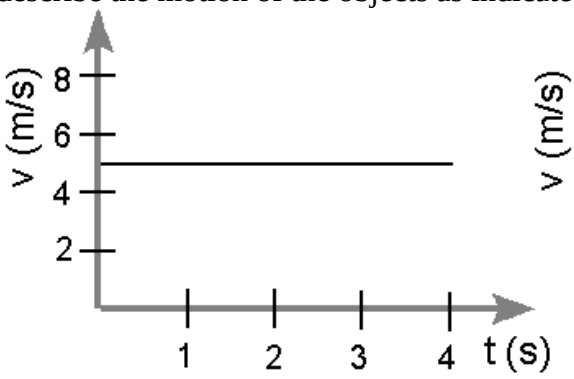
a. Do the cyclists start at the same point? How do you know? If not, which is ahead?

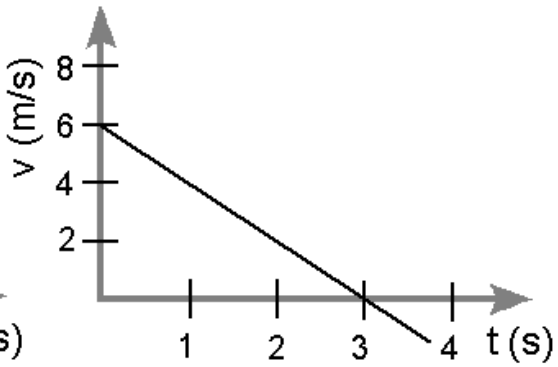
b. At t= 7s, which cyclist is ahead? How do you know?

c. Which cyclist is travelling faster at t = 3s? How do you know?

d. Are their velocities equal at any time? How do you know?

3. The velocity vs time graphs for two objects are shown below. Use the graphs to describe the motion of the objects as indicated.





	Object A	Object B
Determine the displacement for the first 3s. Show work!		
Determine the average velocity for the first 3s. Show work!		
Give a written description of the motion.		
Sketch a motion map. Be sure to include both velocity and acceleration vectors.		

4. An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until is finally lifts off the ground. Determine the distance traveled before takeoff.

5. A car starts from rest and accelerates uniformly over a time of 5.21 seconds for a distance of 110 m. Determine the acceleration of the car.

6. Upton Chuck is riding the Giant Drop at Great America. If Upton free falls for 2.6 seconds, what will be his final velocity and how far will he fall?

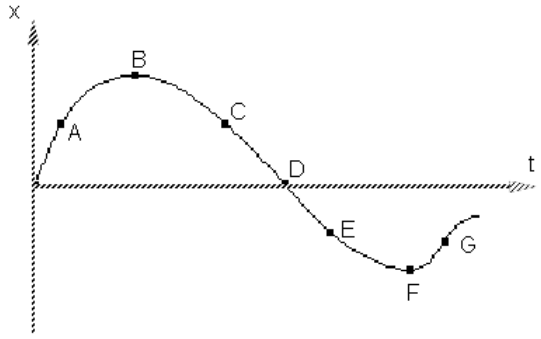
7. A car travels at a speed of 10 m/s for 5 seconds and then speeds up to 15 m/s in the next 5 seconds.

a. Draw a Quantative v-t graph for the above problem.

b. Find the acceleration of the car? Show work

c. What is the distance travelled by the car? Show work

8. The graph below represents the motion of an object.

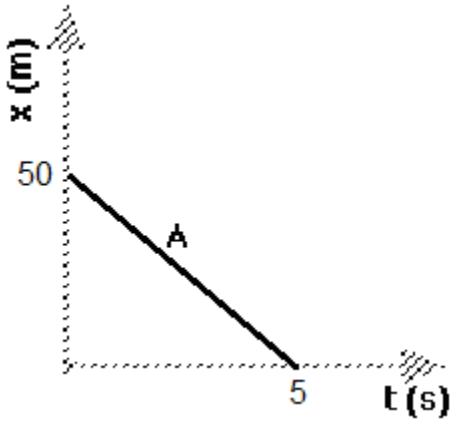


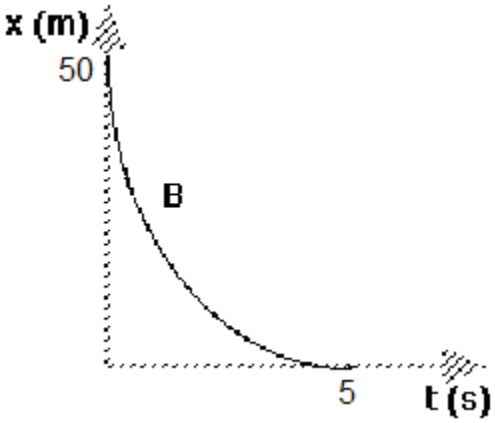
a. At what point(s) on the graph above is the object moving most slowly? (How do you know?)

