AERO/MECH 201
Engineering Dynamics Lecture 3

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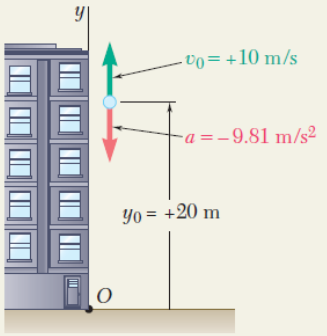
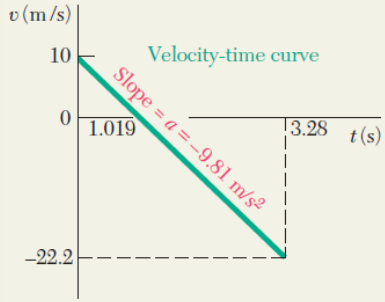
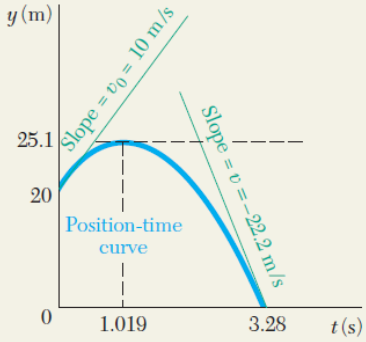
KUSTAR

Read page 610 and 611

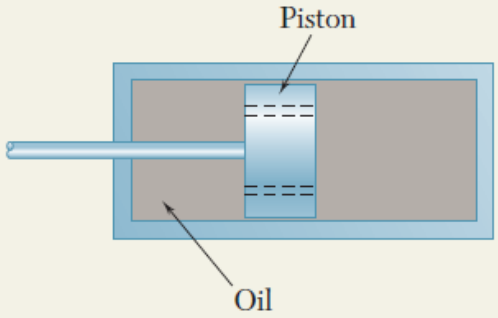






SAMPLE PROBLEM 11.1

The position of a particle which moves along a straight line is defined by the relation $x = t^3 - 6t^2 - 15t + 40$, where x is expressed in feet and t in seconds. Determine (a) the time at which the velocity will be zero, (b) the position and distance traveled by the particle at that time, (c) the acceleration of the particle at that time, (d) the distance traveled by the particle from $t = 4$ s to $t = 6$ s.



SAMPLE PROBLEM 11.3

The brake mechanism used to reduce recoil in certain types of guns consists essentially of a piston attached to the barrel and moving in a fixed cylinder filled with oil. As the barrel recoils with an initial velocity v_0, the piston moves and oil is forced through orifices in the piston, causing the piston and the barrel to decelerate at a rate proportional to their velocity; that is, $a = -kv$. Express (a) v in terms of t, (b) x in terms of t, (c) v in terms of x. Draw the corresponding motion curves.

