

Chapter 2, Problem 14P

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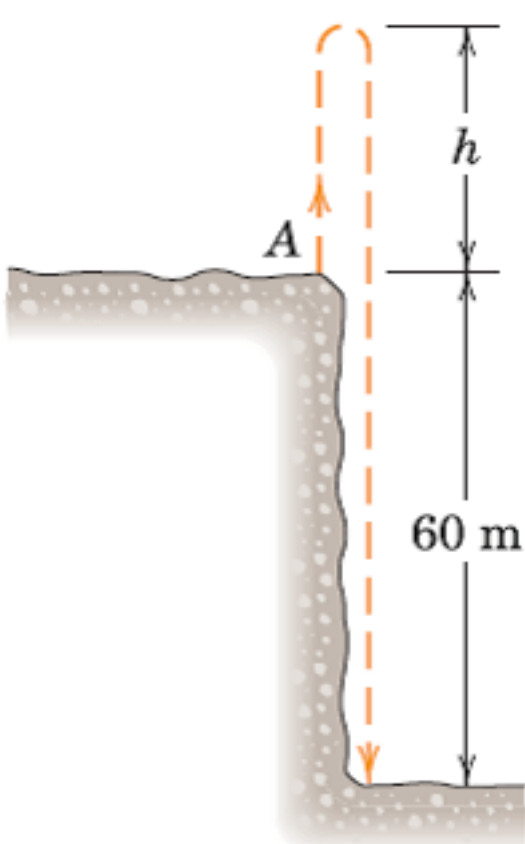
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Problem

A ball is thrown vertically up with a velocity of 30 m /s at the edge of a 60-m cliff. Calculate the height h to which the ball rises and the total time t after release for the ball to reach the bottom of the cliff. Neglect air resistance and take the downward acceleration to be 9.81 m /s².



Problem 2/14

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Step-by-step solution

Step 1 of 2

Write equation for displacement.

$$y = v_0 t + \frac{1}{2} a t^2$$

Here, v_0 is the initial velocity, a is the acceleration and t is time in seconds.

Substitute 30 m/s for v_0 , -9.81 m/s^2 for a and -60 m for y .

$$-60 = 30t + \frac{1}{2}(-9.81)t^2$$

$$-60 = 30t - 4.905t^2$$

$$4.905t^2 - 30t - 60 = 0$$

Solve the quadratic equation.

$$t = \frac{30 \pm \sqrt{30^2 - 4(-60)(4.905)}}{2(4.905)}$$

$$= 7.70 \text{ s and } -15.87 \text{ s}$$

Therefore, the required time is **7.70 s**.

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Step 2 of 2

Write equation for final velocity.

$$v^2 = v_0^2 + 2ay$$

Here, v is final velocity and y is vertical distance.

Substitute h for y , zero for v , -9.81 m/s^2 for a and 30 m/s for v_0 .

$$v^2 = v_0^2 + 2ay$$

$$0^2 = 30^2 + 2 \times -9.81 \times h$$

$$h = \frac{900}{(2 \times 9.81)}$$

$$= 45.9 \text{ m}$$

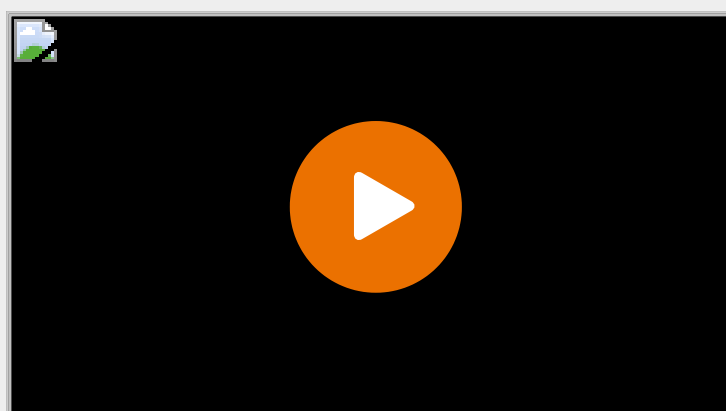
Therefore, the required height to which the ball rises is **45.9 m**.