b. Over what intervals on the graph above is the object speeding up? (How do you know?)

c. Over what intervals on the graph above is the object slowing down? (How do you know?)

9. Consider the **position vs time graph** for objects A and B below.





a. How does the motion of object A differ from that of object B?

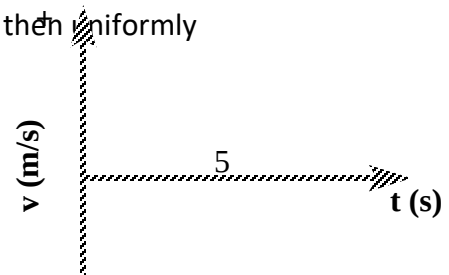
b.Which object, A or B, has **travelled a greater distance** in 5 seconds? Or have they traveled the same amount? Please include evidence from the graph to back up your claim.

c. Which object, A or B is **travelling faster** at 5 seconds? Or are they travelling the same speed at 5 seconds? Please include evidence from the graph to back up your claim.

d. Which object, A or B, has **the greatest average velocity** during 5 seconds? Or do have they t the same average velocity during the 5 seconds? Please include evidence from the graph to back up your claim.

0. A physics student skis down a hill, accelerating at a constant 4.0 m/s^2.
If it takes her 10 s to reach the bottom, what is the length of the slope?

11. A dog runs down his driveway with an initial speed of 6 m/s for 5 s, then uniformly increases his speed to 5 m/s in 10 s.



a) What was his acceleration during the 2nd part of the motion?

b. How long is the driveway?

12. A block weighing 300. N is moved *at constant speed* over a horizontal surface by a force of 50. N applied parallel to the surface.

a. Construct a force diagram for the block.

b. What is the coefficient of kinetic friction?

c. What would be the acceleration of the block if $\mu_k = 0$?

13. A 100. N force is applied to a 50. kg crate resting on a level floor. The coefficient of kinetic friction is 0.15.

a. Draw a force diagram to represent this situation.

b. What is the acceleration of the crate?

14. A 4600 kg helicopter starts from rest and **accelerates** upward at 2.0 m/s^2.

a. Draw a labeled FBD for the helicopter.

b. What is the F(earth → helicopter)? Show work.

c. What is the F (air → helicopter)? Show work.

15. A student, standing on a scale in an elevator at rest, sees that his weight is 840 N. As the elevator rises, his scale increases to 1050 N. Draw a motion map for the student during his elevator ride in the left margin. Determine the student's acceleration.

16. when the elevator from the previous problem slows to a stop at the 10th floor, the same student sees that his weight drops to 588 N.

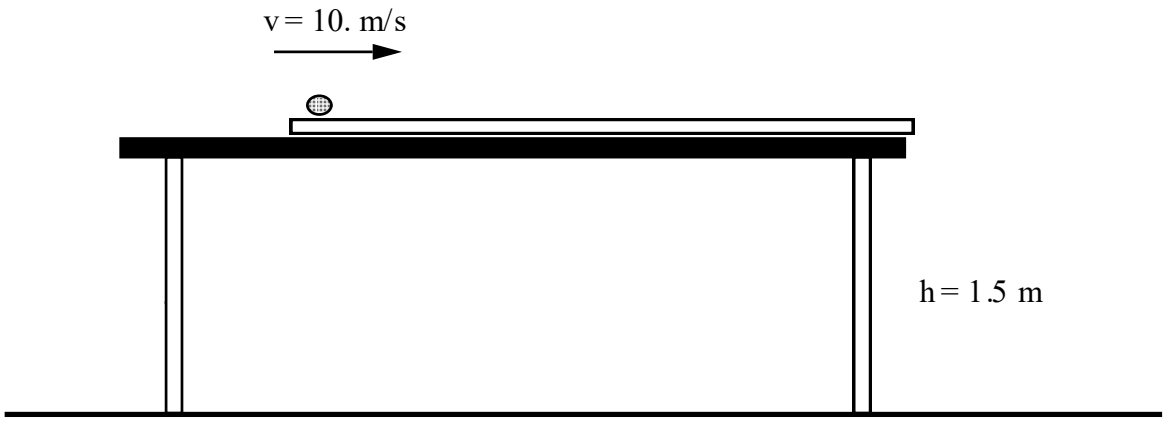
a. Determine the student's acceleration.

