Physics 06, Fa19, LACC, R Erickson **FINAL EXAM** Name_____

Show all work for full credit. Try to keep all work on these sheets if possible. Attach further work to this sheet if more space is needed however. All problems, or parts there in, are 5 pts each.

Ch 2 Kinematics

1) An airplane travels at 300 mi/h south for 2.00 h and then at 250 mi/h north for 750 miles. What is the average speed for the trip?
A) 280 mi/h B) 260 mi/h C) 270 mi/h D) 275 mi/h
ID: ppa7g 2.2–13

2) A race car circles 10 times around a circular 8.0–km track in 20 min. Using SI units
(a) what is its average speed for the ten laps?
(b) what is its average velocity for the ten laps?
ID: ppa7g 2.2–14

3) In a ballistics test, a bullet moving horizontally with a speed of 500 m/s strikes a sandbag and penetrates a distance of 10.0 cm.
(a) What is the magnitude of the average acceleration of the bullet in the sandbag?
(b) How many milliseconds does it take the bullet to come to rest in the sandbag?
ID: ppa7g 2.2–33

4) A car accelerates from 5.0 m/s to 21 m/s at a constant rate of 3.0 m/s^2. How far does it travel while accelerating?
A) 117 m B) 207 m C) 41 m D) 69 m
ID: ppa7g 2.2–49

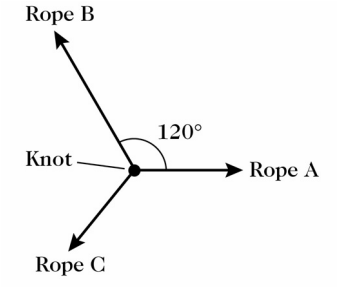
5) A car is traveling with a constant speed when the driver suddenly applies the brakes, causing the car to slow down with a constant acceleration of magnitude 3.50 m/s^2. If the car comes to a stop in a distance of 30.0 m, what was the car's original speed?
A) 315 m/s B) 210 m/s C) 10.2 m/s D) 105 m/s E) 14.5 m/s
ID: ppa7g 2.2–61

6) A package is dropped from a helicopter that is moving upward at 15 m/s. If it takes 8.0 s before the package strikes the ground, how high above the ground was the package when it was released? Neglect air resistance.
ID: ppa7g 2.2–87

Ch 2 2-D Kinematics

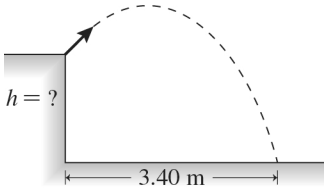
7) A vector $\vec{\mathbf{A}}$ has components $A_x = 12.0$ m and $A_y = 5.00$ m.
(a) What is the angle that vector $\vec{\mathbf{A}}$ makes with the +x–axis?
(b) What is the magnitude of vector $\vec{\mathbf{A}}$?
ID: ppa7g 3.2–9

8) Three ropes are tied in a knot as shown in the figure. One student pulls on rope A with 1.0 pound of force, and another student pulls on rope B with 7.0 pounds of force. How *hard* and in what *direction* must you pull on rope C to *balance* the first two pulls? Give the direction by specifying the angle (clockwise or counterclockwise) of the pull with the direction of rope A.



ID: ppa7g 3.2–21

9) As shown in the figure, a heavy rock is shot upward from the edge of a vertical cliff. It leaves the edge of the cliff with an initial velocity of 15 m/s directed at 25° from the vertical and experiences no appreciable air resistance as it travels. How high is the cliff?



ID: ppa7g 3.2–59

10) A marble moving 1.48 m/s rolls off the top edge of a 125–cm high table in a room where there is no appreciable air resistance and the acceleration due to gravity is 9.80 m/s^2.
(a) How far from the base of the table will it strike the floor?
(b) How long will it be in the air?

