Power

- Power is the rate of doing work.

$$P = \frac{dW}{dt} = \vec{F} \cdot \frac{d\vec{\ell}}{dt} = \vec{F} \cdot \vec{v} \tag{112}$$

NOTE: The above is in general NOT the derivative of W!

- The unit of power is Watt: $[P] = J/s \equiv W$
- The efficiency of an engine is

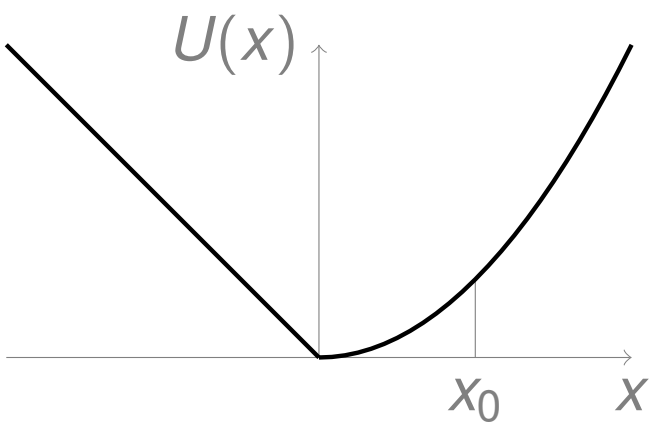
$$e = \frac{P_{out}}{P_{in}} \tag{113}$$

QUESTION TO THINK OVER

The cars are categorized in terms of the volume of their engine. The smaller the engine, the less fuel it uses. When you are driving a car with a small engine, it will be difficult to go up a hill, whereas for a car with a larger engine, it is much easier. This difficulty of the small car can be over come if you use it at a much higher rpm (rotations per minute). Why is it that the car with smaller engine finds it difficult to go uphill but using it with a large rpm resolves this issue? (Assume that the efficiencies of both cars are more or less equal)

Discussion Problems

Send your answer as an SMS to: 4660



A particle is released from rest at the position x = x0 in the potential described below.

$$U(x) = \begin{cases} -ax & x < 0 \\ bx^2 & x > 0 \end{cases} \qquad (114)$$

Determine whether the following statements are true (A) or false (B). (send A or B)

- The subsequent motion is periodic.

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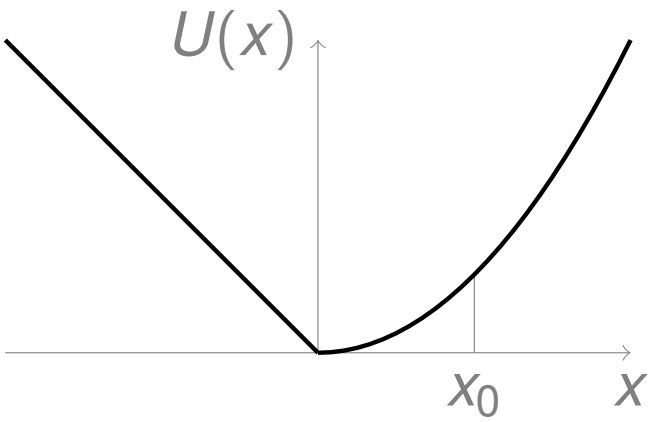

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$$U(x) = \begin{cases} -ax & x < 0 \\ bx^2 & x > 0 \end{cases} \qquad (114)$$

Determine whether the following statements are true (A) or false (B). (send A or B)

- The velocity is a continuous function of time.

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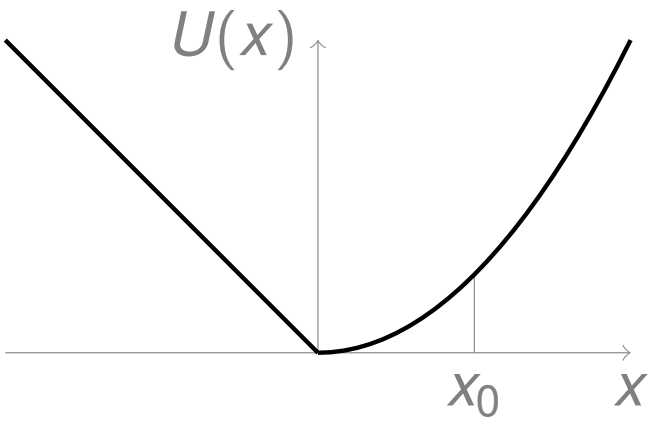

A particle is released from rest at the position x = x0 in the potential described below.

$$U(x) = \begin{cases} -ax & x < 0 \\ bx^2 & x > 0 \end{cases} \qquad (114)$$

Determine whether the following statements are true (A) or false (B). (send A or B)

- The acceleration is a continuous function of time.

