Ex : A rocket is launched from Cape Canaveral. What is the minimum speed it must have to escape from the Earth, i.e. so it does not fall back to the Earth after launch?

◦ From conservation of mechanical energy we can write:

$$K_i + U_i = K_f + U_f$$

Let t_i be the time right after rocket launch, and let t_∞ be the time at some point infinitely far away. In this case:

$$K_\infty = 0 \qquad U_\infty = 0$$

Thus $\quad K_i + U_i = 0$

$$K_i = \frac{1}{2} M_r V_r^2$$

$$U_i = -G\frac{M_E M_r}{r_E}$$

So, we can now solve for the rocket's velocity.

$$V_r = \sqrt{\frac{2\ GM_E}{r_E}} \qquad \textbf{The "escape speed"}$$

Some Escape Speeds			
Body	Mass (kg)	Radius (km)	Escape Speed (km/s)
Ceres (Massive Asteroid)	1.2×10^{21}	3.8×10^{2}	0.6
Earth's Moon	7.4×10^{22}	1.7×10^{3}	2.4
Earth	6.0×10^{24}	6.4×10^{3}	11.2
Jupiter	1.9×10^{27}	7.2×10^{4}	59.5
Neutron Star	2.0×10^{30}	1.0×10^{1}	200000