1) Planet Mars has 0.1 times the mass of Earth and half its radius. Find the escape speed from Mars' surface.

a) 5.0 m/s²
b) 10 m/s²
c) 4.6 m/s²
d) 3.2 m/s²
e) None of the above.

$$v_e^{(MARS)} = \sqrt{\frac{GM}{R}} = \sqrt{\frac{G(0.1)M_E}{R_E/2}}$$

$$= \sqrt{0.2}\sqrt{\frac{GM_E}{R_E}} = \sqrt{0.2}\, v_e^{(EARTH)}$$

$$= \sqrt{0.2}(11.2\ km/s) = 5.01\ km/s$$

We throw a 1 kg object with upward speed of 8 km/s. Neglecting air friction:

2) In terms of Earth's radius R_E, the maximum distance **from Earth's surface** reached by this object is:

a) R_E
b) $2.5R_E$
c) $5.6R_E$
d) $10R_E$
e) None of the above.

By CONSERVATION of ENERGY:

$$\frac{1}{2}m(8\ km/s)^2 - \frac{GM_E m}{R_E} = 0 - \frac{GM_E m}{R}$$

$$(8\ km/s)^2 - v_e^2 = -\left(\frac{2GM_E}{R}\right)\frac{R_E}{R_E} = -v_e^2\frac{R_E}{R}$$

$$-\frac{(8\ km/s)^2}{(11.2\ km/s)^2} + 1 = R_E/R \rightarrow R \simeq 2R_E$$

$$\rightarrow h \simeq R_E$$

3) As the object falls down, its speed right before impact is:

a) 2.5 km/s
b) 6.3 km/s
c) 4.9 km/s
d) 8.0 km/s
e) None of the above.

the SAME as the INITIAL SPEED.

4) The potential energy of this object on Earth's surface is:

a) -8.9×10^7 J
b) -6.3×10^7 J
c) -4.2×10^7 J
d) -3.1×10^7 J
e) None of the above

$$U = -\frac{GM_E m}{R_E} = -\frac{2GM_E}{R_E}\frac{m}{2}$$

$$= -v_e^2\frac{m}{2} = -(11200\ m/s)^2\,(1kg)/2$$