ID: ppa7g 3.2–69

Ch 4 Newton's Laws

11) A 450–kg sports car accelerates from rest to 100 km/h in 4.80 s. What magnitude force does a 68.0 kg passenger experience during the acceleration?

A) 342 N B) 311 N C) 394 N D) 82.0 N

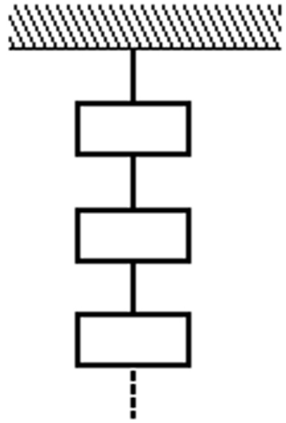
ID: ppa7g 4.2–10

12) A tightrope walker walks across a 30–m long wire tied between two poles. The center of the wire is displaced vertically downward by 1.0 m when he is halfway across. If the tension in both halves of the wire at this point is 6294 N, what is the mass of the tightrope walker? Neglect the mass of the wire.

A) 91 kg B) 85 kg C) 43 kg D) 74 kg

ID: ppa7g 4.2–34

13) A very light wire is used to hang a series of 8.0–kg bricks. This wire will break if the tension in it exceeds 450 N. The bricks are hung one below the other from a hook in the ceiling using this wire, as shown in the figure.
(a) How many whole bricks can be hung without breaking the wire?
(b) If you add one more brick to the number found in part (a), which string will break?



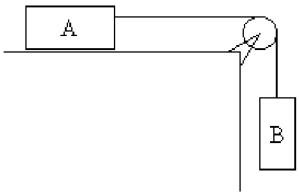
ID: ppa7g 4.2–41

14) Three boxes rest side–by–side on a smooth, horizontal floor. Their masses are 5.0 kg, 3.0 kg, and 2.0 kg, with the 3.0–kg mass in the center. A force of 50 N pushes on the 5.0–kg box, which pushes against the other two boxes. What magnitude force does the 5.0–kg box exert on the 3.0–kg box?

A) 50 N B) 40 N C) 10 N D) 0 N E) 25 N

ID: ppa7g 4.2–49

15) In the figure, block A has a mass of 3.00 kg. It rests on a smooth horizontal table and is connected by a very light horizontal string over an ideal pulley to block B, which has a mass of 2.00 kg. When block B is gently released from rest, how long does it take block B to travel 80.0 cm?



A) 0.494 s B) 0.639 s C) 0.935 s D) 0.404 s E) 0.785 s

ID: ppa7g 4.2–60

16) A 50–kg box is being pushed along a horizontal surface. The coefficient of static friction between the box and the ground is 0.65, and the coefficient of kinetic friction is 0.35. What horizontal force must be exerted on the box for it to accelerate at 1.2 m/s^2?

A) 60 N B) 170 N C) 230 N D) 120 N E) 490 N

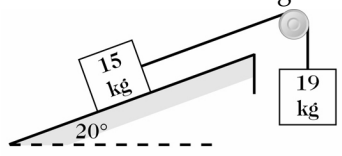
ID: ppa7g 4.2–66

17) In a shuffleboard game, the puck slides a total of 12 m on a horizontal surface before coming to rest. If the coefficient of kinetic friction between the puck and board is 0.10, what was the initial speed of the puck?

A) 4.3 m/s B) 4.8 m/s C) 48.5 m/s D) 3.8 m/s

ID: ppa7g 4.2–71

18) A 15–kg block is on a frictionless ramp that is inclined at 20° above the horizontal. It is connected by a very light string over an ideal pulley at the top edge of the ramp to a hanging 19–kg block, as shown in the figure. The string pulls on the 15–kg block parallel to the surface of the ramp. Find the magnitude of the acceleration of the 19–kg block after the system is gently released?