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11

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WALKTHROUGH VIDEO

For this problem:
Chapter 2, Problem 14P

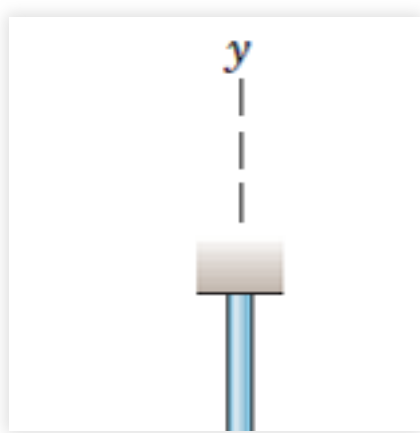
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Recommended solutions for you in Chapter 2

Chapter 2, Problem 217P

Collars A and B slide along the fixed right-angle rods and are connected by a cord of length L . Determine the acceleration a_x ...

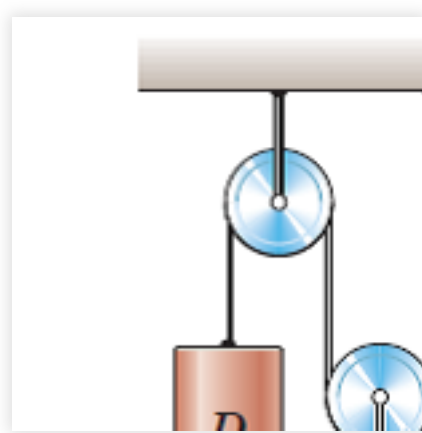
[See solution](#)



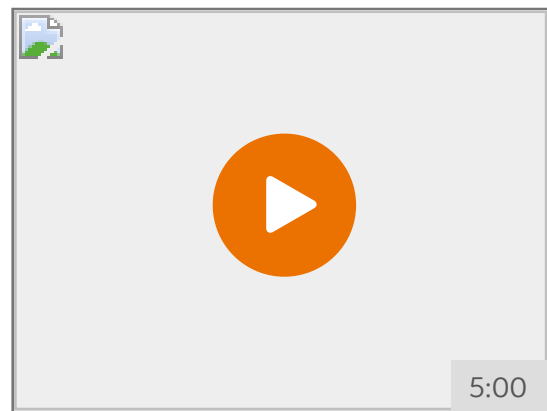
Chapter 2, Problem 216P

Determine the relationship which governs the velocities of the four cylinders. Express all velocities as positive down. How...

[See solution](#)



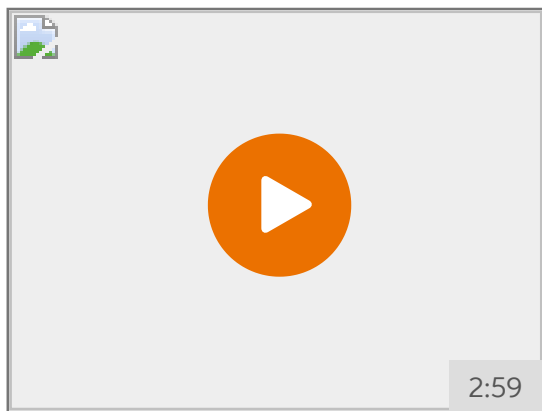
Videos related to Chapter 2



TEXTBOOK SOLUTION

Chain Rule

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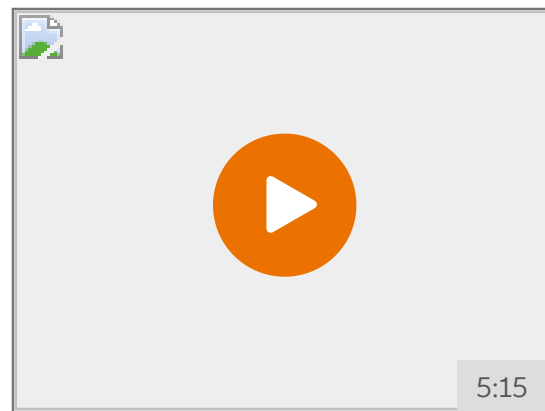


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TEXTBOOK SOLUTION

Basic Integration (for Rectilinear Kinematics)

0 0

Examples related to Chapter 2

Example 1

The position coordinate of a particle which is confined to move along a straight line is given by $s = 2t^3 - 24t + 6$, where s is measured in meters from a convenient origin and t is in seconds. Determine (a) the time required for the particle to reach a velocity of 72 m / s from its initial condition at $t = 0$, (b) the acceleration of the particle when $v = 30$ m / s, and (c) the net displacement of the particle during the interval from $t = 1$ s to $t = 4$ s.



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Example 2

Example 3

Example 4

Example 5

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