11.4 UNIFORM RECTILINEAR MOTION

- Acceleration is ZERO

$$x = x_0 + vt$$

11.5 UNIFORMLY ACCELERATED RECTILINEAR MOTION

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

11.6 MOTION OF SEVERAL PARTICLES

Relative Motion of Two Particles

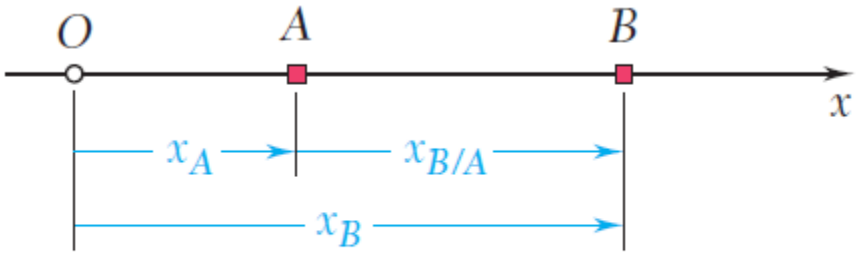


Fig. 11.7

$$x_B = x_A + x_{B/A}$$

$$v_B = v_A + v_{B/A}$$

$$a_B = a_A + a_{B/A}$$

Dependent Motions

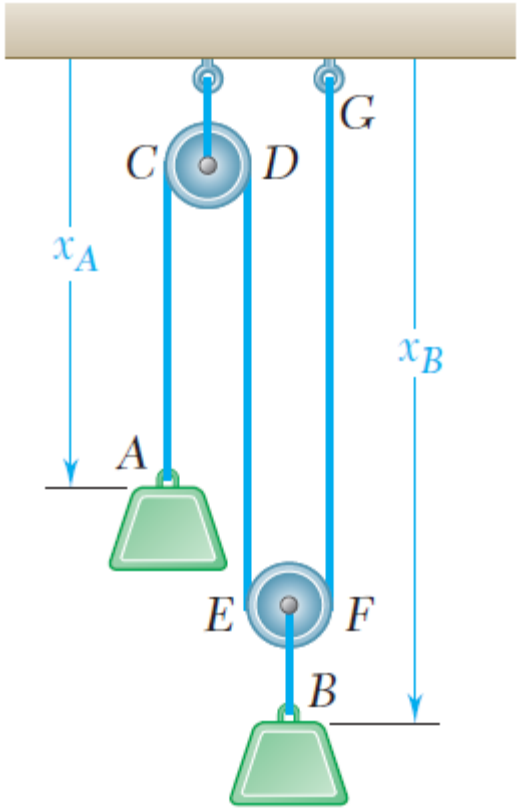
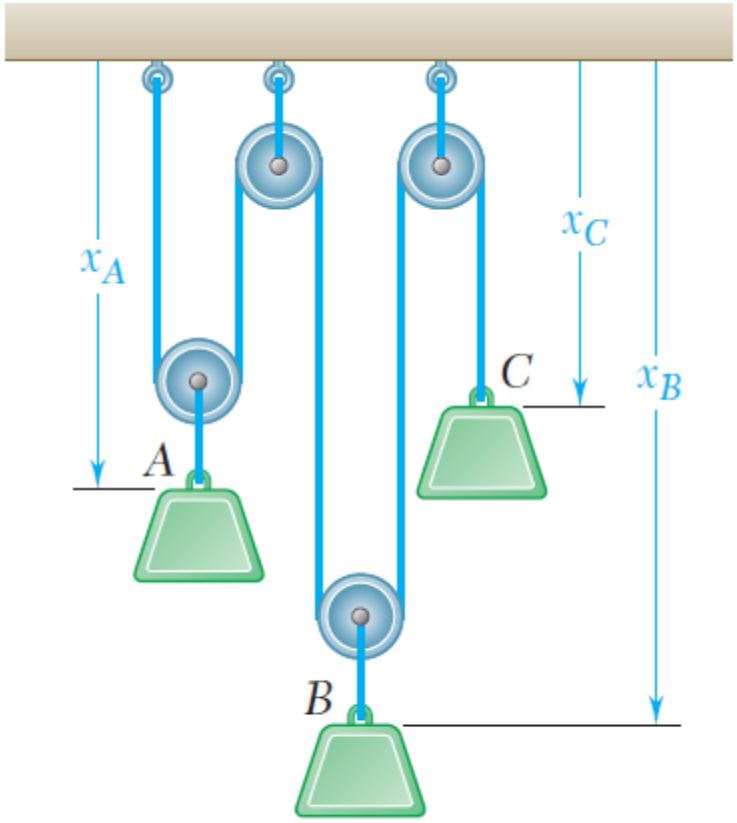


