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PRACTICAL PHYSICS

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According to the *conservation-of-energy principle,* energy can be neither created nor destroyed, only transformed.

Kinetic energy is energy of motion.

$$KE = \frac{1}{2}\frac{W}{g}v^2$$

Potential energy is energy of position or configuration.

QUESTIONS AND PROBLEMS

1. A force of 155 lb is required to start a sled whose weight is 800 lb, while a force of 54 lb is sufficient to keep it moving once it is started. Find the coefficients of starting and sliding friction.

2. A 500-lb piano is moved 20 ft across a floor by a horizontal force of 75 lb. Find the coefficient of friction and the amount of work accomplished. What happens to the energy expended? *Ans.* 0.15; $1,\bar{5}00$ ft-lb.

3. How much work does a 160-lb man do against gravity in climbing a flight of stairs between floors 12 ft apart? Does this account for all of the energy expended?

4. Find the work done in removing 300 gal of water from a coal mine 400 ft deep. *Ans.* $1,0\bar{0}0,000$ ft-lb, or 1.00×10^6 ft-lb.

5. What is the kinetic energy of a 2,000-lb automobile moving 30 mi/hr? How much heat is produced when it stops?

6. A horizontal force of 6.0 lb is applied to a 10-lb block, which rests on a horizontal surface. If the coefficient of friction is 0.40, find the acceleration. *Ans.* 6.4 ft/sec^2.

7. From how high must a piece of ice be dropped in order to be just melted by friction and the heat of impact?

8. The heat of combustion of canned salmon is 363 Btu/lb. Assuming 30 per cent of this heat is useful in producing bodily energy, how much canned salmon should you eat to lift yourself 100 ft? *Ans.* 0.0012 times your weight.

9. A 100-lb stone is dropped from a height of 200 ft. Find its kinetic and potential energies at 0, 1, and 2 sec after being released, and also upon striking the ground. Notice that the sum of the potential and kinetic energies is constant.

EXPERIMENT

Friction

Apparatus: Friction board; pulley; cord; friction blocks; weights; weight hanger; glass plate; oil.

This experiment is intended to show that (1) the starting frictional force between two solid surfaces is greater than the sliding frictional force; (2) the latter is independent of speed, provided the speed is not excessive; (3) the frictional force depends upon how hard the surfaces are pushed together, that is, upon the perpendicular force between them; (4) it depends upon the nature and condition of the surface; (5) it is nearly independent of the area of the surfaces, unless they are so small as to approximate points or sharp edges. Also we shall observe the effects of wet surfaces, oily surfaces, etc., upon frictional forces.

Use will be made of friction blocks of different materials, on a friction board. Each block has holes to receive weights, and hooks to which cords may be attached. The board upon which the block slides is rather rough on one side, and smoothly sandpapered on the other. Figure 4 illustrates the experimental setup.

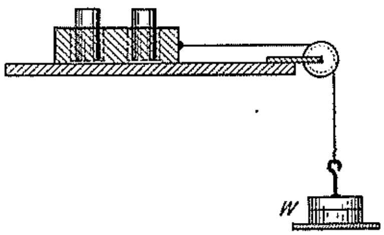

FIG. 4.—Apparatus for measuring coefficient of friction.

To obtain the coefficient of *starting friction*, place slotted weights upon the weight holder until the force F is just sufficient to start the block. Record the values of F and the normal force N, and compute the coefficient of starting friction. Repeat this procedure for (*a*) a different normal force, (*b*) a different friction block, (*c*) the other side of the friction board. Record the data in Table II. How does the frictional force F depend upon N? How does it depend upon the condition of the surfaces? How does the coefficient of friction μ depend upon these factors?

TABLE II

Weight of block, B = ______
Weight of weight holder, F_1 = ______

Load on block, L	$L + B = N$	Load on weight holder, F_2	$F_1 + F_2 = F$	Coefficient $\mu = F/N$

To obtain the coefficient of sliding friction, place slotted weights upon the weight hanger until the block will move uniformly after one starts it. Record as before, using a separate table labeled "sliding friction." Compare F and μ with the values obtained for starting friction.

Repeat this procedure for a different face of the block and compare the results with those previously obtained.

Determine the coefficients of sliding friction for rubber on dry glass, on wet glass, and on glass covered with a thin film of oil. Compare the results.