PHY252 - Physics I – Exercises

TROY Program

Chapter 1: Units, Estimation, Dimensional analysis, Coordinate system, Uncertainty in Measurement, Trigonometry 1 - 39, 43, 55

Ex. 1.39.

Two points are given in polar coordinates by (r, θ)=(2.00 m, 50.0°) and (r, θ) = (5.00 m, 250.0°), respectively.
What is the distance between them?

Ex.1.43.

A high fountain of water is located at the center of a circular pool as shown in Figure P1.43. Not wishing to get his feet wet, a student walks around the pool and measures its circum ference to be 15.0 m. Next, the student stands at the edge of the pool and uses a protractor to gauge the angle of elevation at the bottom of the fountain to be 55.0°. How high is the fountain?

Ex. 1.55.

The displacement of an object moving under uniform acceleration is some function of time and the acceleration. Suppose we write this displacement as $s = ka^m t^n$, where k is a dimensionless constant. Show by dimensional analysis that this expression is satisfied if m= 1 and n= 2. Can the analysis give the value of k?

Chapter 2: Motion in one dimension. 2 - 6, 11, 18, 20, 21, 33, 37, 47, 59

Ex 2.6.

A graph of position versus time for a certain particle moving along the *x*-axis is shown in Figure P2.6.
Find the average velocity in the time intervals from (a) 0 to 2.00 s, (b) 0 to 4.00 s, (c) 2.00 s to 4.00 s, (d) 4.00 s to 7.00 s, and (e) 0 to 8.00 s.

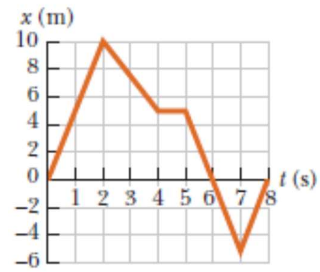

Figure P2.6 Problems 6 and 17

Ex.2.11.

The cheetah can reach a top speed of 114 km/h (71 mi/h). While chasing its prey in a short sprint, a cheetah starts from rest and runs 45 m in a straight line, reaching a final speed of 72 km/h. (a) Determine the cheetah's average acceleration during the short sprint, and (b) find its displacement at $t = 3.5$ s.

Ex. 2.18.

A race car moves such that its position fits the relationship

$$x = (5.0\ \text{m/s})t + (0.75\ \text{m/s}^3)t^3$$

where x is measured in meters and t in seconds.
(a) Plot a graph of the car's position versus time.
(b) Determine the instantaneous velocity of the car at $t = 4.0$ s, using time intervals of 0.40 s, 0.20 s, and 0.10 s.
(c) Compare the average velocity during the first 4.0 s with the results of part (b).
Ex. 2.20.
A particle starts from rest and accelerates as shown in Figure P2.20. Determine (a) the particle's speed at $t = 10.0$ s and at $t = 20.0$ s and (b) the distance traveled in the first 20.0 s.

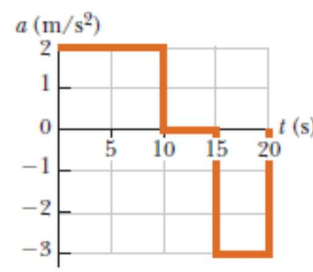

Figure P2.20

2.21.

A 50.0-g Super Ball traveling at 25.0 m/s bounces off a brick wall and rebounds at 22.0 m/s. A high-speed camera records this event. If the ball is in contact with the wall for 3.50 ms, what is the magnitude of the average acceleration of the ball during this time interval?

2.33.

In a test run, a certain car accelerates uniformly from zero to 24.0 m/s in 2.95 s. (a) What is the magnitude of the car's acceleration? (b) How long does it take the car to change its speed from 10.0 m/s to 20.0 m/s? (c) Will doubling the time always double the change in speed? Why?

2.37.

A train is traveling down a straight track at 20 m/s when the engineer applies the brakes, resulting in an acceleration of **$-1.0\ \text{m/s}^2$** as long as the train is in motion. How far does the train move during a 40-s time interval starting at the instant the brakes are applied?

2.47.

A certain freely falling object, released from rest, requires 1.50 s to travel the last 30.0 m before it hits the ground. (a) Find the velocity of the object when it is 30.0 m above the ground. (b) Find the total distance the object travels during the fall.

2.59.

A student throws a set of keys vertically upward to his fraternity brother, who is in a window 4.00 m above. The brother's outstretched hand catches the keys 1.50 s later. (a) With what initial velocity were the keys thrown? (b)? What was the velocity of the keys just before they were caught?

Chapter 3: Vectors and Two-dimensional motion

Ex. 3.14.

