Name _____

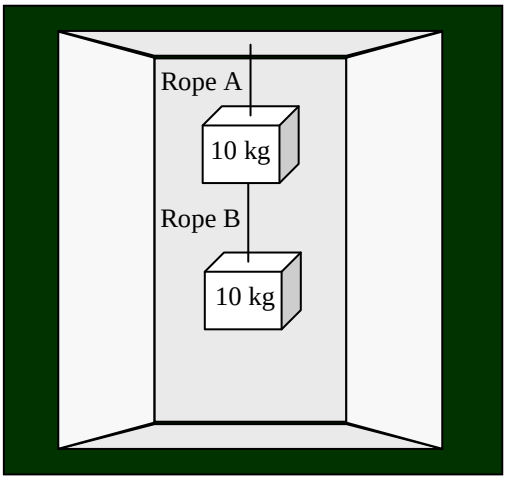
Hour _____

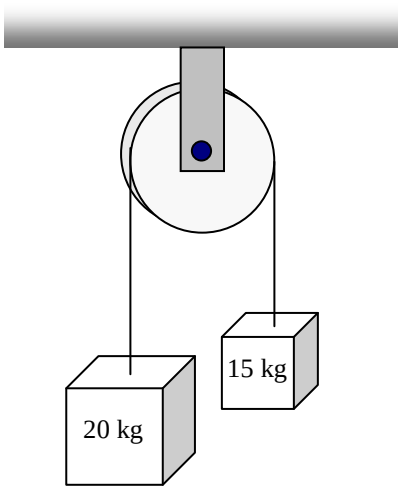
AP Physics: Chapter 4
Newton's Laws of Motion

Question A:

Two blocks of mass 10.0 kg are fastened to the ceiling of an elevator, as shown in the diagram below. The elevator accelerates upward at 2.00 m/s^2. Draw a free body diagram of each block and calculate the tension in . . .

a) Rope B.
b) Rope A.





Question B:

Two blocks of mass 15.0 kg and 20.0 kg are connected by a light string that passes over a pulley, as shown in the diagram below. The blocks are released from rest.

a) Calculate the tension in the string and the acceleration of the masses if the pulley is assumed frictionless.

b) Calculate the tension in the string and the acceleration of the masses if a frictional force of 5.75 N is present on the pulley.

Question C:

Draw and label a free body diagram for the following situations:

a) A Physics textbook sits motionless on a table. Diagram the forces acting on the book.
b) A truck is moving to the right with a constant velocity. Diagram the forces acting on the truck, including air resistance.
c) A nail falls from the hand of a rooftop worker. Neglecting air resistance, diagram the forces acting on the nail.

Question D:

Draw and label a free body diagram for the following situations:

a) A rope attached to a water pail is used to pull the pail up from a water well. Diagram the forces acting on the pail if the pail is raised at a constant velocity.
b) A rope attached to a water pail is used to pull the pail up from a water well. Diagram the forces acting on the pail if the pail is raised with an upwards acceleration.

Question E:

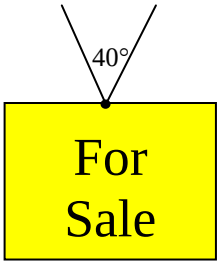
Superman exerts a force of 1810.0 N to push a 910.0 kg boulder. The force of friction acting on the boulder is 720.0 Newtons.

a) Calculate the weight of the boulder.
b) Draw a free body diagram of the forces acting on the boulder.
c) Determine the net force acting on the boulder.
d) Calculate the acceleration of the boulder.

Question F:

Wally, the weightlifter, can lift a 210.0 kg barbell overhead on Earth.

a) How much weight is Wally lifting in Newtons?
b) The acceleration of gravity on the moon is approximately 1/6 of the gravity on the Earth. What is the mass of the barbells on the moon?
c) Approximately how many kilograms would Wally be able to lift on the moon? Why?



