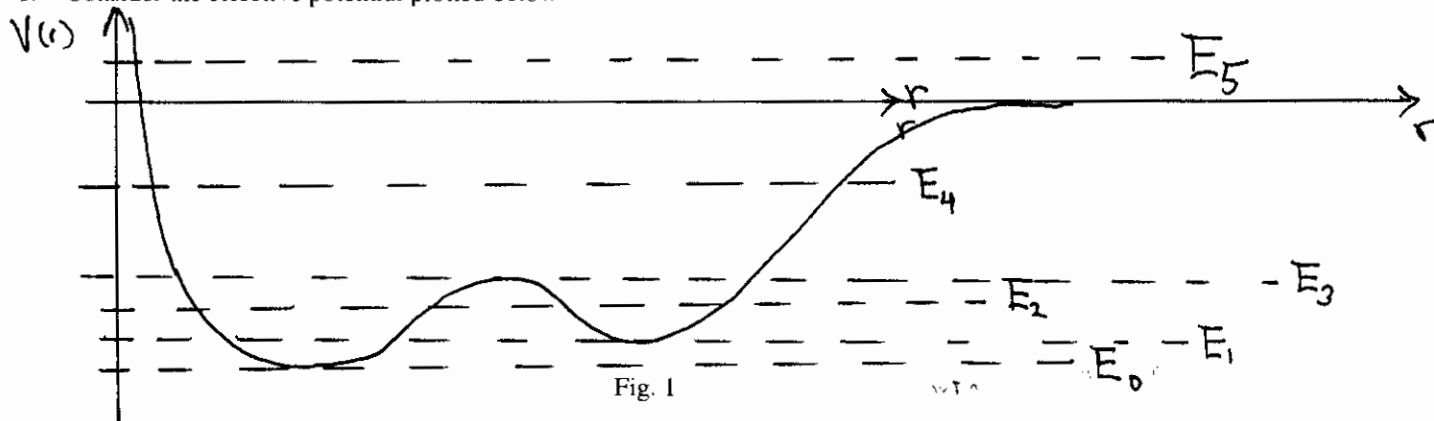


Instructions

1. Read the book before starting the homework and before the lecture. Problems cover Chapter 8.
2. Start the homework early. Ask questions early.
3. Make sure you know how to do all the problems. Never surrender, giving up is not an option!

1. Consider the effective potential plotted below



- a. Describe any possible motion in words for each energy $E_0, E_1, E_2, E_3, E_4,$ and E_5 .
- b. For each energy, sketch a possible trajectory for the particle.
2. Problem 8-5. For this problem find the time as asked; however, the book result is suspect.
3. A particle experiences a repulsive force $F(r) = kr$.
 - a. Find and plot effective potential.
 - b. Are there any stable orbits? Sketch a possible orbit.
 - c. Find an expression the minimum value of r for as a function of energy E .
4. Problem 8-14
5. Problem 8-22
 - a. Find the effective potential.
 - b. Are there any stable orbits for any parameters?
 - c. Let $k = 1$ and $\mu = 1$. What are the units of k ? Plot the effective potential.
 - d. The trajectory of the particle is a spiral in the xy plane. Given $E = 5$ J, $\dot{\theta}(t=0) = 1$ rad/s, $r(t=0) = 5$ m and $\dot{r}(0) < 1$ sketch the trajectory of the particle for c). What is the value of l ? What are the minimum and maximum values of r ?
6. Problem 8-31
 - a. Find the effective potential
 - b. Find ρ , the radius of a stable circular orbit.
 - c. Show that if $\rho^2 k > k'$, the particle can move in a stable circular orbit at $r = \rho$. (Hint: Eq. 8.93)
 - d. Sketch the effective potential given b) and c).

Review of collisions

7. Two billiard balls are placed in contact on a smooth, frictionless table. A third ball moves toward this pair with velocity $v = 0.1$ m/s as shown. What will be the velocity (magnitude and direction) of the three balls after the collision? Assume the balls are identical with mass 0.1 kg and the collision is elastic.

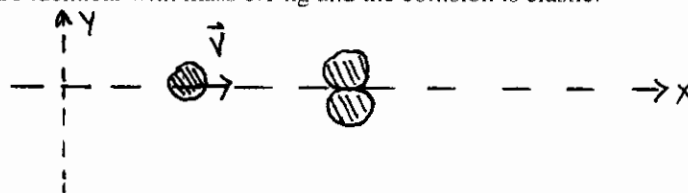


Fig. 2