A hiker starts at his camp and moves the following distances while exploring his surroundings: 75.0 m north, 2.50×10^2 m east, 125 m at an angle 30.0° north of east, and 1.50×10^2 m south.

(a) Find his resultant displacement from camp. (Take east as the positive x-direction and north as the positive y-direction.)

(b) Would changes in the order in which the hiker makes the given displacements alter his final position? Explain.

Ex. 3.23.

A student stands at the edge of a cliff and throws a stone horizontally over the edge with a speed of 18.0 m/s. The cliff is 50.0 m above a flat, horizontal beach as shown in Figure P3.23.

(a) What are the coordinates of the initial position of the stone?

(b) What are the components of the initial velocity?

(c) Write the equations for the x- and y-components of the velocity of the stone with time.

(d) Write the equations for the position of the stone with time, using the coordinates in Figure P3.23.

(e) How long after being released does the stone strike the beach below the cliff?

(f) With what speed and angle of impact does the stone land?

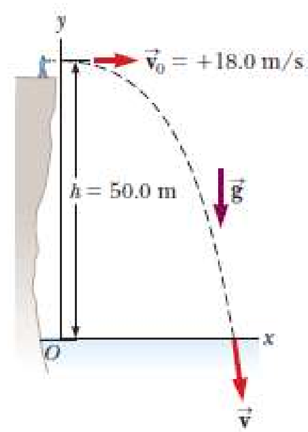

Figure P3.23

Ex.3.32

A fireman d=50.0 m away from a burning building directs a stream of water from a ground-level fire hose at an angle of θ_i=30.0° above the horizontal as shown in Figure P3.32. If the speed of the stream as it leaves the hose is v_i =40.0 m/s, at what height will the stream of water strike the building?

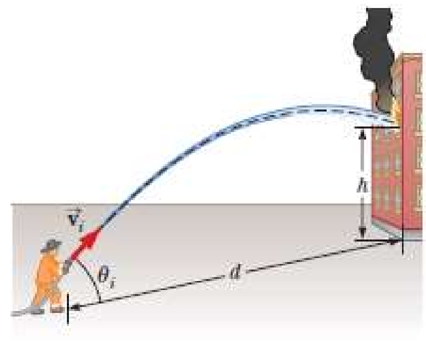

Figure P3.32

Ex.3.41

A river has a steady speed of 0.500 m/s. A student swims upstream a distance of 1.00 km and swims back to the starting point.

(a) If the student can swim at a speed of 1.20 m/s in still water, how long does the trip take?

(b) How much time is required in still water for the same length swim?

(c) Intuitively, why does the swim take longer when there is a current?

Ex.3.58

A 2.00-m-tall basketball player is standing on the floor 10.0 m from the basket, as in Figure P3.58. If he shoots the ball at a 40.0° angle with the horizontal, at what initial speed must he throw the basketball so that it goes through the hoop without striking the backboard? The height of the basket is 3.05 m.

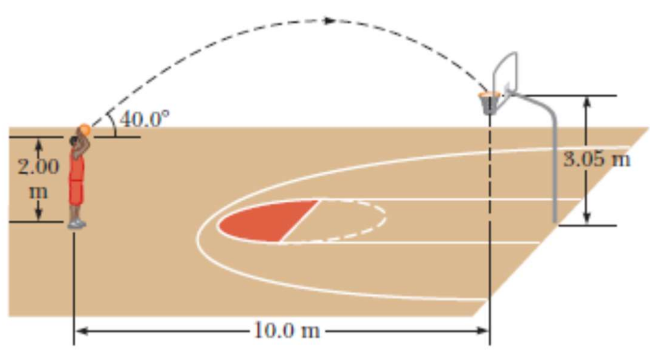

Figure P3.58

Chapter 7: Rotational Motion

Ex.7.3

The tires on a new compact car have a diameter of 2.0 ft and are warranted for 60 000 miles.

(a) Determine the angle (in radians) through which one of these tires will rotate during the warranty period.

(b) How many revolutions of the tire are equivalent to your answer in part (a)?

Ex.7.4

A potter's wheel moves uniformly from rest to an angular speed of 1.00 rev/s in 30.0 s.

(rev = revolution)
(a) Find its angular acceleration in radians per second per second.
(b) Would doubling the angular acceleration during the given period have doubled final angular speed?

Ex.7.14

An electric motor rotating a workshop grinding wheel at a rate of 1.0×10^2 rev/min is switched off. Assume the wheel has a constant negative angular acceleration of magnitude 2.00 rad/s^2.
(a) How long does it take for the grinding wheel to stop?
(b) Through how many radians has the wheel turned during the interval found in part (a)?