A) 4.2 m/s^2 B) 4.0 m/s^2 C) 4.5 m/s^2 D) 3.8 m/s^2

ID: ppa7g 4.2–84

Ch 5 Rotation and Gravitation

19) A particularly scary roller coaster contains a loop–the–loop in which the car and rider are completely upside down. If the radius of the loop is 13.2 m, with what minimum speed must the car traverse the loop so that the rider does not fall out while upside down at the top? Assume the rider is not strapped to the car.

A) 12.5 m/s B) 10.1 m/s C) 14.9 m/s D) 11.4 m/s

ID: ppa7g 5.2–1

20) Pulling out of a dive, the pilot of an airplane guides his plane into a vertical circle with a radius of 600 m. At the bottom of the dive, the speed of the airplane is 150 m/s. What is the apparent weight of the 70–kg pilot at that point?

A) 1400 N B) 2600 N C) 3300 N D) 490 N E) 690 N

ID: ppa7g 5.2–13

21) A curved portion of highway has a radius of curvature of 65 m. As a highway engineer, you want to bank this curve at the proper angle for a steady speed of 22 m/s.
(a) What banking angle should you specify for this curve?
(b) At the proper banking angle, what normal force and what friction force does the highway exert on a 750–kg car going around the curve at the proper speed?

ID: ppa7g 5.2–24

22) What is the proper banking angle for an Olympic bobsled to negotiate a 100–m radius turn at 35 m/s without skidding?

A) 61° B) 41° C) 31° D) 51°

ID: ppa7g 5.2–26

23) The mass of the Moon is 7.4×10^{22} kg, its radius is 1.74×10^3 km, and it has no atmosphere. What is the acceleration due to gravity at the surface of the Moon? ($G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$)

A) $2.8 \times 10^6\ m/s^2$
B) $4.9\ m/s^2$
C) $9.8\ m/s^2$
D) $0.80\ m/s^2$
E) $1.6\ m/s^2$

ID: ppa7g 5.2–47

24) An astronaut drops a marble on the surface of the airless Planet Z–49 and observes that it takes 1.02 s for the marble to fall 2.00 m starting from rest. She also knows that the radius of Z–49 is 3.39×10^6 m. From this information, what will she determine for the mass of Z–49? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2)

A) 8.09×10^{23} kg.

B) 6.62×10^{23} kg.

C) 9.95×10^{23} kg.

D) 4.62×10^{23} kg.

E) 3.30×10^{23} kg.

ID: ppa7g 5.2–51

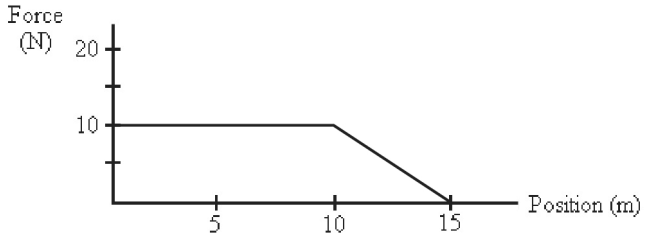
25) Asteroid Ida was photographed by the Galileo spacecraft in 1993, and the photograph revealed that the asteroid has a small moon, which has been named Dactyl. From the dimensions of Ida and its general features, one can estimate the mass of Ida to be 4.5×10^{16} kg, and the distance between Dactyl and Ida is approximately 90 km. Assuming a circular orbit, what would be the orbital speed of Dactyl? ($G = 6.67 \times 10^{-11}$ N • m^2/kg^2)

A) 11 m/s B) 2.3 m/s C) 5.8 m/s D) 2.9 m/s E) 30 m/s

ID: ppa7g 5.2–64

Ch 6 Energy

26) A force acts on an object, causing it to move parallel to the force. The graph in the figure shows this force as a function of the position of the object. How much work does the force do as the object moves from 0 to 15 m?



A) 125 J B) 25 J C) 50 J D) 150 J E) 100 J

ID: ppa7g 6.2–26

27) A 1000–kg car experiences a net force of 9500 N while slowing down from 30 m/s to 15.9 m/s. How far does it travel while slowing down?