Fig. 11.8

$$x_A + 2x_B = \text{constant}$$

$$\Delta x_B = -\tfrac{1}{2}\Delta x_A$$

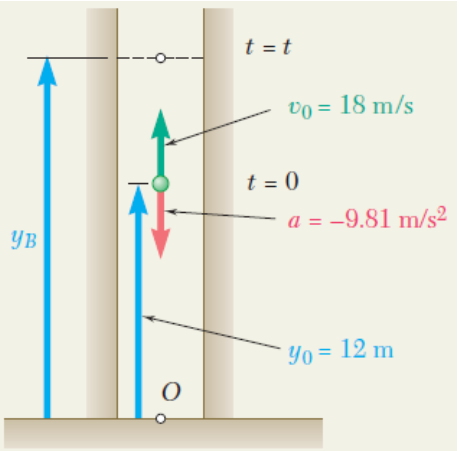


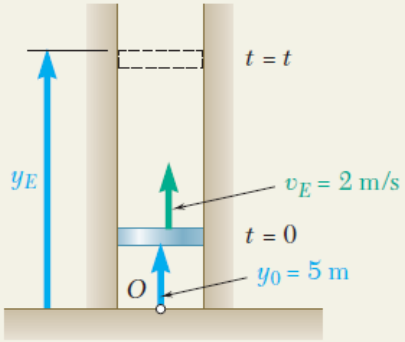
$$2x_A + 2x_B + x_C = \text{constant}$$

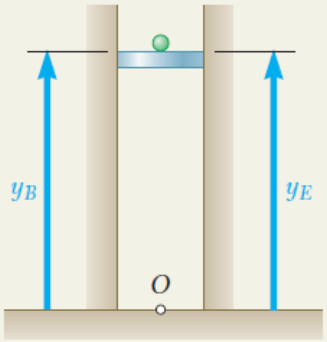
Fig. 11.9

$$2\frac{dx_A}{dt} + 2\frac{dx_B}{dt} + \frac{dx_C}{dt} = 0 \qquad \text{or} \qquad 2v_A + 2v_B + v_C = 0$$

$$2\frac{dv_A}{dt} + 2\frac{dv_B}{dt} + \frac{dv_C}{dt} = 0 \qquad \text{or} \qquad 2a_A + 2a_B + a_C = 0$$

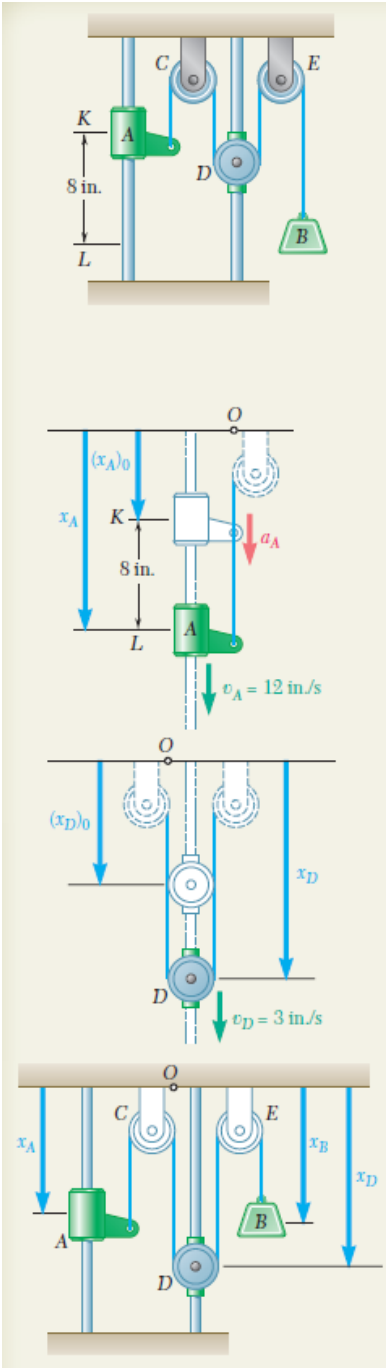






SAMPLE PROBLEM 11.4

A ball is thrown vertically upward from the 12-m level in an elevator shaft with an initial velocity of 18 m/s. At the same instant an open-platform elevator passes the 5-m level, moving upward with a constant velocity of 2 m/s. Determine (*a*) when and where the ball will hit the elevator, (*b*) the relative velocity of the ball with respect to the elevator when the ball hits the elevator.



SAMPLE PROBLEM 11.5

Collar A and block B are connected by a cable passing over three pulleys C, D, and E as shown. Pulleys C and E are fixed, while D is attached to a collar which is pulled downward with a constant velocity of 3 in./s. At $t = 0$, collar A starts moving downward from position K with a constant acceleration and no initial velocity. Knowing that the velocity of collar A is 12 in./s as it passes through point L, determine the change in elevation, the velocity, and the acceleration of block B when collar A passes through L.