Ex.7.15

A car initially traveling eastward turns north by traveling in a circular path at uniform speed as shown in Figure P7.15. The length of the arc ABC is 235 m, and the car completes the turn in 36.0 s.
(a) Determine the car's speed.
(b) What is the magnitude and direction of the acceleration when the car is at point B?

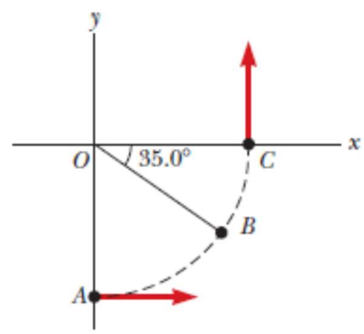

Figure P7.15

Chapter 4: The laws of Motion 4 -7,15,21, 38,41

Ex. 4.7.

A 75-kg man standing on a scale in an elevator notes that as the elevator rises, the scale reads 825 N. What is the acceleration of the elevator?

Ex. 4.15

After falling from rest from a height of 30 m, a 0.50-kg ball rebounds upward, reaching a height of 20 m. If the contact between ball and ground lasted 2.0 ms, what average force was exerted on the ball?

Ex. 4.21.

Two blocks each of mass m=3.50 kg are fastened to the top of an elevator as in Figure P4.21.

(a) If the elevator has an upward acceleration a =1.60 m/s^2, find the tensions T_1 and T_2 in the upper and lower strings.

(b) If the strings can withstand a maximum tension of 85.0 N, what maximum acceleration can the elevator have before the upper string breaks?

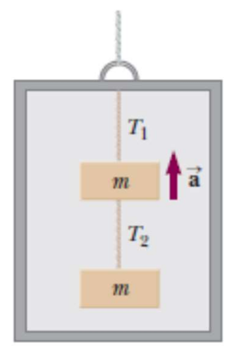

Figure P4.21
(Problems 21 and 22)

Ex.4.38

Two objects with masses of 3.00 kg and 5.00 kg are connected by a light string that passes over a frictionless pulley, as in Figure P4.38. Determine

(a) the tension in the string,

(b) the acceleration of each object, and

(c) the distance each object will move in the first second of motion if both objects start from rest.

Ex.4.41

A 1 000-N crate is being pushed across a level floor at a constant speed by a force **F** : of 300 N at an angle of 20.0° below the horizontal, as shown in Figure P4.41a.

(a) What is the coefficient of kinetic friction between the crate and the floor?

(b) If the 300-N force is instead pulling the block at an angle of 20.0° above the horizontal, as shown in Figure P4.41b, what will be the acceleration of the crate? Assume that the coefficient of friction is the same as that found in part (a).

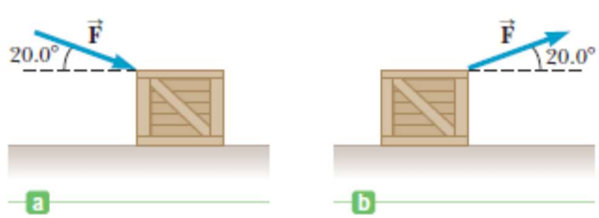

Figure P4.41

Chapter 7 : Rotation Motion and the Law of Gravity: 7 – 25,27,34,63,70

Ex.7.25

A 50.0-kg child stands at the rim of a merry-go-round of radius 2.0 m, rotating with an angular speed of 3.0 rad/s.

(a) What is the child's centripetal acceleration?

(b) What is the minimum force between her feet and the floor of the carousel that is required to keep her in the circular path?

(c) What minimum coefficient of static friction is required? Is the answer you found reasonable? In other words, is she likely to stay on the merry-go-round?

Ex.7.27

An air puck of mass m_1 =0.25 kg is tied to a string and allowed to revolve in a circle of radius R=1.0 m on a frictionless horizontal table. The other end of the string passes through a hole in the center of the table, and a mass of m_2 =1.0 kg is tied to it (Fig. P7.27). The suspended mass remains in equilibrium while the puck on the tabletop revolves.

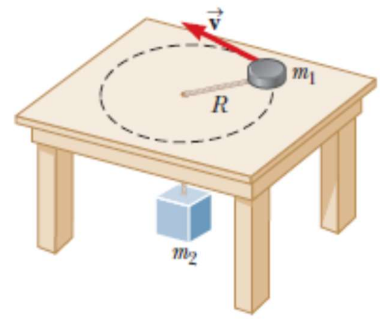

Figure P7.27 Problems 27 and 28.

(a) What is the tension in the string?

(b) What is the horizontal force acting on the puck?

(c) What is the speed of the puck?

Ex.7.34

A satellite has a mass of 100 kg and is located at 2.0×10^6 m above the surface of Earth.

(a) What is the potential energy associated with the satellite at this location?