17. A 100kg crate is pushed with a 1000N Force. The force of sliding friction acting on the crate is 450N. How fast will the crate be moving after 20 seconds? How far will it have moved in this time?

Draw a diagram FBD. Consider the forces (if applicable): • Fearth→object (determine from the mass if necessary) • Fsurface→object (friction) • Applied force or thrust • Fstring→object (tension) • Fground→object (normal)
Determine the net force (Fnet or ΣF) (this will be along the direction of motion)
List the mass of the object with units (or determine from weight if necessary) m=_____

Use Newton's Second Law to find acceleration • Write equation • Substitute values with units • Calculate values with units
Use Kinematics to find "how far" or "how fast" or both the object travels. • Write equation(s) • Substitute values with units • Calculate values with units

18. Given the following situation of a marble in motion on a rail with negligible F_{drag}:



a. Sketch a motion map showing the motion of the marble after it leaves the rail. You may show both horizontal and vertical velocity vectors on each dot.

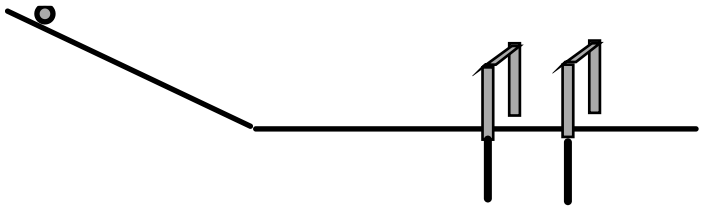
b. Sketch and label force diagrams for the marble both when it is on the rail and off the rail.

c. Determine the horizontal range of the marble as it falls to the floor. Explain your method for solving this problem.

19. Suppose that an airplane flying 60 m/s, at a height of 320m, dropped a sack of flour. How far from the point of release would the sack have traveled when it struck the ground?

20.In many locations, old abandoned stone quarries have become filled with water once excavating has been completed. While standing on a quarry wall, a boy tosses a piece of granite into the water below. If he throws the ball horizontally with a velocity of 3.0 m/s, and it strikes the water 4.5 m away, how high above the water is the wall?

21.Sam drops her bowling ball out the car window 1.25 m above the ground while traveling along the highway at 30 m/s. How far, horizontally, from the initial dropping point will the ball hit the ground? If the car continues to travel at the same speed, where will the car be in relation to the ball when it lands?

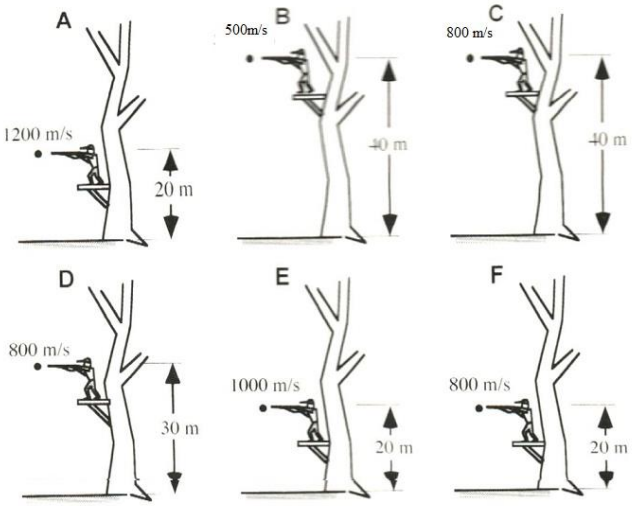


22. A student finds that it takes 0.20s for a ball to pass through a set distance of 0.3 m apart on a level ramp. The end of the ramp is 0.92 m above the floor.

