

Pole Vaulting

Make a reasoned approximate estimate of the height a “pole-vaulter” could succeed in obtaining.

Answer

A pole-vaulter converts kinetic energy into gravitational potential energy. Let us assume that the pole-vaulter can run at a speed of $v=10$ m/s and that the kinetic energy is converted with 100% efficiency to gravitational potential energy. We can use conservation of energy

$$(1/2) mv^2 = mgh$$

Which gives $h=5$ m.

There are many additional factors, such as the work done by the athlete's legs and arms, the fact that the initial height for the centre of mass above the ground is about 1 m and the athlete's centre of mass can be slightly lower than the height of the bar. On the other hand, the efficiency of energy conversion will not be 100%.