(b) What is the magnitude of the gravitational force on the satellite?

Ex.7.63

A skier starts at rest at the top of a large hemispherical hill (Fig. P7.63). Neglecting friction, show that the skier will leave the hill and become airborne at a distance $h= R/3$ below the top of the hill. *Hint:* At this point, the normal force goes to zero.

Figure P7.63

Ex.7.70

A 0.275-kg object is swung in a *vertical* circular path on a string 0.850 m long as in Figure P7.70.

(a) What are the forces acting on the ball at any point along this path?

(b) Draw free-body diagrams for the ball when it is at the bottom of the circle and when it is at the top.

(c) If its speed is 5.20 m/s at the top of the circle, what is the tension in the string there?

(d) If the string breaks when its tension exceeds 22.5 N, what is the maximum speed the object can have at the bottom before the string breaks?

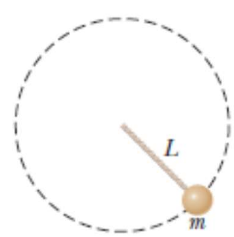

Figure P7.70

Chapter 5: Energy, (5)– 8, 15, 20, 45, 61

Ex.5.8

A block of mass m=2.50 kg is pushed a distance d= 2.20 m along a frictionless horizontal table by a constant applied force of magnitude F=16.0 N directed at an angle θ= 25.0° below the horizontal as shown in Figure P5.8. Determine the work done by

(a) the applied force,
(b) the normal force exerted by the table,
(c) the force of gravity, and
(d) the net force on the block.

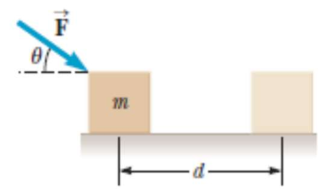

Figure P5.8

Ex.5.15

A 7.80-g bullet moving at 575 m/s penetrates a tree trunk to a depth of 5.50 cm.
(a) Use work and energy considerations to find the average frictional force that stops the bullet.
(b) Assuming the frictional force is constant, determine how much time elapses between the moment the bullet enters the tree and the moment it stops moving.

Ex.5.20

When a 2.50-kg object is hung vertically on a certain light spring described by Hooke's law, the spring stretches 2.76 cm.
(a) What is the force constant of the spring?
(b) If the 2.50-kg object is removed, how far will the spring stretch if a 1.25-kg block is hung on it?
(c) How much work must an external agent do to stretch the same spring 8.0 cm from its unstretched position?

Ex.5.45

A 2.1×10^3-kg car starts from rest at the top of a 5.0-m-long driveway that is inclined at 20° with the horizontal. If an average friction force of 4.0×10^3 N impedes the motion, find the speed of the car at the bottom of the driveway.

Ex.5.61

The force acting on an object is given by F_x =(8x-16) N, where x is in meters. (a) Make a plot of this force versus x from x= 0 to x= 3.0 m. (b) From your graph, find the net work done by the force as the object moves from x= 0 to x= 3.0 m.

Chapter 6: Momentum and Collisions 6 – 9,15,25,38,40,56

Ex.6.9

A 0.280-kg volleyball approaches a player horizontally with a speed of 15.0 m/s. The player strikes the ball with her fist and causes the ball to move in the opposite direction with a speed of 22.0 m/s.
(a) What impulse is delivered to the ball by the player?
(b) If the player's fist is in contact with the ball for 0.060 s, find the magnitude of the average force exerted on the player's fist.

Ex.6.15

The force shown in the force vs. time diagram in Figure P6.15 acts on a 1.5-kg object. Find
(a) the impulse of the force,
(b) the final velocity of the object if it is initially at rest, and
c) the final velocity of the object if it is initially moving along the x-axis with a velocity of -2.0 m/s.

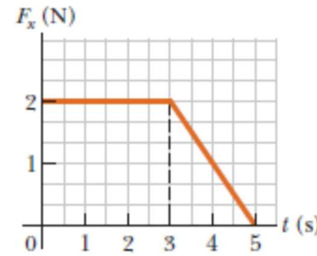

Figure P6.15

Ex.6.25

An astronaut in her space suit has a total mass of 87.0 kg, including suit and oxygen tank. Her tether line loses its attachment to her spacecraft while she's on a spacewalk. Initially at rest with respect to her spacecraft, she throws her 12.0-kg oxygen tank away from her spacecraft with a speed of 8.0 m/s to propel herself back toward it (Fig. P6.25).
(a) Determine the maximum distance she can be from the craft and still return within 2.0 min (the amount of time the air in her helmet remains breathable).
(b) Explain in terms of Newton's laws of motion why this strategy works

