Answer on Question #41798 – Physics – Physics, Mechanics | Kinematics | Dynamics

1. A rocket is launched with velocity 10km/s. If radius of earth is R, then maximum height attained by it will be?

$v = 10^4 \frac{m}{s}$ $R = 6.37 \cdot 10^6\ m$	*Solution.* The maximum height attained by the rocket is determined by the law of conservation and transformation energy: the sum of the potential energy of the rocket (gravity energy) and its kinematic energy keeps constant.
$h - ?$	If the Earth's mass is *M*, then

$$-G\frac{mM}{R}+\frac{mv^2}{2}=-G\frac{mM}{R+h}.$$

The force of gravity at the surface of the Earth: $mg = G\frac{mM}{R^2}$.

One can find the height, at which the velocity equals to zero:

$$h=\frac{1}{\frac{1}{R}-\frac{v^2}{2GM}}-R,\quad \boxed{h=\frac{1}{\frac{2g}{v^2}-\frac{1}{R}}}.$$

Let check the dimension: $[h]=\dfrac{1}{\dfrac{\frac{m}{s^2}}{\left(\frac{m}{s}\right)^2}-\frac{1}{m}}=\dfrac{1}{\frac{1}{m}-\frac{1}{m}}=m.$

Let evaluate the quantity: $h=\dfrac{1}{\frac{2\cdot 9.81}{\left(10^4\right)^2}-\frac{1}{6.37\cdot 10^6}}=2.55\cdot 10^7\,(m).$

Answer: $2.55\cdot 10^4\ km$.