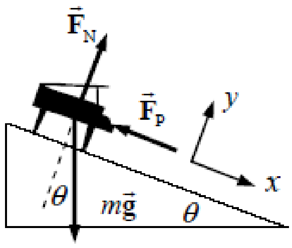
ÇANKAYA UNIVERSITY
PHYS 131 – PHYSICS I

CHAPTER VII
KINETIC ENERGY AND WORK

PROBLEM SET

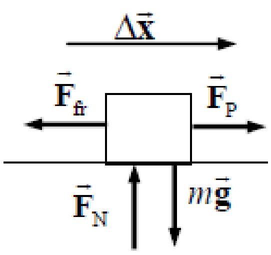
1) A box of mass 6.0 kg is accelerated from rest by a force across a floor at a rate of $2.0\ \mathrm{m/s^2}$ for 7.0 s. Find the net work done on the box. **[Answer: 590 J]**

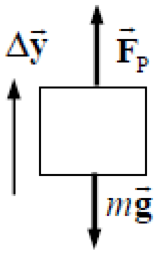
2) A 380-kg piano slides 3.9 m down a 27° incline and is kept from accelerating by a man who is pushing back on it *parallel to the incline* (Fig. 7–21). Determine: (*a*) the force exerted by the man, (*b*) the work done by the man on the piano, (*c*) the work done by the force of gravity, and (*d*) the net work done on the piano. Ignore friction. **[Answer: a) 1700 N, b) -6600 J, c) 6600 J, d) 0 J]**



3) *** A gondola can carry 20 skiers, with a total mass of up to 2250 kg. The gondola ascends at a constant speed from the base of a mountain, at 2150 m, to the summit at 3345 m. (*a*) How much work does the motor do in moving a full gondola up the mountain? (*b*) How much work does gravity do on the gondola? (*c*) If the motor is capable of generating 10% more work than found in (*a*), what is the acceleration of the gondola? **[Answer: a) 2.63×10^7 J, b) -2.63×10^7 J, c) $0.98\ \mathrm{m/s^2}$]**

4) A 2200-N crate rests on the floor. How much work is required to move it at constant speed (*a*) 4.0 m along the floor against a drag force of 230 N, and (*b*) 4.0 m vertically?**[Answer: a) 920 J, b) 8800 J]**



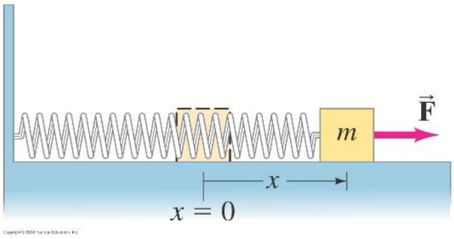


5) *** The force needed to hold a particular spring compressed an amount *x* from its normal length is given by $F = kx + ax^3 + bx^4$. How much work must be done to compress it by an amount *X*, starting from $x = 0$? **[Answer: expression below]**

$$\tfrac{1}{2}kX^2 + \tfrac{1}{4}aX^4 + \tfrac{1}{5}bX^5$$

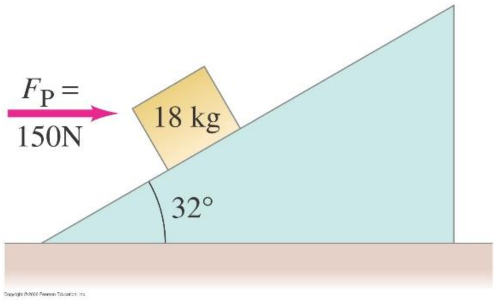
6) A mass m is attached to a spring which is held stretched a distance x by a force F (Fig. 7–28), and then released. The spring compresses, pulling the mass. Assuming there is no friction, determine the speed of the mass m when the spring returns: (a) to its normal length $(x=0)$; (b) to half its original extension ($x/2$).

[Answer: a) $v_f = \boxed{\sqrt{\frac{Fx}{m}}}$ **b)** $v_f = \boxed{\sqrt{\frac{3Fx}{4m}}}$ **]**



7) *** (a) How much work is done by the horizontal force $F_P = 150\ \text{N}$ on the 18-kg block of Fig. 7–29 when the force pushes the block 5.0 m up along the 32° frictionless incline? (b) How much work is done by the gravitational force on the block during this displacement? (c) How much work is done by the normal force? (d) What is the speed of the block (assume that it is zero initially) after this displacement? [*Hint*: Work-energy involves *net* work done.]

[Answer: a) 640 J, b) -470 J, c) 0, d) 4.3 m/s]



8) An 85-kg football player traveling $5.0\ \text{m/s}$ is stopped in 1.0 s by a tackler. (a) What is the original kinetic energy of the player? (b) What average power is required to stop him?

[Answer: a) 1100 J, b) 1100 W]

9) A 1400-kg sports car accelerates from rest to 95 km/h in 7.4 s. What is the average power delivered by the engine? **[Answer: 6.6×10^4 W]**

10) A ski area claims that its lifts can move 47,000 people per hour. If the average lift carries people about 200 m (vertically) higher, estimate the maximum total power needed. (We assume the mass of the average person to be 70 kg.)**[Answer: 2×10^6 W]**