

※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

1. (20%)

The spring mounted slider moves in horizontal guide with no friction and has a velocity  $v_0$  in the  $x$ -direction as it crosses the mid position when  $x=0$ , and  $t=0$ . The two springs together exert a retarding force to the motion of the slider, which gives it an acceleration proportional to the displacement but oppositely directed and equal to  $a = -k^2x$ , where  $k$  is a constant. Determine the expressions for the displacement  $x$  and velocity  $v$  as functions of time  $t$ .

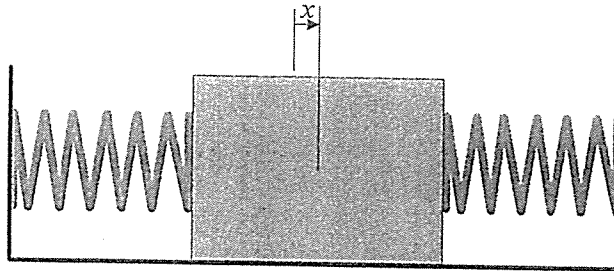


Fig. 1

2. (20%)

Calculate the velocity  $v$  of the 50-kg crate when it reaches the bottom of the slope at B if it is given an initial velocity of 4 m/s down the slope at A. The coefficient of kinetic friction is 0.3.

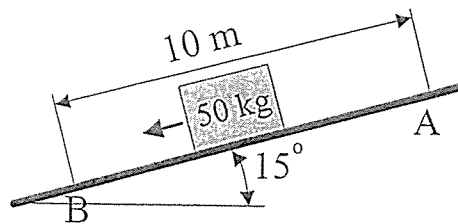


Fig. 2

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3. (20%)

Spherical particle 1 has velocity  $v_1 = 6$  m/s, in the direction as shown in Fig. 3, and collides with spherical particle 2 of equal mass and diameter and initially at rest. If the coefficient of restitution for those conditions is  $e = 0.6$ . Determine the resulting motion of each particle following impact.

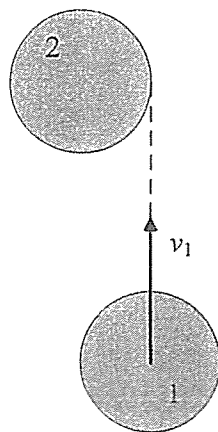


Fig. 3

4. (20%)

A ship moving at 5 m/s relative to the water in a uniform current flowing east at 2 m/s. If the captain wants to sail northwest relative to the earth, what direction should she point the ship? What will be the resulting magnitude of the ship's velocity relative to the earth?

5. (20%)

The earth has a radius of  $R_E$ . A satellite is in a circular orbit of radius  $R$  around the earth. What is the velocity of the satellite?