Where a coin should be placed so that the ball strikes it directly on impact with the ground?

23. Six figures below show rifles that are fired horizontally off platforms. The bullets fired from the rifles are all identical, but the rifles propel the bullets at different speeds. The initial velocity and height of the platform are given. All of the bullets miss the targets and hit the ground.

Rank these bullets, from longest to shortest; on the basis of how long it takes the bullet to hit the ground.



Rank the bullets from longest time to shortest time.

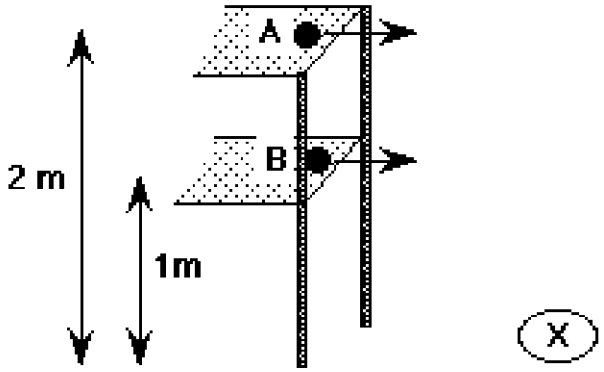
Longest time _____ _____ _____ _____ _____ _____ Shortest time

Or, all the bullets have the same time but not zero. _____

Or, the time of all these cases is zero. _____

Briefly explain your reasoning:

24. The next **two** questions refer to the diagram and situation described below:



Two spheres of equal mass A and B are projected at the **same horizontal velocity** off the edge of two different height shelves. Sphere A leaves from a height of 2.0 m. Sphere B leaves a shelf 1.0 m off the floor.

__a. If both spheres leave the edge of the table at the same instant, sphere A will land
a. at some time before sphere B.
b. at some time after sphere B.
c. at the same time as sphere B.
d. There is not enough information to decide.

__b. If both spheres leave the edge of the table at the same instant, sphere A hits the floor at the spot marked X. Sphere B will hit the floor
a. at some point between the edge of the table and X.
b. at the same distance from the table as X.
c. at some point past X.
d. There is not enough information to decide.

25. A 1000-kg car moving at 20 m/s takes a turn around a circle with a radius of 10.0 m.

a.Draw the FBD for the car?

b.Pick any two points on the circle and draw the velocity components.

c. Determine the acceleration and the net force acting upon the car?

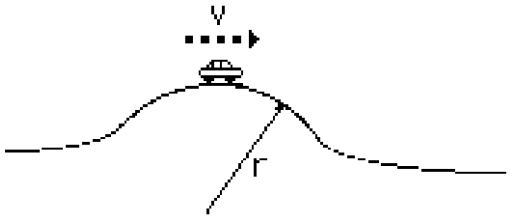
26.A 100-kg fullback makes a turn on the football field. The fullback sweeps out a path that is a portion of a circle with a radius of 10-meters. The fullback makes a **half of a turn** around the circle in 5.0 seconds. A. Determine the speed?

b. Determine the acceleration?

c. Determine net force acting upon the halfback?

27. .

a. Construct a qualitative motion map of the car by placing dots on the road.



b. In what direction is the car experiencing an acceleration Explain how you know.

c. Construct a qualitative force diagram for the car when it's at the top of the hill. (Justify the relative forces in your force diagram.) Explain if you feel heavier or lighter in this situation and how you know this from the Free-body diagram you drew.

d. Suppose the speed of the car is 10 m/s and the radius of curvature (r) is 25 m; determine the magnitude of the centripetal acceleration (a_c) of the car.

e. If the mass of the car is 1000 kg, what $F_{net\text{-}c}$ would be required to cause this a_c?

f. Place quantitative force values on the forces you drew in part c.

g.

h. At what speed would the centripetal force equal the force of gravity?

28. The maximum speed with which a 400-kg car makes a 180-degree turn is 5.0 m/s. The radius of the circle through which the car is turning is 10.0 m.

a. Draw a free body diagram?

b. Show the velocity and the acceleration vectors for the car?

c. Determine the normal force on the object?