Question G:

A realtor hangs a 12.0 N "For Sale" sign from two wires. The wires hang at a 40° angle to each other, as shown in the diagram at left.

a) Draw a free body diagram of the sign. Label all forces and force components.
b) Calculate the vertical tension in each wire.
c) Calculate the horizontal tension in each wire.
d) Calculate the overall tension in each wire.

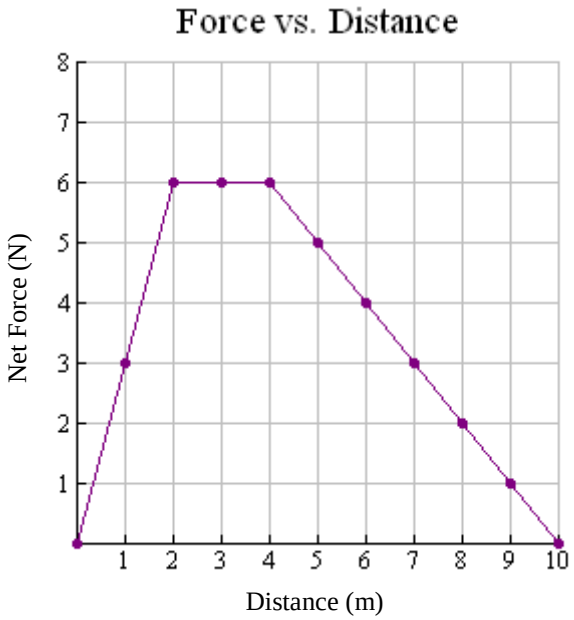
Question H:

A 25.0 kg toy cart rolls down a hill, inclined at an angle of 14°. The coefficient of friction between the cart's wheels and the hill is .23.

a) Calculate the gravitational force component acting to move the cart down the hill.
b) Calculate the force of friction acting on the cart.
c) Calculate the acceleration of the cart as it rolls down the hill.

AP Physics: Chapter 5
Work and Energy

The Force vs. Distance graph below shows the *net force* acting on a 1.0 kg object as an applied force causes it to start from rest and move along a straight-line path. The coefficient of friction between the object and the surface it travels on is .30. Use g = -10 m/s^2.



Question A:

Consider the movement of the object at a distance of d = 5:

a) Calculate the force of friction acting on the object.
b) Draw a free body diagram of the forces acting on the object. Label each force with its type and amount.
c) Calculate the acceleration of the object.

Question B:

What is the work done by the net force . . .

a) from d = 0 to d = 2?
b) from d = 2 to d = 4?
c) from d = 4 to d = 10?
d) over the entire 10 second time period?

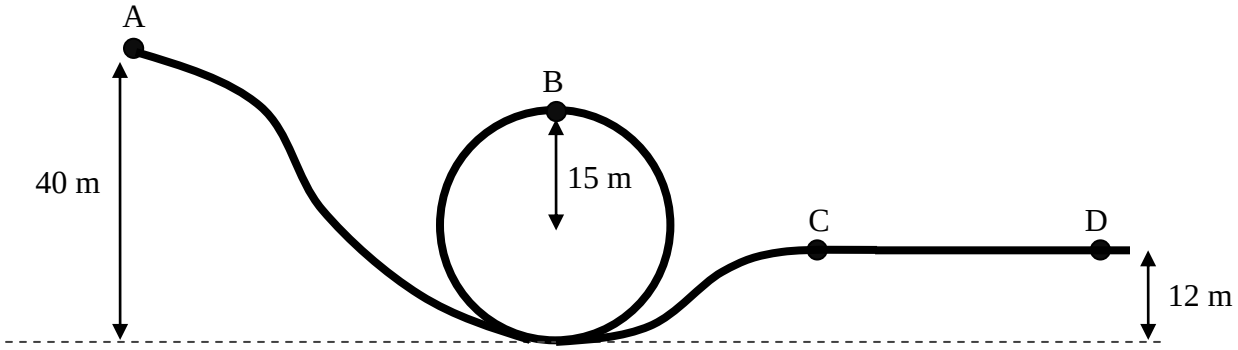
Question C:

Determine the velocity of the object at . . .

a) d = 2.
b) d = 4.
c) d = 10.