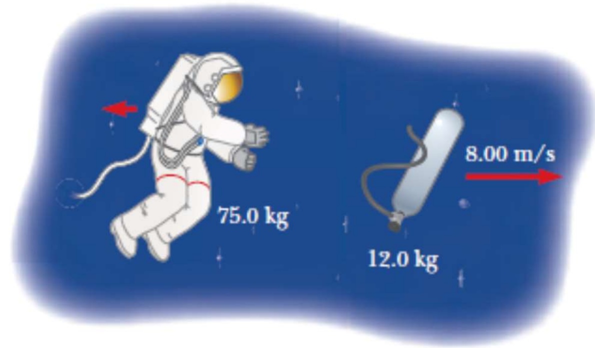

Figure P6.25

Ex.6.38

Two shuffleboard disks of equal mass, one orange and the other green, are involved in a perfectly elastic glancing collision. The green disk is initially at rest and is struck by the orange disk moving initially to the right at 5.0 m/s as in Figure P6.38a. After the collision, the orange disk moves in a direction that makes an angle of 37.0° with the horizontal axis while the green disk makes an angle of 53.0° with this axis as in Figure P6.38b. Determine the speed of each disk after the collision.

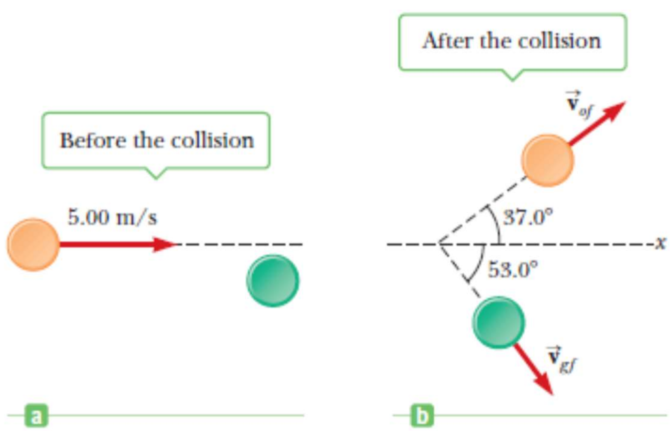

Figure P6.38

Ex.6.40

An bullet of mass m = 8.00 g is fired into a block of mass M = 250 g that is initially at rest at the edge of a table of height h=1.0 m

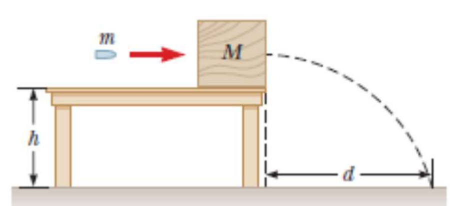

Figure P6.40

(Fig. P6.40). The bullet remains in the block, and after the impact the block lands $d = 2.0$ m from the bottom of the table. Determine the initial speed of the bullet.

Ex.6.56

A bullet of mass m and speed v passes completely through a pendulum bob of mass M as shown in Figure P6.56. The bullet emerges with a speed of $v/2$. The pendulum bob is suspended by a stiff rod of length , and neglgible mass. What is the minimum value of v such that the bob will barely swing through a complete vertical circle?

Chapter 8: Rotational Equilibrium and Rotational Dynamics 8–2,11,30,52,56,65,70,80,84

Ex.8.2

Find the net torque on the wheel in Figure P8.2 about the axle through O perpendicular to the page, taking a=10.0 cm and b= 25.0 cm.

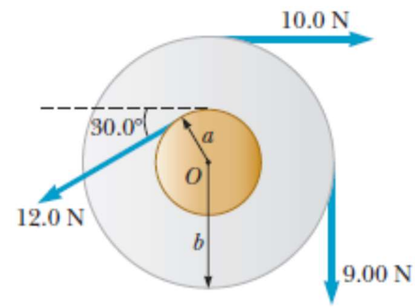

Figure P8.2

Ex.8.11

Find the x- and y-coordinates of the center of gravity of a 4.0-ft by 8.00-ft uniform sheet of plywood with the upper right quadrant removed as shown in Figure P8.11.
Hint: The mass of any segment of the plywood sheet is proportional to the area of that segment.

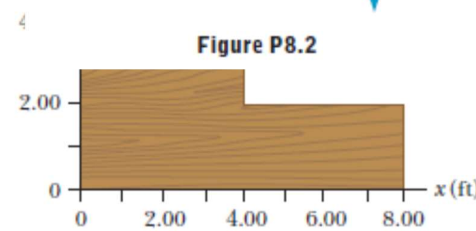

Figure P8.11

Ex.8.30

One end of a uniform 4.0-m-long rod of weight ω is supported by a cable at an angle of $\theta = 37°$ with the rod. The other end rests against a wall, where it is held by friction. (See Fig. P8.30.) The coefficient of static friction between the wall and the rod is $\mu_s = 0.50$. Determine the minimum distance x from point A at which an additional weight ω (the same as the weight of the rod) can be hung without causing the rod to slip at point A.