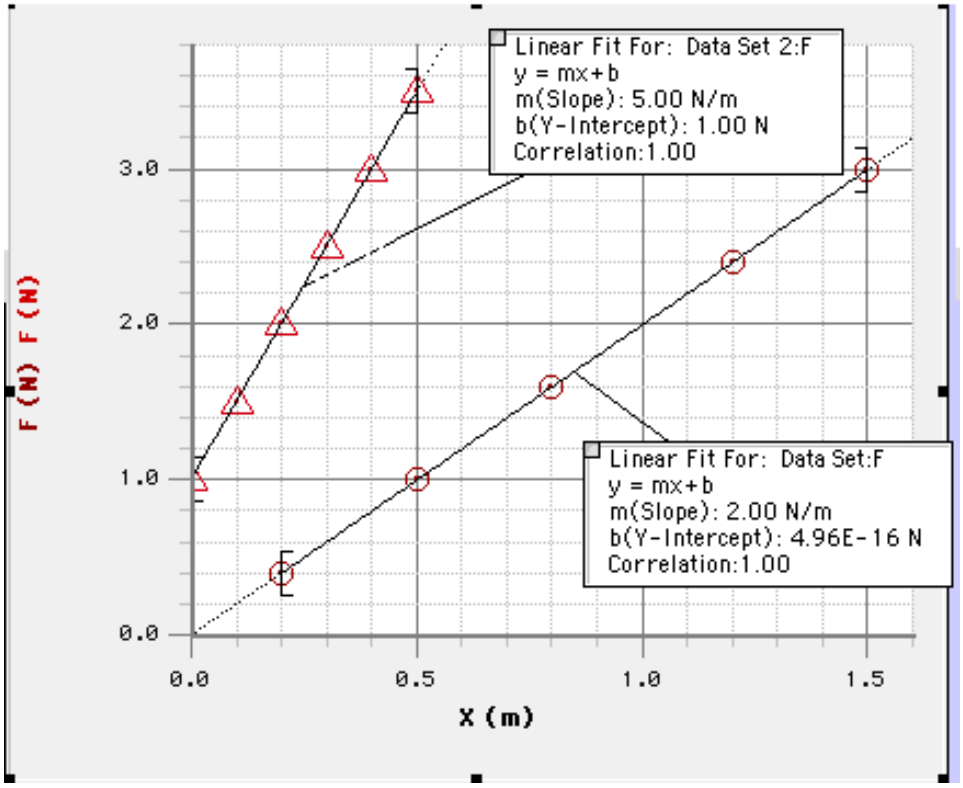
d. Determine the Centripetal force(FnetC)?

e. Can we say that the FnetC is the frictional force? Explain.

f. Determine the coefficient of friction acting upon the car.

29. A vine is just strong enough to support Tarzan when he is hanging straight down and motionless. However, when he tries to swing from tree to tree, the same vine breaks at the bottom of the swing. How could this happen?

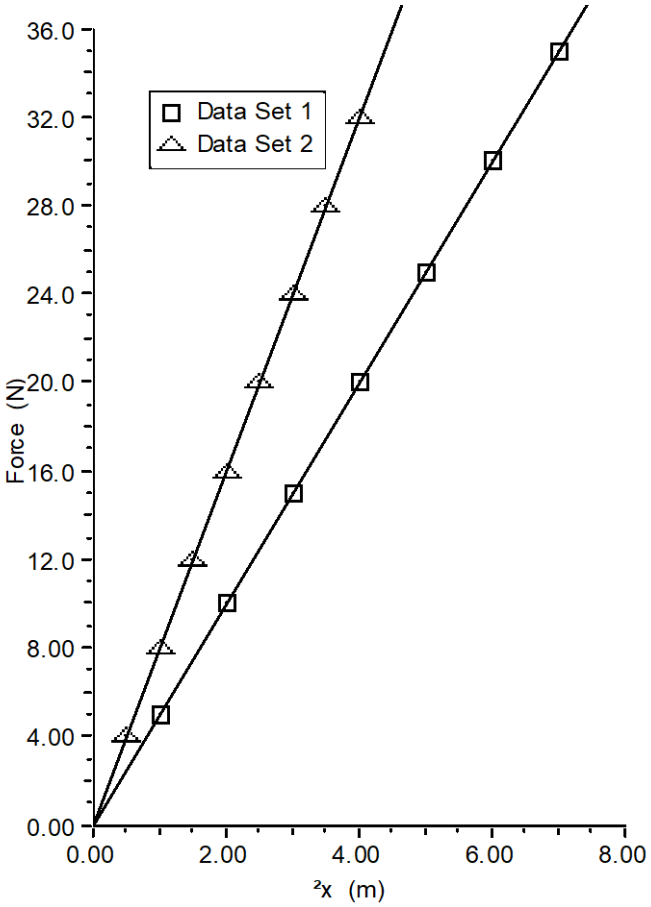
30. Consider the graph below.