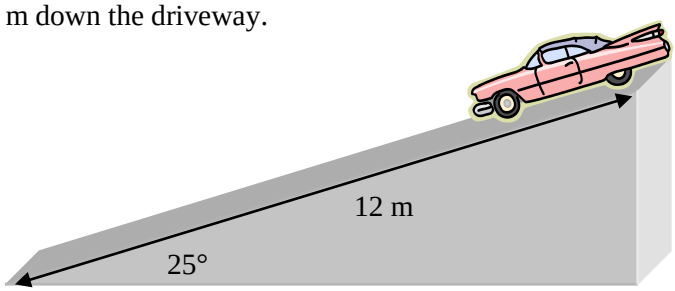
Question D:

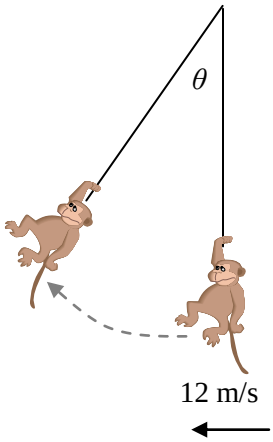
A portion of the path of a roller coaster is shown below. The roller coaster car begins from rest at Point *A* and travels down a smooth track with no friction from Point *A* to Point *C*. Point *B* is located at the top of a circular loop of radius 15 m as shown. Determine the velocity of the roller coaster car at Point *B*.



Question E:

A 1500 kg car begins at rest at the top of a smooth driveway sloped at an angle of 25°. Determine the velocity of the car at the bottom of the driveway if it travels a distance of 12 m down the driveway.



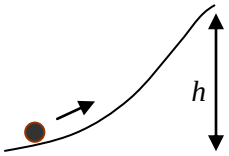


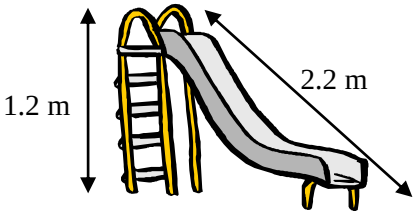
Question F:

A monkey begins with a running start and grabs on to a 2.5 m vine to swing himself upwards. Determine the maximum angle θ that the vine will reach from the horizontal if the monkey begins with an initial velocity of 4.2 m/s.

Question G:

A marble shooter is used to aim a .05 kg marble up a marble track. The marble leaves the shooter with a velocity of 3.5 m/s. As the marble shoots up the track, friction does .238 J of work on the marble. How high on the marble track does the marble travel?



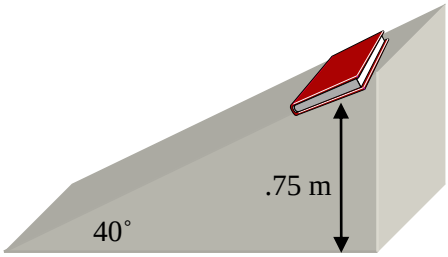


Question H:

Little Johnny has a mass of 35 kg and begins at rest at a height of 1.2 m on a slide. When he reaches the bottom of the 2.2 m slide, his velocity is 3.85 m/s. Calculate the force of friction acting on Johnny.

Question I:

A .30 kg book begins at rest at a height of .75 m on a ramp inclined at 40˚. The force of friction as the book slides down the ramp is .80 N. Determine the velocity of the book when it reaches the bottom of the ramp.



Question J:

A roller coaster travels along a track as described in Question #D. From Point *C* to Point *D*, the track is horizontal and has a coefficient of friction of .70. Determine the distance from Point *C* to Point *D* if the car comes to a complete stop at Point *D*.