KEY

Gravity Practice – Version 1

1.) A cliff diver is on a $30.0\ m$ high cliff. With what velocity should they leave the cliff, (assume the person jumps out horizontally) in order to miss $8.0\ m$ of rock coming from the cliff's base?

Solve for time first. Solve for displacement second. $\vec{v}_x = +3.2\ \frac{m}{s}$

2.) A mountain goat butts you off a $50.0\ m$ high cliff with a horizontal velocity of $+3.0\frac{m}{s}$. How far from the base will you strike the ground?

Solve for time first. Solve for displacement second. $\vec{d}_x = +9.6\ m$

3.) A golfer strikes a ball giving it a velocity of $+35\frac{m}{s}$ at $35°$. If the course is completely flat how far will the ball travel before bouncing?

Solve for time first. Solve for displacement second. $\vec{d}_x = +1.2\ \times 10^2\ m$

4.) Use the information in #3 to find the maximum height to which the ball will rise.

Solve using $\vec{d}\ =\ \vec{v}_o t\ +\ \frac{1}{2}\vec{a}t^2$ but with only half time as this is the highest point. $\vec{d}_y = +21\ m$

5.) Two stars of a 'binary system' are $2.00 \times 10^{12}\ m$ apart, find the force of attraction between the stars if one has mass $2.0 \times 10^{30}\ kg$ and the other $6.0 \times 10^{31}\ kg$.

Answer - $\vec{F}_g\ =\ \frac{Gm_1m_2}{r^2}$ $\vec{F}_g\ =\ \frac{6.67\times10^{-11}(2.0\times10^{30})(6.0\times10^{31})}{(2.00\times10^{12})^2}$ $\vec{F}_g\ = 2.001 \times 10^{27}\ N$

$\vec{F}_g\ = 2.0 \times 10^{27}\ N$

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6.) Two masses are attracted by a gravitational force of $15\ N$. If they are identical mass and are $12\ m$ apart find the mass of each.

Answer - $\vec{F}_g = \frac{Gm_1m_2}{r^2}$ $15 = \frac{6.67\times10^{-11}(m)^2}{12^2}$ $m^2 = 3.2383808\times10^{13}\ kg$

$m = 5.7\times10^6\ kg$

7.) A physics 11 student is blasted into orbit to a distance of 3 earth radii from the centre of the planet. What gravitational field strength would the student measure here?

Answer - The inverse square law applies. So … $\vec{F}_g = 9.81\times(\frac{1}{3})^2 = 1.09\ N$ $\vec{F}_g = 1.09\ N$

8.) The moon has a radius of $1.74\times10^6\ m$ and mass $7.35\times10^{22}\ kg$. What would be the force of gravity on a $10.0\ kg$ mass on the moon's surface?

Answer - $\vec{F}_g = \frac{Gm_1m_2}{r^2}$ $\vec{F}_g = \frac{6.67\times10^{-11}(7.35\times10^{22})(10.0)}{(1.74\times10^6)^2}$ $\vec{F}_g = 16.1925\ N$

$\vec{F}_g = 16.2\ N$

Bonus - A kid throws a rock on a $45°$ angle with velocity $+10.0\frac{m}{s}$ off a $10.0\ m$ high cliff. How far from the base of the cliff will the rock land?

Answer – Solve for time. $\vec{d}_y = \vec{v}_{o_y}t + \frac{1}{2}\vec{a}t^2$ $-10 = (+7.07)t + (0.5)(-9.81)t^2$

Use quadratic equation. $t = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $t = \frac{-7.07\pm\sqrt{7.07^2-4(-4.905)(+10)}}{2(-4.905)}$ $t = 2.32\ s$

$\vec{v}_x = \frac{\Delta\vec{d}_x}{\Delta t}$ $7.07 = \frac{\Delta\vec{d}_x}{2.32}$ $\vec{d}_x = 16.4024\ m$ $\vec{d}_x = 16.4\ m$