AP PHYSICS 1 - REVIEW
FRICTION, DRAG AND ELASTICITY

1.   Be able to define:

Normal Force, Static Friction, Kinetic Friction, Coefficient of Static and Kinetic Friction,
Hooke's Law, Restoring Force, Spring Constant, microwelds

2.   How is the coefficient of static friction measured and what does it describe? What are the
units?

3.   What is the relationship between Fn and friction?

4.   An empty wooden crate is slid across a warehouse floor. If the crate were filled, what
would happen to the coefficient of kinetic friction between the crate and the floor.

5.   A 200-N sled of slides down a frictionless hillside that rises at 37° above the horizontal.
What is the magnitude of the force that the surface of the hill exerts on the sled? (160N)

6.   A block of mass m sits at rest on a rough inclined ramp that makes an angle θ with the
horizontal. What must be true about normal force F on the block due to the ramp?($F = mg \cos \theta$)

7. Two objects have masses m and $5m$, respectively. They both are placed side by side on a
frictionless inclined ramp and allowed to slide down from rest without any air resistance. Which
one of the following statements about these objects is correct?

8. A 55-kg box rests on a horizontal surface. The coefficient of static friction between the box
and the surface is 0.30. A horizontal 140-N force is applied to the box. What is the friction force
on the box?

9) A horizontal 52-N force is needed to slide a 50-kg box across a flat surface at a constant
velocity of 3.5 m/s. What is the coefficient of kinetic friction between the box and the floor?

10) In a shuffleboard game, the puck slides a total of 12 m on a horizontal surface before coming
to rest. If the coefficient of kinetic friction between the puck and board is 0.10, what was the
initial speed of the puck?

11) A driver in a 1000-kg car traveling at 24 m/s slams on the brakes and skids to a stop. If the coefficient of friction between the tires and the level road is 0.80, how long will the skid marks be?

12) A flatbed truck is carrying a 20.0-kg crate along a level road. The coefficient of static friction between the crate and the bed is 0.400, and the coefficient of kinetic friction is 0.300. What is the maximum acceleration that the truck can have if the crate is to stay in place relative to the truck?

13. Jason takes off across level water on his jet-powered skis. The combined mass of Jason and his skis is 75 kg (the mass of the fuel is negligible). The skis produce a forward thrust of 200 N and have a coefficient of kinetic friction with water of 0.10. Unfortunately, the skis run out of fuel after only 90 s. What is Jason's top speed?

14.

7. Consider the 65.0-kg ice skater being pushed by two others shown in Figure 5.21. (a) Find the direction and magnitude of $\mathbf{F}_{tot}$, the total force exerted on her by the others, given that the magnitudes F_1 and F_2 are 26.4 N and 18.6 N, respectively. (b) What is her initial acceleration if she is initially stationary and wearing steel-bladed skates that point in the direction of $\mathbf{F}_{tot}$? (c) What is her acceleration assuming she is already moving in the direction of $\mathbf{F}_{tot}$? (Remember that friction always acts in the direction opposite that of motion or attempted motion between surfaces in contact.)
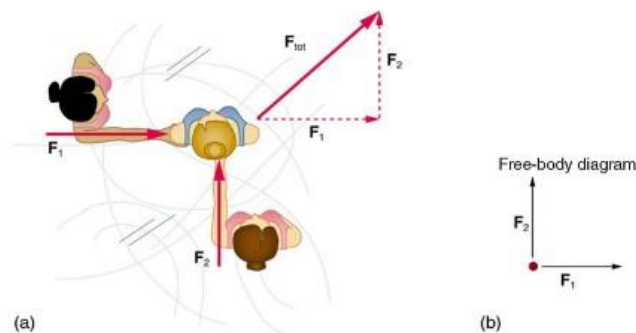

Figure 5.21

15. When graphing Force and Displacement in the lab regarding Hooke's Law, what did the slope of the graph represent?

16. Describe the relationship between Potential Energy of a Spring and the Kinetic Energy of a Spring?

17. A team of eight dogs pulls a sled with waxed wood runners on wet snow (mush!). The dogs have average masses of 19.0 kg, and the loaded sled with its rider has a mass of 210 kg. (a) Calculate the magnitude of the acceleration starting from rest if each dog exerts an average force of 185 N backward on the snow. (b) What is the magnitude of the acceleration once the sled starts to move? (c) For both situations, calculate the magnitude of the force in the coupling between the dogs and the sled. (μs = .14, μk = .10)

18. What is the spring constant of a spring that stretches 24 cm when an object weighing 48 N is hung from it?

19. A trampoline has a spring constant of 3430 N/m. How far will the trampoline sink when a 80 kg person steps on it?

20. A force of 400 N stretches a spring 60 cm. What is the spring constant of the spring? How far would this spring stretch with a force of 200 N applied to it?

21. A 60 kg box is attached to a compressed spring that has a spring constant of 667 N/m. The box is resting on a frictionless surface and the spring is compressed 60 cm.
a. What is the U_s of the spring?
b. What will be the K of the box when the spring expands back to its natural length?
c. How fast will the box be moving after the spring releases the box?

22. A spring has a spring constant of 256 N/m. How far must it be stretched to give it an elastic potential energy of 48 J?

23. . A toy rocket-launcher contains a spring with a spring constant of 35 N/m. How much must the spring be compressed to store 1.5 J of energy?

24. . Each of the coil springs of a car has a spring constant of 25,000 N/m. How much is each spring compressed if it supports one-forth of the car's 12,000 N weight?