A) 34 m B) 41 m C) 31 m D) 37 m

ID: ppa7g 6.2–40

28) You do 116 J of work while pulling your sister back on a fritctionless swing, whose chain is 5.10 m long, until the swing makes an angle of 32.0° with the vertical. What is your sister's mass?

A) 13.0 kg B) 19.0 kg C) 15.3 kg D) 17.6 kg

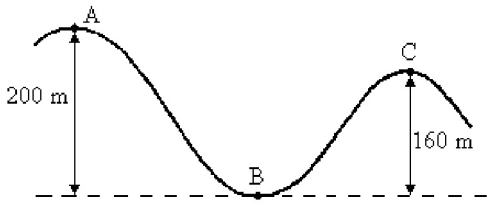
ID: ppa7g 6.2–52

29) A rock falls from a vertical cliff that is 4.0 m tall and experiences no significant air resistance as it falls. At what speed will its gravitational potential energy (relative to the base of the cliff) be equal to its kinetic energy?

A) 13 m/s B) 4.4 m/s C) 6.3 m/s D) 8.9 m/s E) 3.1 m/s

ID: ppa7g 6.2–65

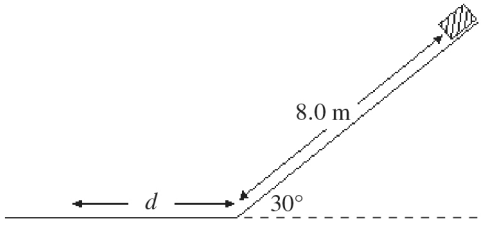
30) A bead is moving with a speed of 20 m/s at position A on the track shown in the figure. This track is friction–free, and there is no appreciable air resistance. What is the speed of the bead at point C?



A) 20 m/s
B) 0 m/s
C) 69 m/s
D) 34 m/s
E) We cannot solve this problem without knowing the mass of the bead.

ID: ppa7g 6.2–69

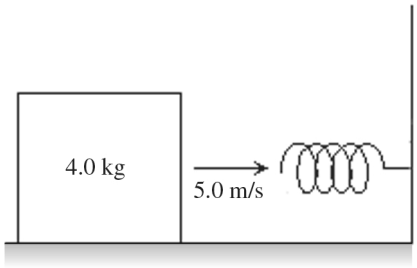
31) An object with a mass of 10 kg is initially at rest at the top of a frictionless inclined plane that rises at 30° above the horizontal. At the top, the object is initially 8.0 m from the bottom of the incline, as shown in the figure. When the object is released from this position, it eventually stops at a distance d from the bottom of the inclined plane along a horizontal surface, as shown. The coefficient of kinetic friction between the horizontal surface and the object is 0.20, and air resistance is negligible. Find the distance d.



A) 10 m B) 15 m C) 20 m D) 25 m E) 5.0 m

ID: ppa7g 6.2–89

32) As shown in the figure, a 4.0–kg block is moving at 5.0 m/s along a horizontal frictionless surface toward an ideal spring that is attached to a wall. After the block collides with the spring, the spring is compressed a maximum distance of 0.68 m. What is the speed of the block when the spring is compressed to only one–half of the maximum distance?



ID: ppa7g 6.2–96

33) A 1500–kg car accelerates from rest to 25 m/s in 7.0 s. What is the average power delivered by the engine? (1 hp = 746 W)

A) 70 hp B) 80 hp C) 60 hp D) 90 hp

ID: ppa7g 6.2–100

34) If electricity costs 7.06¢/kW•h, how much would it cost you to run a 120–W stereo system 4.0 hours per day for 4.0 weeks?

