Engineering Dynamics
Homework 3

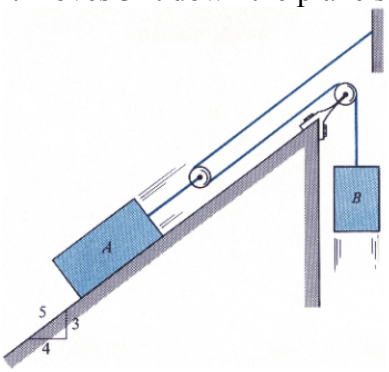
1.
A freight car having a mass of 15 Mg is towed along a horizontal track. If the car starts from rest and attains a speed of 14 m/s after traveling a distance of 150 m, determine the constant horizontal towing force applied to the car. Neglect friction and the mass of the wheels.

T = _____kN

2.
A crate has a weight of 1,700 lb. If it is pulled along the ground at a constant speed for a distance of 30 ft, and the towing cable makes an angle of 25º with the horizontal, determine the tension in the cable and the work done by the towing force. The coefficient of friction between the ground and the crate is μ=0.55

$T =$ _____ lb
$U =$ _____ ft lb

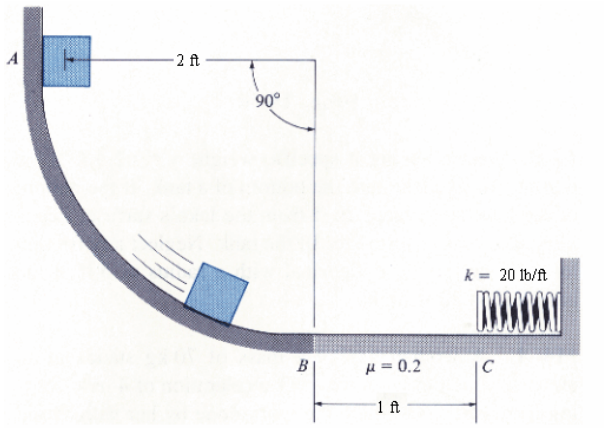
3.
The two blocks have weights $W_A = 61$ lb and $W_B = 11$ lb. If the kinetic coefficient of friction between the incline and block A is $\mu_k = 0.18$ determine the speed of block A after it moves 3 ft down the plane starting from rest. Neglect the mass of the cord and pulleys.



$v_A =$ _____ ft/s

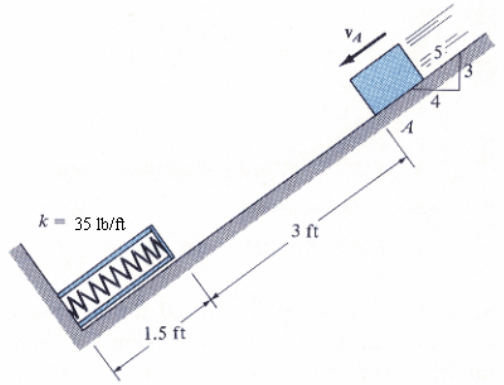
4.

The 3-lb block is released from rest at *A* and slides down the smooth circular surface *AB* It then continues to slide along the horizontal rough surface until it strikes the spring. Determine how far it compresses the spring before stopping.



v_A = _____ ft/s

5.
The spring has a stiffness k=35 lb/ft and an unstretched length of 2.15 ft. As shown, it is confined by the plate and wall using cables so that its length is 1.5 ft. A 6.5-lb block is given a speed v_A when it is at A and it slides down the incline having a coefficient of friction μ_k=0.2 . If it strikes the plate and pushes it forward 0.4 ft before stopping, determining its speed at A. Neglect the mass of the plate and spring.

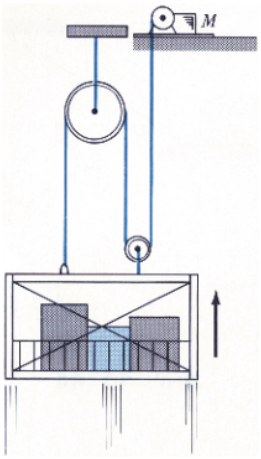


v_A = _____ ft/s

6.
The diesel engine of a 400-Mg train increases the train's speed uniformly from rest to 13 m/s in 100 s along a horizontal track. Determine the average power developed.

