20-P-WE-JK-225-R14-8

Inspired by Chapter 14 Hibbeler Section 14.6 Conservation of Energy
Review Problem R14-8

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August 7 2020

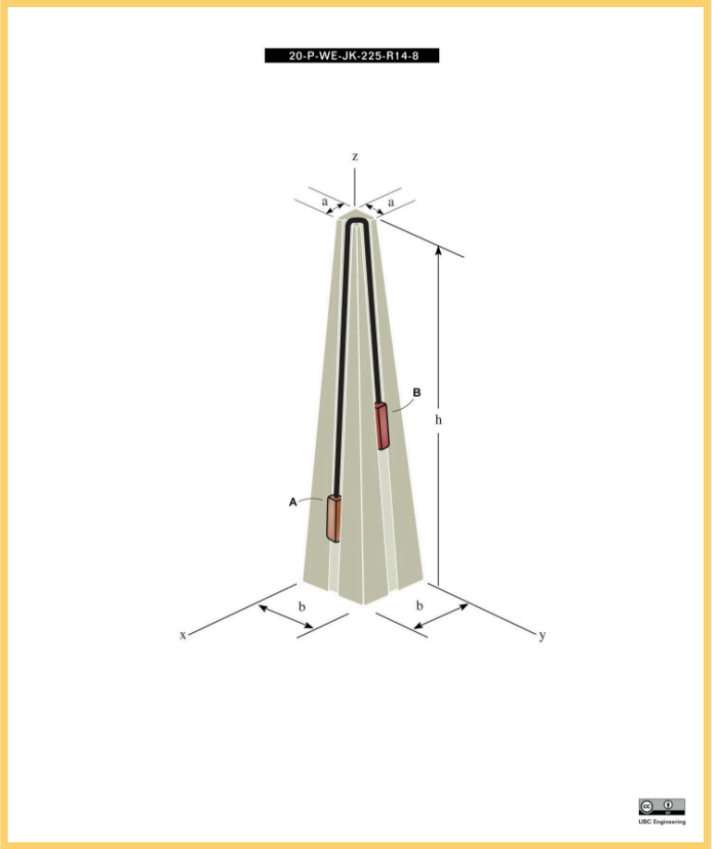
CCYB4.0 Diagram by Brina Schrenk

The blocks A and B are connected by a light, massless cord and ride in frictionless grooves along the tower.

Block A weighs 10 pounds = WA
Block B weights 30 lb = WB

What is the speed of each block after block A moves 6 feet up along the plane, after they are released from rest.

On the diagram
a = 1 ft
b = 3 ft
h = h tower = 15 feet
d = distance up = 6 feet



Solution

First you need to get the height change, along z to find the change in gravitational potential energy

Do the ratio of d = 6 feet up a tilted tower that is h = 15 feet tall in total

$d / z = (h^2 + b^2)^{½} / h$

$6 / z = (15^2 + 2^2)^{½} / 15$

$z = (d\ h) / (h^2 + b^2)^{½}$

z = 5.9474 = 5.95 ft

Law of conservation of energy
T = kinetic and V = gravitational potential energy

T1 + V1 = T2 + V2

T1 = 0 as it starts from rest
V1 = 0 as we take h = 0 at the start of the motion
The masses move together so the v is the same

Weight of A is in pounds so you must convert to slugs. 10 lb / 32.2 ft/s^2

$0 = ½ (WA/32.2)v_2^2 + ½ (WB/32.2)v_2^2 + (WA)(5.95\ ft) – (WB)(5.95\ ft)$

A goes up 5.95 ft, and B goes down 5.95 ft.

$0 = ½ (WA/32.2)v_2^2 + ½ (WB/32.2)v_2^2 + (WA)(5.95\ ft) – (WB)(5.95\ ft)$

$v_2^2 = 2 (WB)(5.95\ ft) - 2(WA)(5.95\ ft) / (WA/32.2 + WB/32.2)$

$v_2^2 = 64.4 ((WB)(5.95\ ft) - (WA)(5.95\ ft) / (WA + WB))$

$V_2 = 13.841 = 13.8$ ft/s