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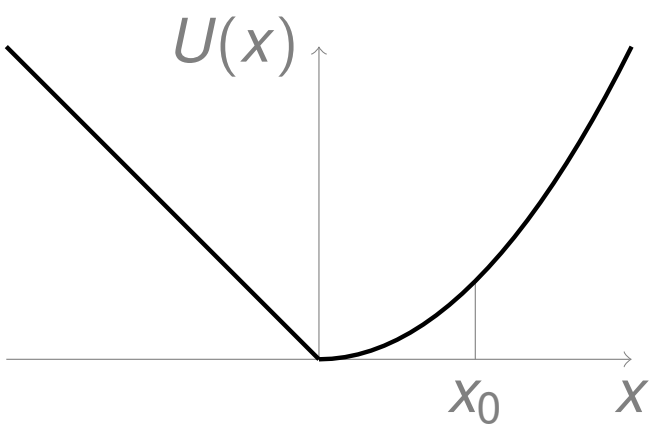

A particle is released from rest at the position x = x0 in the potential described below.

$$U(x) = \begin{cases} -ax & x < 0 \\ bx^2 & x > 0 \end{cases} \qquad (114)$$

Determine whether the following statements are true (A) or false (B). (send A or B)

- The force is conservative.

Discussion Problems

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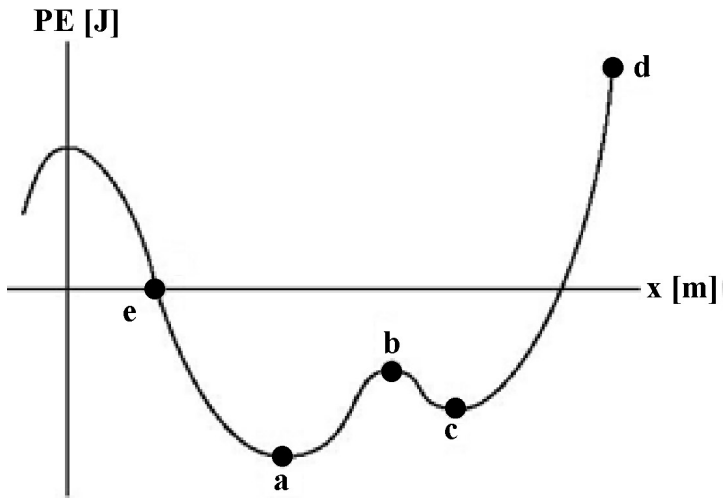

Consider the above sketch of potential energy for a particle as a function of position. There are no dissipative forces or internal sources of energy. If a particle travels through the entire region of space shown in the diagram, at which point is the particle's velocity a maximum?
(A) a (B) b (C) c (D) d (E) e

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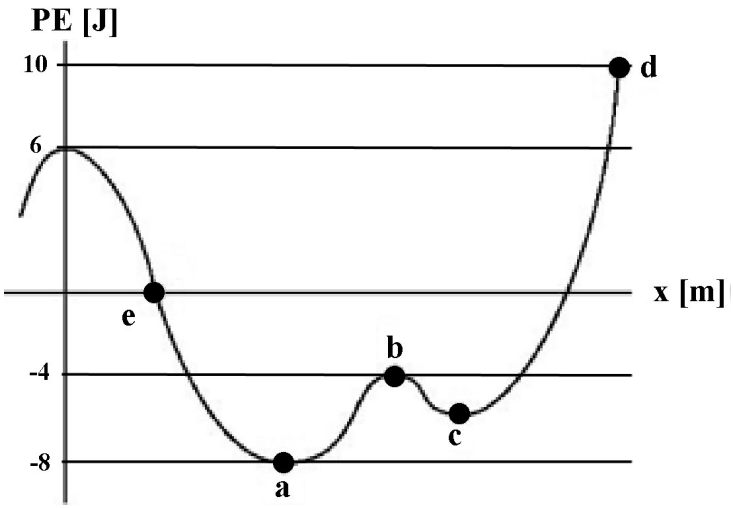

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Consider the above sketch of potential energy for a particle as a function of position. There are no dissipative forces or internal sources of energy. What is the minimum total mechanical energy that the particle can have if you know that it has traveled over the entire region of X shown?

(A) -8 (B) 6 (C) 10 (D) It depends on direction of travel

(E) Can't say - Potential Energy uncertain by a constant

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You lift a ball at constant velocity from a height h_i to a greater height h_f. Considering the ball and the earth together as the system, which of the following statements is true?

A The potential energy of the system increases.

B The kinetic energy of the system decreases.

C The earth does negative work on the system.

D You do negative work on the system.

E The source energy of the ball increases.

F Two of the above.

G None of the above.

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