A) \$2.66 B) \$1.62 C) \$0.14 D) \$0.95

ID: ppa7g 6.2–102

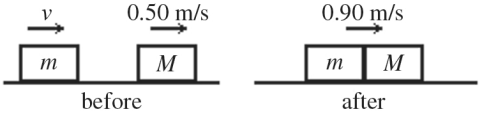
Ch 7 Momentum

35) A 0.140–kg baseball is thrown with a velocity of 27.1 m/s. It is struck by the bat with an average force of 5000 N, which results in a velocity of 37.0 m/s in the opposite direction from the original velocity. How long were the bat and ball in contact?

A) 1.79×10^{-3} s B) 4.30×10^{-3} s C) 1.28×10^{-2} s D) 3.07×10^{-2} s

ID: ppa7g 7.2–35

36) A block of mass $m = 34$ kg and speed V is behind a block of mass $M = 81$ kg and speed of 0.50 m/s, as shown in the figure. The surface is frictionless and the blocks collide and couple. After the collision, the blocks have a common speed of 0.90 m/s. What is the magnitude of the impulse on the 34–kg block due to the collision?



A) 73 N • s B) 32 N • s C) 41 N • s D) 57 N • s E) 14 N • s

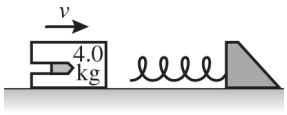
ID: ppa7g 7.2–43

37) A 340–g air track cart traveling at 1.25 m/s suddenly collides elastically with a stationary 300–g cart. What is the speed of the 300–g cart just after the collision?

A) 1.25 m/s B) 1.33 m/s C) 0.0781 m/s D) 0.664 m/s E) 0.625 m/s

ID: ppa7g 7.2–60

38) An 8.0–g bullet is suddenly shot into a 4.0–kg block, at rest on a frictionless horizontal surface, as shown in the figure. The bullet remains lodged in the block. The block then moves against a spring and compresses it by 8.9 cm. The force constant (spring constant) of the spring is 1400 N/m. What is the magnitude of the impulse on the block (including the bullet inside) due to the spring during the entire time interval during which the block compresses the spring?



A) 6.7 N • s B) 13 N • s C) 8.3 N • s D) 10 N • s E) 12 N • s

ID: ppa7g 7.2–81

Ch 8 Angular Momentum

39) When a fan is turned off, its angular speed decreases from 10 rad/s to 6.3 rad/s in 5.0 s. What is the magnitude of the average angular acceleration of the fan?

A) 0.86 rad/s^2 B) 0.37 rad/s^2 C) 0.74 rad/s^2 D) 11 rad/s^2 E) 1.2 rad/s^2

ID: ppa7g 8.2–9

40) A child is riding a merry–go–round that is turning at 7.18 rpm. If the child is standing 4.65 m from the center of the merry–go–round, how fast is the child moving?

A) 3.50 m/s B) 0.556 m/s C) 1.80 m/s D) 5.64 m/s E) 1.75 m/s

ID: ppa7g 8.2–14

41) How long does it take for a rotating object to speed up from 15.0 rad/s to 33.3 rad/s if it has a uniform angular acceleration of 3.45 rad/s^2?

A) 5.30 s B) 4.35 s C) 9.57 s D) 63.1 s E) 10.6 s

ID: ppa7g 8.2–26

42) A potter's wheel has the shape of a solid uniform disk of mass 7.0 kg and radius 0.65 m. It spins about an axis perpendicular to the disk at its center. A small 2.1 kg lump of very dense clay is dropped onto the wheel at a distance 0.41 m from the axis. What is the moment of inertia of the system about the axis of spin?

A) 1.5 kg • m^2 B) 1.8 kg • m^2 C) 2.5 kg • m^2 D) 0.40 kg • m^2

ID: ppa7g 8.2–45

43) A solid uniform ball with a mass of 125 g is rolling without slipping along the horizontal surface of a table with a speed of 4.5 m/s when it rolls off the edge and falls towards the floor, 1.1 m below. What is the rotational kinetic energy of the ball just before it hits the floor?