a.Write the equation that describes the relationship between the force and the stretch of **spring 2**.

b.Write a clear, English sentence that describes the significance of the y-intercept for the above equation.

c.Write a clear, English sentence that describes in layperson terms how spring 1 differs from
spring 2.



31.
The graph at left was made from data collected during an investigation of the relationship between the amount two different springs stretched, when different forces were applied.

a. For each spring determine the spring constant.

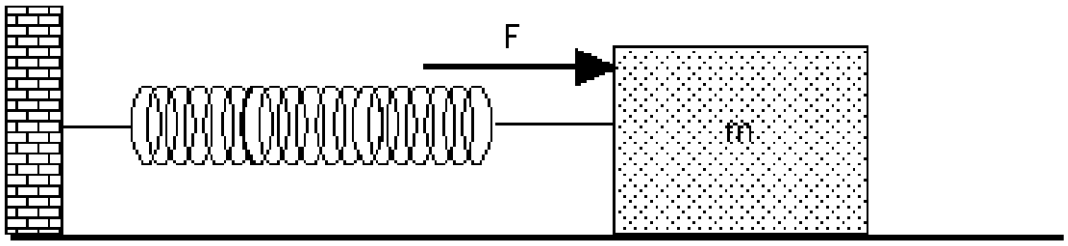
. For each spring, compare

b. the amount of force required to stretch the spring 3.0 m.

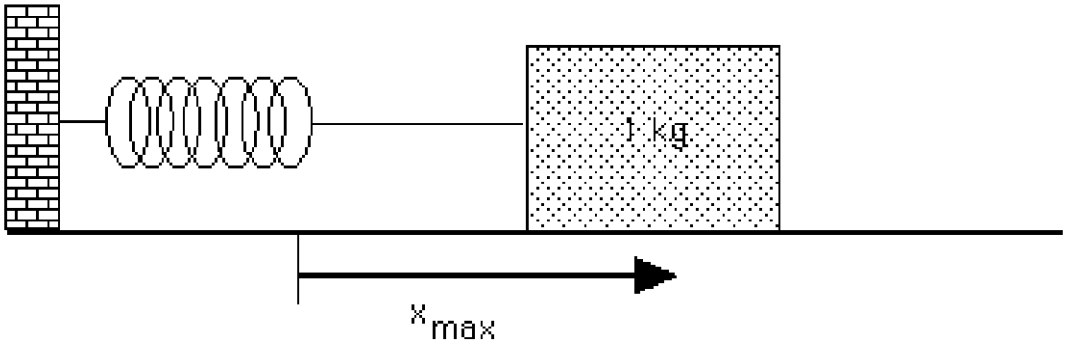
c. the E_{el} stored in each spring when stretched 3.0 m.

32. Determine the amount that spring 2 needs to be stretched in order to store 54 joules of energy.

33. The spring below has a spring constant of 10. N/m. If the block is pulled 0.30 m horizontally to the right, and held motionless, what force does the spring exert on the block? Sketch a force diagram for the mass as you hold it still. (Assume a frictionless surface.)



34. The spring below has a spring constant of 40. N/m. The μ_s between the box and the surface is 0.40.



a. The box is pushed to the right, then released. Draw a force diagram for the box above when the spring is stretched, yet the box is stationary.

b. What is the maximum distance that the spring can be stretched from equilibrium before the box begins to slide back?

35. An 800 kg hiker climbs Mt. Humphrey near Flagstaff. During a two hour period, the hiker's vertical elevation increases by 1540 meters.

a. Calculate the climber's ΔE_g.

b. Find the power generated to increase the hiker's E_g.

36.
A baseball (mass= 140 grams) travelling 35 m/s moves a fielder's glove backward 25 cm when the ball is caught. What is the average force exerted by the ball on the glove?

