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Revision

Practice questions

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Bouncing bombs

1 On pages 4–5 the author describes how a pair of angled spotlights could be used to show when the bomber reached the correct height for launch.

A Lancaster plane is about 21 m long. (http://www.aviastar.org/air/england/avro_lancaster.php)

Estimate the angle from the vertical that each beam would be directed for their beams to coincide on the ground when the height was 18 m. State any assumptions you make.

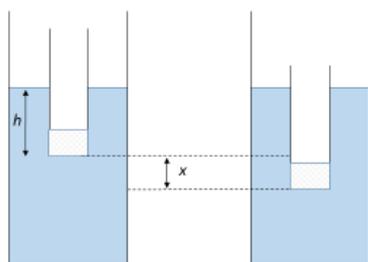
2 Box 3 states that the path of a projectile is a parabola.

Use the equations of motion to show why that path of a projectile which falls from a height h with an initial horizontal velocity u_h has the form $y = h - cx^2$.

What does the constant c depend on?

Mathskit: Simple harmonic motion

Pages 10–14 describes the simple harmonic motion (SHM) of a mass on a spring. Another example of an object moving with simple harmonic motion is a test tube that is floating vertically in water. When displaced it oscillates up and down.



A test tube is loaded with sand until it floats upright in a beaker of water. When it is displaced down a distance x and then released it moves with simple harmonic motion.

1 Use your understanding of the forces on the test tube to show that the motion is SHM.

2 Use the 'recipe' for SHM to find an equation for the time period of the motion in terms of the properties of the system.

- 3 Suggest and explain how the motion of the test tube would change if the water were replaced with an oil which is less dense, but more viscous, than water.

At a glance: GPS

- 1 Use information in the poster to estimate the average speed of a Galileo satellite in orbit.
- 2 Show that the additional time the clock on the moving satellite will appear to count in 24 hours is about $7 \mu\text{s}$

Luis Alvarez: a versatile physicist

- 1 Luis Alvarez developed the hydrogen bubble chamber to charged track subatomic particles. Often the chamber will be in a magnetic field — a classic bubble chamber image from CERN can be found here:

https://home.cern/sites/home.web.cern.ch/files/image/update-for_the_public/2015/06/bubble-chamber-bebc.jpg

In this image spiral paths can be seen moving in opposite directions away from a straight line. What information can you infer from looking at a pair of such paths?

- 2 The Bevatron accelerator provides particles with energies up to 10^9 eV .
- a Convert 10^9 eV to J.
- b Explain why it is not possible to use the equation for kinetic energy ($E_k = \frac{1}{2}mv^2$) to estimate the speed of an electron with energy 10^9 eV .

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