A) 0.51 J
B) 1.1 J
C) 0.73 J
D) 2.6 J
E) This question cannot be answered without knowing the radius of the ball.

ID: ppa7g 8.2–58

44) A pencil that is 15.7 cm long is released from a vertical position with the eraser end resting on a table. The eraser does not slip as it tips over. Treat the pencil like a uniform rod. What is the angular speed of the pencil just before it hits the table?

A) 16.8 rad/s B) 7.23 rad/s C) 13.7 rad/s D) 3.70 rad/s E) 24.5 rad/s

ID: ppa7g 8.2–63

45) A hoop with a mass of 2.75 kg is rolling without slipping along a horizontal surface with a speed of 4.5 m/s when it starts down a ramp that makes an angle of 25° below the horizontal. What is the forward speed of the hoop after it has rolled 3.0 m down as measured along the surface of the ramp?

A) 5.2 m/s B) 4.9 m/s C) 8.0 m/s D) 6.3 m/s E) 5.7 m/s

ID: ppa7g 8.2–68

46) An ice skater has a moment of inertia of 5.0 kg • m^2 when her arms are outstretched, and at this time she is spinning at 3.0 rev/s. If she pulls in her arms and decreases her moment of inertia to 2.0 kg • m^2, how fast will she be spinning?

A) 10 rev/s B) 7.5 rev/s C) 2.0 rev/s D) 3.3 rev/s

ID: ppa7g 8.2–107

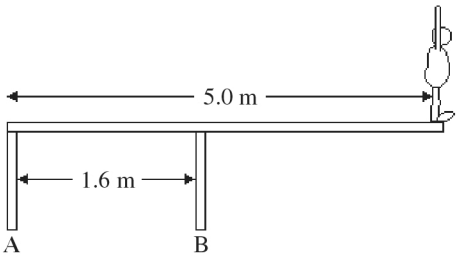
47) A 40.0-kg child running at 3.00 m/s suddenly jumps onto a stationary playground merry-go-round at a distance 1.50 m from the axis of rotation of the merry-go-round. The child is traveling tangential to the edge of the merry-go-round just before jumping on. The moment of inertia about its axis of rotation is 600 kg • m^2 and very little friction at its rotation axis. What is the angular speed of the merry-go-round just after the child has jumped onto it?

A) 0.788 rad/s B) 2.00 rad/s C) 0.261 rad/s D) 3.14 rev/s E) 6.28 rev/s

ID: ppa7g 8.2–111

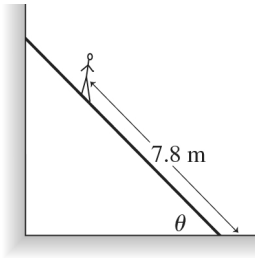
Ch 9 Statics and Elasticity

48) An 82–kg diver stands at the edge of a light 5.0–m diving board, which is supported by two vertical pillars that are 1.6 m apart, as shown in the figure. Find the magnitude and direction of the force exerted by each pillar.



ID: ppa7g 9.2–4

49) A uniform ladder 12 meters long rests against a vertical frictionless wall, as shown in the figure. The ladder weighs 400 N and makes an angle $\theta = 51°$ with the floor. A man weighing 874 N climbs slowly up the ladder. When he is 78 m from the bottom of the ladder, it just starts to slip. What is the coefficient of static friction between the floor and the ladder?



ID: ppa7g 9.2–10

50) A steel wire, 3.2 m long, has a diameter of 1.2 mm. The wire stretches 1.6 mm when it bears a load. Young's modulus for steel is 2.0×10^{11} Pa. The mass of the load is closest to

A) 28 kg. B) 16 kg. C) 12 kg. D) 20 kg. E) 24 kg.

