Final Examination

Part I: Multiple choice question

1. A ball hits a wall and bounces back with less speed. What principle best explains this?
   A. Conservation of momentum
   B. Conservation of energy
   C. Work-energy principle
   D. Impulse-momentum principle
2 . Which of the following coordinate systems uses unit vectors that change direction as the particle moves
   A. Only Polar
   B. Polar and NT
   C. Only Cartesian
   D. Cartesian and Polar

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3. A car moves along a straight road. Initially, it speeds up, then maintains constant speed, and finally slows down to a stop. Which of the following correctly describes the acceleration during the motion?

A. Acceleration is constant throughout.
B. Acceleration changes sign and becomes zero during the constant speed phase.
C. Acceleration is zero at all times.
D. Acceleration is positive throughout.

4. A ball is thrown and is moving with projectile motion, and it reaches a maximum height and falls back down. At the highest point:

A. Vertical Velocity and acceleration are both zero
B. Horizontal Velocity and horizontal acceleration are both zero
C. Acceleration is zero, and velocity is downward
D. Both velocity and acceleration are downward

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5. A particle moves along a curve, and its speed increases. What can be said about its total acceleration?

A. Only the tangential component exists

B. Only the normal component exists

C. Both normal and tangential components exist

D. Acceleration is zero

6. A particle slides down a frictionless hill and then moves along a horizontal surface with friction. Which of the following is true?

A. Mechanical energy is conserved throughout

B. Energy is conserved only on the hill

C. Energy is lost only on the hill

D. Friction increases the mechanical energy

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7. A particle moves such that the net force is always perpendicular to the velocity.. What happens to its speed?

A. It increases

B. It decreases

C. It remains constant

D. It becomes zero

Part 2 :Numerical problems

8. A 2-kg block A is pushed up against a spring compressing it a distance x. The block is then released from rest and slides down the 20° incline until it strikes a 1-kg sphere B which is suspended from a 1-m inextensible rope. The spring constant k 5 800 N/m, the coefficient of friction between A and the ground is 0.2, the distance A slides from the unstretched length of the spring d 5 1.5 m, and the coefficient of restitution between A and B is 0.8. Knowing the tension in the rope is 20 N when α = 30°, determine the initial compression x of the spring

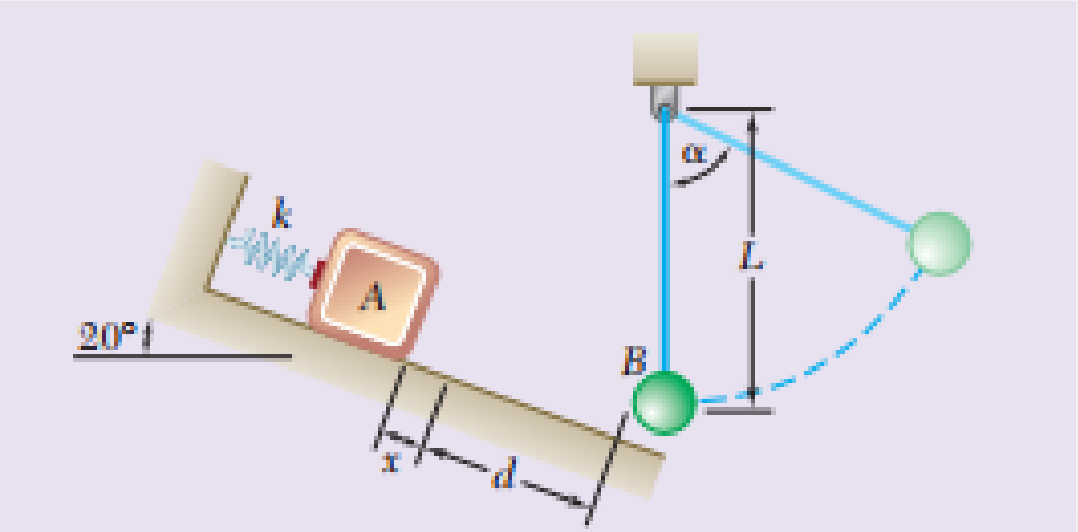

Figure 1. problem 8

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9. The oil pumping unit consists of a walking beam AB, connecting rod BC, and crank CD. If the crank rotates at a constant rate of 6 rad/s, determine the speed of the rod hanger H at the instant shown. Hint: Point B follows a circular path about point E and therefore the velocity of B is not vertical

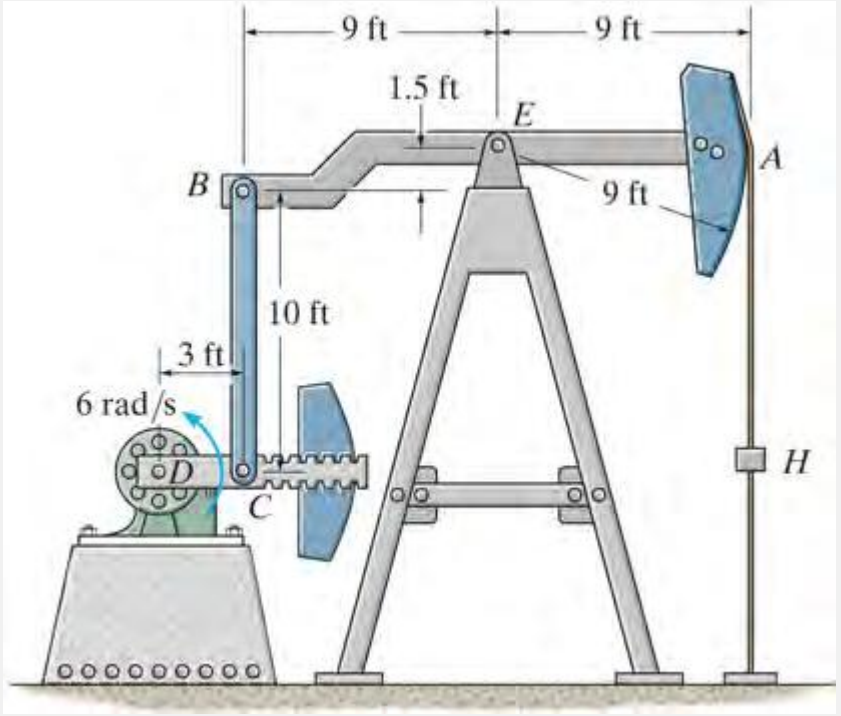

Figure 2. Problem 9