(ANSWER: 3.4×10^2N in the direction of motion of the ball)

37. A 55 kg hiker starts at an elevation of 1600 meters and climbs to the top of a 3100 m peak.

a. What is the hiker's change in potential energy?
b. What is the minimum work required of the hiker?
c. Can the actual work done be more than this ? Explain why.

ANS: a . 8.1×10^5J , b. 8.1×10^5 J, Yes

38. Jane, looking for Tarzan, is running at top speed(5.6 m/s) and grabs a vine hanging vertically from tall tree in the jungle. How high can she swing upward? Does the length of the vine (or rope) affect your answer

39. A 1000 kg car is traveling at a constant speed of 30 m/s.

a. How much energy is dissipated as the car comes to rest?

b. If the car stops in 100 meters, what is the average force applied to the car?

40. A 1.5 kg kitten jumps down from a 2.0 meter high fence.

a. What is the kitten's E_g?

b. What will be the kitten's speed when it reaches the ground?

41. A 50. g dart rests up against a spring that has been compressed 0.050 meters.

a. If 1.25 J of work were required to compress the spring, what is its spring constant?

b. What is the maximum velocity of the dart after the spring has transferred its energy to it?

c. If the dart were fired vertically, what height would it reach?

d. Draw an energy bar graph for the above situation when the dart reaches a height of 1 m. Include a graph for both the initial (y = 0m) and final states.

42. A Aston Rama and Ferrari Bulu cars are initially at rest on a horizontal parking lot at an edge of a steep cliff. Just for the heck of it, we assume that the Ferrari Bulu has thrice the mass as Aston Rama. Equal constant forces are applied to each car and they accelerate across equal distances (Let ignore friction). When they reach the far end of the lot the force is suddenly removed, whereupon they fly through the air and crash to the ground below. (DON'T worry the cars are insured and everyone is safe, NO ANIMALS were Injured during the experiment).

Answer the following questions and explain using the concepts you have learned

a.Which car has the greatest acceleration?

b.Which car spends more time along the surface of the lot?

c.Which car is moving faster when it reaches the edge of the cliff?

d.Which car has the largest impulse imparted to it by the applied force?

e.Which car has the greatest change in momentum at the edge of the cliff?

f.Which car has the greatest work done on it by the applied force? (Hint: Defend your answer based on the distance travelled).

g. Which car has the greater kinetic energy at the edge of the cliff? Does your answer follow from your explanation of Q6? Does it contradict your answer to 4?

h.Which car spends more quality time in air, from the edge of the cliff to the ground below?

i.Which car will land farther horizontally from the edge of the cliff onto the ground below?

43. A 65 kg person throws a 0.0450 kg snowball forward with a speed of 30 m/s. A second person, with a mass of 60.0kg, catches the snowball. Both people are on skates. The first person is initially moving forward with a speed of 2.50 m/s and the second person is initially at rest.

a. What are the velocities of the two people after the snowball is exchanged? Disregard the friction between the skates and the ice.

44. A raft of mass 180 kg carries two swimmers of mass 50. kg and 80. kg. The raft is initially floating at rest. The two swimmers simultaneously dive off opposite ends of the raft, each with a horizontal velocity of 3 m/s. With what velocity and in what direction does the raft start to move?

45. Discuss the following in terms of impulse and momentum:

a. Why are padded dashboards safer in automobiles?

b. Why are nylon ropes, which stretch considerably under stress, favored by mountain climbers?

c. Why is it preferred that railroad cars be loosely coupled with slack between cars?

46. If you throw a ball horizontally while standing on roller skates, you roll backwards. Will you roll backwards if you go through the motions of throwing the ball, but hold on to it instead? Explain your reasoning.

47. Why is it difficult for a fire-fighter to hold a hose that ejects large amounts of high-speed water?

48. If a Mack truck and a Geo traveling at equal speeds have a head-on collision, which vehicle will experience the greatest force of impact?

Which will experience the greatest change in momentum?

Which will experience the greatest acceleration?

49. The following data as collected by set of hardworking students. The plan is to find the spring constant. Before plotting the graph decide what quantities must be used to get spring constant.

Mass(g)	**Displacement (cm)**
20	2
40	4
60	6

80	8

1. Plot the data and figure out the spring constant?

   (NEED to add graph)

2. If the mass is increases to 160grams, what will be the new displacement?

3. If the displacement is 10 cm, what will be the weight of the object?