PH 221 Week 7

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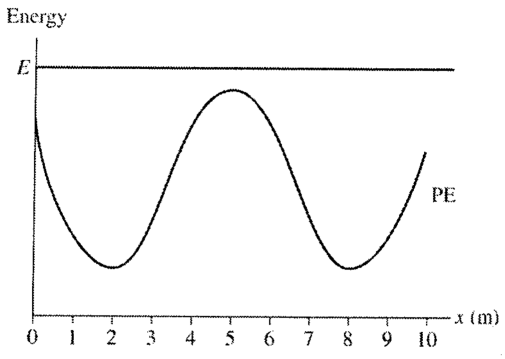
This material is borrowed/adapted from Chapter 10 of the *Student Workbook* for *Physics for Scientists and Engineers.*

R7-1: Interpreting a Potential Energy Graph

A particle with the potential energy shown in the graph is moving to the right at $x = 0$ m with total energy E.



(a) At what value or values of x is the particle's speed a maximum?

(b) At what value or values of x is the particle's speed a minimum?

(c) At what value or values of x is the potential energy a maximum?

(d) Does this particle have a turning point in the range of x covered by the graph? If so, where?

(e) In which intervals of x is the force on the particle to the right?

(f) In which intervals of x is the force on the particle to the left?

(g) At what value or values of x is the magnitude of the force a maximum?

(h) At what value or values of x are positions of stable equilibrium?

(i) At what value or values of x are positions of unstable equilibrium?

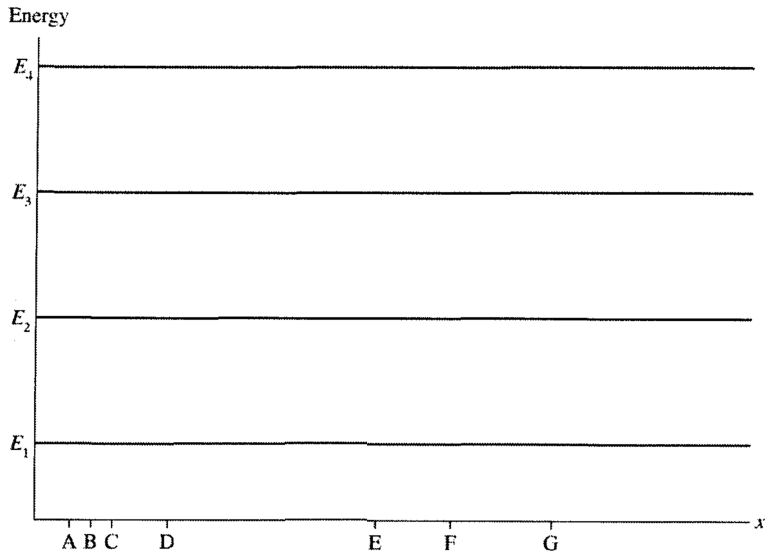
(j) If the particle is released from rest at $x = 0$ m, will it reach $x = 10m$? Explain.

R7-2: Producing a Potential Energy Graph

Below is a set of axes on which you are going to draw a potential energy curve. By doing experiments, you find the following information:

- A particle with energy E_1 oscillates between positions D and E.
- A particle with energy E_2 oscillates between positions C and F.
- A particle with energy E_3 oscillates between positions B and G.
- A particle with energy E_4 enters from the right, bounces at A, then never returns.

Draw a potential energy curve that is consistent with this information.



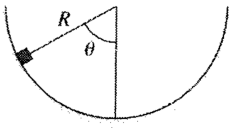
R7-3: Potential versus Change in Potential

(a) If the force on a particle at some point in space is zero, must its potential energy also be zero at that point? Explain.

(b) If the potential energy of a particle at some point in space is zero, must the force on it also be zero at that point? Explain.

R7-4: Sliding Cube in a Bowl

A small cube of mass m slides back and forth in a frictionless, hemispherical bowl of radius R. Suppose the cube is released at angle θ. What is the cube's speed at the bottom of the bowl?



(a) Begin by drawing a before-and-after pictorial representation. Let the cube's initial position and speed be y_i and v_i. Use a similar notation for the final position and speed.

(b) At the initial position, are either K_i or U_{Gi} zero? If so, which?

(c) At the final position, are either K_f or U_{Gf} zero? If so, which?

(d) Does thermal energy need to be considered in this situation? Why or why not?

(e) Write the conservation of energy equation in terms of position and speed variables, omitting any terms that are zero.

(f) You're given not the initial position but the initial angle. Do the geometry and trigonometry to find y_i in terms of R and θ.

(g) Use your result of part (f) in the energy conservation equation, and then finish solving the problem.