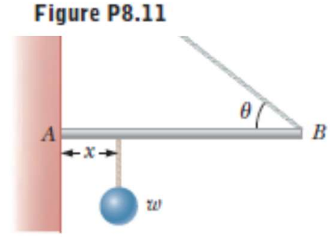

Figure P8.30

Ex.8.52

Use conservation of energy to determine the angular speed of the spool shown in Figure P8.52 after the 3.0-kg bucket has fallen 4.0 m, starting from rest. The light string attached to the bucket is wrapped around the spool and does not slip as it unwinds.

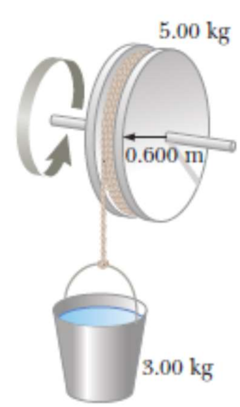

Figure P8.52

Ex.8.56

A 0.005-kg bullet traveling horizontally with a speed of 1.0×10^3 m/s enters an 18.0-kg door, embedding itself 10.0 cm from the side opposite the hinges as in Figure P8.56. The 1.0-m-wide door is free to swing on its hinges.

(a) Before it hits the door, does the bullet have angular momentum relative the door's axis of rotation? Explain.

(b) Is mechanical energy conserved in this collision? Answer without doing a calculation.

(c) At what angular speed does the door swing open immediately after the collision? (The door has same moment of inertia as a rod with axis at one end.)

(d) Calculate the energy of the door–bullet system and determine whether it is less than or equal to the kinetic energy of the bullet before the collision.

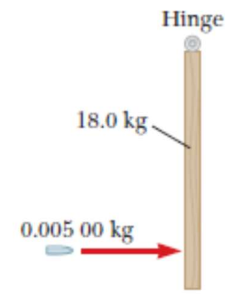

Figure P8.56. An overhead view of a bullet striking a door.

Ex.8.65

A cylinder with moment of inertia I_1 rotates with angular velocity v_0 about a frictionless vertical axle. A second cylinder, with moment of inertia I_2, initially not rotating, drops onto the first cylinder (Fig. P8.65). Because the surfaces are rough, the two cylinders eventually reach the same angular speed v.

(a) Calculate v.

(b) Show that kinetic energy is lost in this situation, and calculate the ratio of the final to the initial kinetic energy.

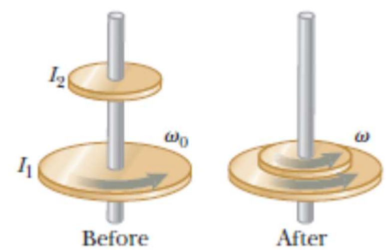

Figure P8.65

Ex.8.70

An object of mass M= 12.0 kg is attached to a cord that is wrapped around a wheel of radius r=10.0 cm (Fig. P8.70). The acceleration of the object down the frictionless incline is measured to be a=2.0 m/s^2 and the incline makes an angle θ=37.0° with the horizontal. the axle of the wheel to be frictionless, determine

(a) the tension in the rope,

(b) the moment of inertia of the wheel, and

(c) the angular speed of the wheel 2.00 s after it begins rotating, starting from rest.

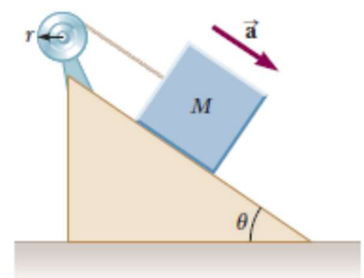

Figure P8.70

Ex.8.80

A uniform thin rod of length L and mass M is free to rotate on a frictionless pin passing through one end (Fig. P8.80). The rod is released from rest in the horizontal position.

(a) What is the speed of its center of gravity when the rod reaches its lowest position?

(b) What is the tangential speed of the lowest point on the rod when it is in the vertical position?

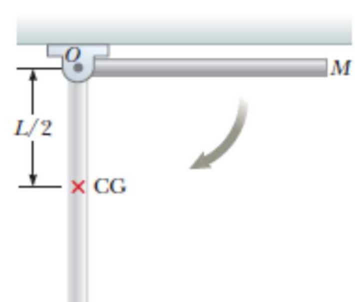

Figure P8.80

Ex.8.84

A string is wrapped around a uniform cylinder of mass M and radius R. The cylinder is released from rest with the string vertical and its top end tied to a fixed bar (Fig. P8.84). Show that
(a) the tension in the string is one-third the weight of the cylinder,
(b) the magnitude of the acceleration of the center of gravity is $2g/3$, and
(c) the speed of the center of gravity is $(4gh/3)^{1/2}$ after the cylinder has descended through distance h. Verify your answer to part (c) with the energy approach.

