1. If a Saturn V rocket with an Apollo spacecraft has a combined mass of 2.9 x 10^5 kg and is to reach a speed of 11.2 km/sec, how much kinetic energy will it have?

2. If an electron in copper at the lowest possible temperature has a kinetic energy of 6.7 x 10^{-19} J, what is its speed?

3. Calculate the kinetic energies at the following speeds: A) a 110 kg linebacker running at 8.1 m/sec B) 1 4.2 gm bullet moving at 950 m/sec ?

4. On August 10, 1972, a large meteorite skipped across the atmosphere, much like a stone skipping across water. The accompanying fireball was so bright, it could be seen in the nighttime sky. The meteor's mass was about 4 x 10^6 kg, and its speed was about 15 km/sec. Had it entered the atmosphere vertically, it would have hit at the same speed. A) Calculate the kinetic energy associated with the meteor. B) Express the energy as a multiple of the explosive energy of 1 megaton of TNT, which is 4.2 x 10^{15} J. C) The energy associated with the atomic bomb explosion over Hiroshima was equivalent to 13 kilotons of TNT. How many "Hiroshima bombs: would the meteorite impact been equivalent to?

5. A proton is being accelerated a straight line at 3.6 x 10^{15} m/sec^{2}in a machine called a linear accelerator. If the proton has an initial speed of 2.4 x 10^7m/sec and travels 3.5 cm, then what is its speed and what is its gain in kinetic energy (in eV)?

6. To pull a 50 kg crate across a frictionless floor, a worker applies a force of 210 N, directed 20 degrees above the horizontal. As the crate moves 3 m, what work is done by the crate?

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7. An initially stationary proton is accelerated in a cyclotron to a final speed of 3.0 x 10^6 m/sec. How much work is done on the proton?

8. The loaded cab of an elevator has a mass of 3.0 x 10^3 kg and moves 210 m up the shaft in 23 sec at constant speed. What is the power in the motor in watts and horsepower?

9. A horse pulls a cart with a force of 40 lb at an angle of 30 degrees above the horizontal and moves along at a speed of 6 MPH. A) How much work does the force do in 10 min? B) What is the average power (in horsepower) of the horse?

10. A child of mass, m, is released from rest at the top of a water slide, height 8.5 m above the bottom of the slide. Assuming the slide is frictionless, find the child's speed at the bottom.

11. A circus beagle of mass 6 kg runs onto a curved ramp with a speed of 7.8 m/sec at a height of 8.5 m. It slides to the right a comes to a momentary stop 11.1 m above the floor. What is the energy is lost to heat from the beagle sliding?

12. The area of the continental US is about 8 x 10^6 km^2, and the average elevation is about 500 m above sea level. The average yearly rainfall is 75 cm. Two thirds of this is evaporated; the remaining third runs back into the ocean. If the runoff could be converted into electric energy, how much would it be? What is the average power generated? 1 cubic meter of water has a mass of 1000 kg.

13. A 70 kg baseball player steals home by sliding into the plate with an initial speed of 10 m/sec; he comes to rest in 2 m A) how much kinetic energy is dissipated by the frictional force stopping him B) what is the change in thermal energy? C) What is the force that stopped him?

14. Spacecraft Voyager 2, mass 1.0 x 10^8 kg approaches the planet Jupiter with a speed of 12 km/sec. The spacecraft rounds the planet and departs in the opposite direction with a sling shot effect. This encounter can be analyzed as an elastic collision. Jupiter's orbital speed before the encounter is 12 km/sec. What is the spacecraft's final speed? What is Jupiter's final speed?