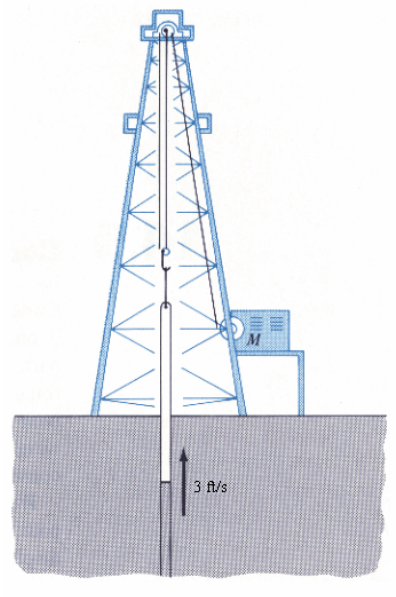
P = _____kW

7.
The motor is used to hoist the loaded 575 kg elevator upward with a constant velocity v_E=5 m/s. If the motor draws 100 kW of electrical power, determine the motor's efficiency. Neglect the mass of the pulleys and cable.



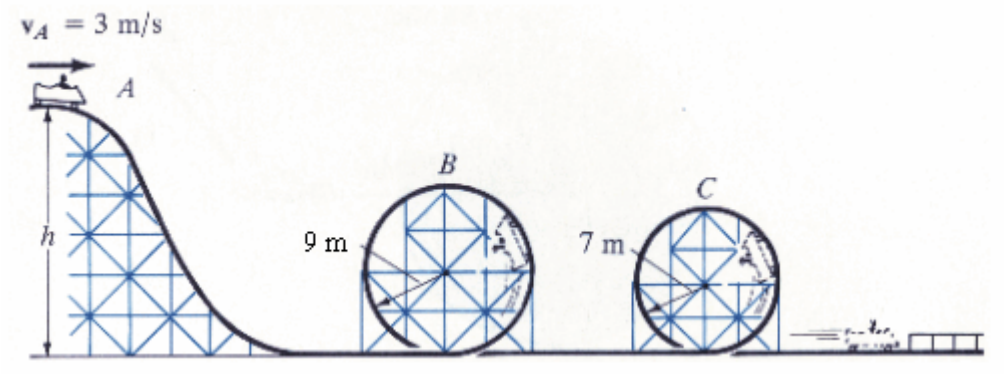
ε = _____ ($0 \leq \varepsilon \leq 1$)

8.
The block and tackle arrangement for the oil rig is shown schematically in the figure. Determine the power output of the draw-work motor *M* necessary to lift the 600-lb drill pipe upward with a constant speed of 3 ft/s.



P = _____hp

9.
The roller-coaster car has a mass of 750 kg, including its passenger, and moves from the top of the hill A with a speed v_A=3 m/s. Determine the minimum height h of the hill crest so that the car travels around both inside loops without leaving the track. Neglect friction, the mass of the wheels, and the size of the car. What is the normal reaction on the car when the car is at B and when it is at C?



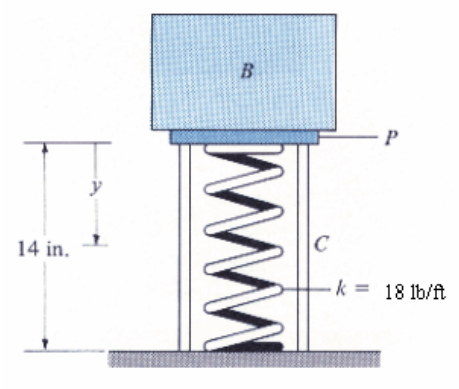
Enter the value for upward normal reactions (negative values indicates downward motion).

h = _____ m

N_B = _____ kN

N_C = _____ kN

10.
Four inelastic cables *C* are attached to a plate *P* and hold the 20-in. spring 6 inches in compression when no force acts on the plate. If a block *B* having a weight of 10 lb, is placed on the plate and the plate is pushed down *y*=10 in. and released from rest, determine how high the block rises from the point where it was released. Neglect the mass of the plate.



y_D = _____in.