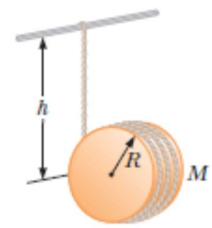

Figure P8.84

Chapter 13: Vibrations and Wave 13– 27,34,40,42,62

Ex.13.27

A cart of mass 250 g is placed on a frictionless horizontal air track. A spring having a spring constant of 9.5 N/m is attached between the cart and the left end of the track. If the cart is displaced 4.5 cm from its equilibrium position, find (a) the period at which it oscillates, (b) its maximum speed, and (c) its speed when it is located 2.0 cm from its equilibrium position.

Ex.13.34

A man enters a tall tower, needing to know its height. He notes that a long pendulum extends from the ceiling almost to the floor and that its period is 15.5 s.
(a) How tall is the tower?
(b) If this pendulum is taken to the Moon, where the free-fall acceleration is 1.67 m/s^2, what is the period there?

Ex.13.40

A simple pendulum is 5.0 m long. (a) What is the period of simple harmonic motion for this pendulum if it is located in an elevator accelerating upward at 5.0 m/s^2? (b) What is its period if the elevator is accelerating downward at 5.0 m/s^2? (c) What is the period of simple harmonic motion for the pendulum if it is placed in a truck that is accelerating horizontally at 5.0 m/s^2?

Ex.13.42

An object attached to a spring vibrates with simple harmonic motion as described by Figure P13.42. For this motion, find (a) the amplitude, (b) the period, (c) the angular frequency, (d) the maximum speed, (e) the maximum acceleration, and (f) an equation for its position x in terms of a sine function.

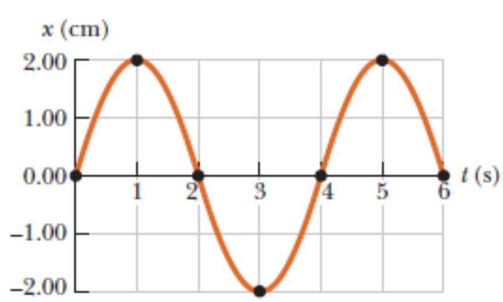

Figure P13.42

Ex.13.62
The position of a 0.30-kg object attached to a spring isdescribed by

$$x = (0.25 \text{ m}) \cos (0.4\pi t)$$

Find (a) the amplitude of the motion, (b) the spring constant, (c) the position of the object at t=0.30 s, and (d) the object's speed at t=0.30 s.

Chapter 10: Thermal Physics

Ex.10.29
One mole of oxygen gas is at a pressure of 6.0 atm and a temperature of 27°C. (a) If the gas is heated at constant volume until the pressure triples, what is the final temperature? (b) If the gas is heated so that both the pressure and volume are doubled, what is the final temperature?

Ex.10.31
(a) An ideal gas occupies a volume of 1.0 cm^3 at 20°C and atmospheric pressure. Determine the number of molecules of gas in the container. (b) If the pressure of the 1.0-cm^3 volume is reduced to 1.0×10^{-11} Pa (an extremely good vacuum) while the temperature remains constant, how many moles of gas remain in the container?

Ex.10.33
Gas is confined in a tank at a pressure of 11.0 atm and a temperature of 25°C. If two-thirds of the gas is withdrawn and the temperature is raised to 75°C, what is the new pressure of the gas remaining in the tank?

Ex.10.39
What is the average kinetic energy of a molecule of oxygen at a temperature of 300 K?

Ex.10.43
At what temperature would the rms speed of helium atoms equal (a) the escape speed from Earth, 1.12×10^4 m/s and (b) the escape speed from the Moon, 2.37×10^3 m/s? (See Chapter 7 for a discussion of escape speed.) Note: The mass of a helium atom is 6.64×10^{-27} kg

Ex.10.44
A 7.00-L vessel contains 3.5 moles of ideal gas at a pressure of 1.6×10^6 Pa. Find (a) the temperature of the gas and (b) the average kinetic energy of a gas molecule in the vessel. (c) What additional information would you need if you were asked to find the average speed of a gas molecule?

Chapter 10b: Thermal Physic – 1,2,3 (Supplement document)

10b.1 How many percentages of nitrogen molecules at temperature of 7°C having velocity in the range from 500 to 510 m/s?

