KIT - International Department GmbH

Pre-Semester Physics - Exercises Summer 2010

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1. Exercise:

A person stands on a cliff which has a height of $h_1 = 80\,\mathrm{m}$ measured from the water surface. The sea itself has a depth of $h_2 = 16\,\mathrm{m}$. The person drops a stone down the cliff, which is accelerated (due to gravity) by $g = 10\,\frac{\mathrm{m}}{\mathrm{s}^2}$. Assume the stone entering the water to propagate with the constant velocity from the point on when it is at the water surface.

(a) At what speed v_i the stone impacts with the ground of the sea?

(b) Find the time T the stone needs to hit the ground of the sea.

(c) Sketch the $x(t)$ diagram.

(d) Draw the $v(t)$ diagram.

(e) Now conclude what height $\tilde{h}_1$ the cliff has, if the person hears the sound of the impact with the sea $\tilde{t}_{ac} = 6.6\,\mathrm{s}$ after he had dropped the stone. Note that the acoustic velocity is $v_{ac} = 340\,\frac{\mathrm{m}}{\mathrm{s}}$.

2. Exercise:

A car is racing along the street at a speed of $v = 72\,\frac{\mathrm{km}}{\mathrm{h}}$. At some place there is a police car spotting racers. As the racer passes the police car they start to catch up with the car driver. The police car accelerates with $a = 10\,\frac{\mathrm{m}}{\mathrm{s}^2}$.

(a) Find the time T the police car needs to catch up with the car driver!

(b) How far did the racer come?

(c) Draw the $x(t)$ dependencies for the racer and the police car in one diagram.

3. Exercise:

A mass point is shot with an initial velocity of $v_0 = 20\,\frac{\mathrm{m}}{\mathrm{s}}$ at $\alpha = 45°$ from the horizontal. Along the vertical gravity is acting with $g = 10\,\frac{\mathrm{m}}{\mathrm{s}^2}$.

(a) Sketch the path $\vec{r}(t)$.

(b) What is the total time T the mass point is in the air?

(c) Find the range, the total horizontal distance s traveled.

(d) Determine the maximum height h of the mass point.

(e) How would the range s change if the angle would be increased?