10b.2 Find the altitude (above sea level) in which the density of gas decreases:

a. 2 times; b. *e* times;

Know that the temperature of air is 0°C and independent with altitude; specific mass of air is 29kg/kmol.

10b.3 Find the ratio of pressure of are at sea level and at 1000-m altitude (above sea level)? Knowing that the temperature of air is 27°C and independent with altitude.

Chapter 12: Heat engine

Ex.12.3

Gas in a container is at a pressure of 1.5 atm and a volume of 4.0 m^3. What is the work done on the gas

(a) if it expands at constant pressure to twice its initial volume, and

(b) if it is compressed at constant pressure to one-quarter its initial volume?

Ex.12.5

A gas expands from I to F along the three paths indicated in Figure P12.5. Calculate the work done on the gas along paths (a) IAF, (b) IF, and (c) IBF

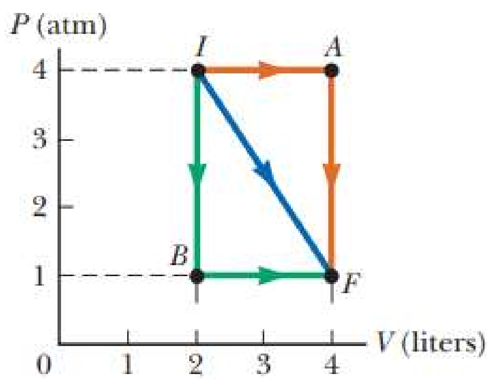

Figure P12.5 Problems 5 and 13.

Ex.12.15

A gas is compressed at a constant pressure of 0.80 atm from 9.0 L to 2.0 L. In the process, 400 J of energy leaves the gas by heat.

(a) What is the work done on the gas?

(b) What is the change in its internal energy?

Ex.12.27

Consider the Universe to be an adiabatic expansion of atomic hydrogen gas.

(a) Use the ideal gas law and Equation 12.8a to show that $TV^{\gamma-1}=C$, where C is a constant.

(b) The current Universe extends at least 15 billion light-years in all directions (1.4×10^{26} m), and the current temperature of the Universe is 2.7 K. Estimate the temperature of the Universe when it was the size of a nutshell, with a radius of 2 cm. (For this calculation, assume the Universe is spherical.)

Ex.12.29,

A gas increases in pressure from 2.00 atm to 6.00 atm at a constant volume of 1.00 m^3 and then expands at constant pressure to a volume of 3.00 m^3 before returning to its initial state as shown in Figure P12.29. How much work is done in one cycle?

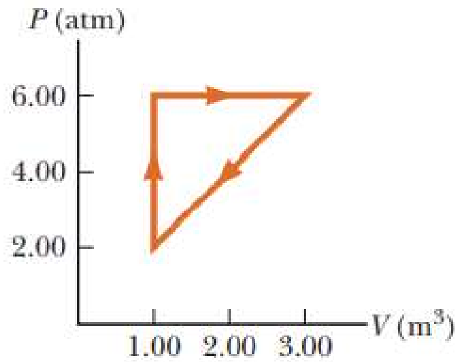

Figure P12.29

Ex.12.33

The work done by an engine equals one-fourth the energy it absorbs from a reservoir. (a) What is its thermal efficiency? (b) What fraction of the energy absorbed is expelled to the cold reservoir?

Ex.12.37

An engine absorbs 1.70 kJ from a hot reservoir at 277°C and expels 1.20 kJ to a cold reservoir at 27°C in each cycle.

(a) What is the engine's efficiency?

(b) How much work is done by the engine in each cycle?

(c) What is the power output of the engine if each cycle lasts 0.300 s?

Chapter 12b: Entropy 12b–1,2,3,4,5 (Supplement document)

12b.1 Ten grams of oxygen is heated up from 50°C to 150°C. Find the change in entropy if the process is:

a. Isovolumetric process;

b. Isobaric process;

12b.2 Find the change in entropy of 6 grams of hydrogen gas when it is expanded from volume 20 liters, pressure 1.5 at to volume 60 liters, pressure 1.0 at.

12b.3 The change in entropy between two adiabatic process in a Carno cycle is 1 kcal/K. The difference of temperature between two isothermal processes is 100 K. Find the heat converting into work in this cycle (or find the work done in a cycle)?

12b.4 Put 100 gram of ice cube at 0°C into 400-g water at 30°C in a thermally insulating container. Find the change in entropy of system in the heat interexchange. From this result, can we conclude that the heat can only transfer from hot object to cold object? The latent heat of fusion of ice water at 0°C is 80 kcal/kg; the specific heat of liquid water is 1kcal/kg.K.

12b.5 Put 200-g iron at 100°C into a thermometer containing 300-g water at 12°C. When the system gets to thermal equilibrium state, find the change in entropy of system.