ID: ppa7g 9.2–33

51) A copper sphere that is 10 cm in diameter at an atmospheric pressure of 1.01×10^5 N/m^2 is put into a chamber where the pressure is 1.0×10^6 N/m^2. What is the change in the diameter of the sphere caused by this change in pressure? The bulk modulus for copper is 1.4×10^{11} Pa. {V=4/3 pi r^3 }

A) -2.1×10^{-5} cm
B) -2.1×10^{-4} cm
C) -7.1×10^{-6} cm
D) -7.1×10^{-5} cm
E) -7.1×10^{-4} cm

ID: ppa7g 9.2–55+

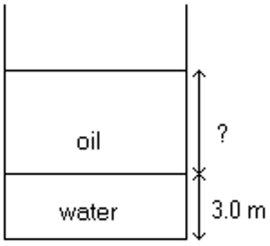
Ch 10 Fluids

52) A cubical box 25.0 cm on each side is immersed in a fluid. The pressure at the top surface of the box is 109.40 kPa and the pressure on the bottom surface is 112.00 kPa. What is the density of the fluid?

A) 1060 kg/m^3
B) 1030 kg/m^3
C) 1120 kg/m^3
D) 1000 kg/m^3
E) 1090 kg/m^3

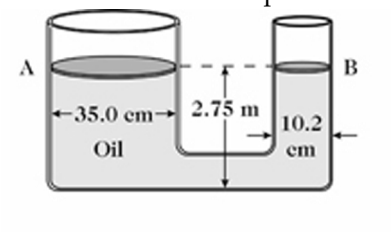
ID: ppa7g 10.2–19

53) As shown in the figure, a large open tank contains a layer of oil (density 450 kg/m^3) floating on top of a layer of water (density 1000 kg/m^3) that is 3.0 m thick, as shown in the sketch. What must be the thickness of the oil layer if the gauge pressure at the bottom of the tank is to be 8.5 x 10^4 Pa?



ID: ppa7g 10.2–24

54) A container consists of two vertical cylindrical columns of different diameter connected by a narrow horizontal section, as shown in the figure. The open faces of the two columns are closed by very light plates that can move up and down without friction. The tube diameter at *A* is 35.0 cm and at *B* it is 10.2 cm. This container is filled with oil of density 0.820 g/cm^3. If a 125–kg object is placed on the larger plate at *A*, how much mass should be placed on the smaller plate at *B* to balance it?



ID: ppa7g 10.2–25

55) A block of metal weighs 40 N in air and 30 N in water. What is the buoyant force on the block due to the water? The density of water is 1000 kg/m^3.

A) 30 N B) 40 N C) 70 N D) 10 N

ID: ppa7g 10.2–32

56) A rectangular box of negligible mass measures 5.0 m long, 1.0 m wide, and 0.50 m high. How many kilograms of mass can be loaded onto the box before it sinks in a lake having water of density 1000 kg/m^3?

A) 1.5 × 10^3 kg B) 2.5 × 10^3 kg C) 3.5 × 10^3 kg D) 0.50 × 10^3 kg

ID: ppa7g 10.2–42

57) Consider a very small hole in the bottom of a tank that is 17.0 cm in diameter and filled with water to a height of 90.0 cm. Find the speed at which the water exits the tank through the hole.

A) 4.20 m/s B) 17.64 m/s C) 48.3 m/s D) 44.1 m/s

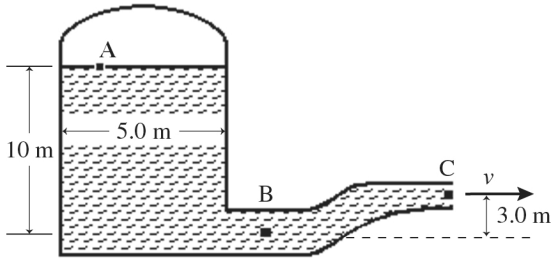
ID: ppa7g 10.2–60

58) For a certain patient, the build–up of fatty tissue on the wall of an artery has decreased the arterial radius by 10%. By how much would the pressure provided by the heart have to be increased to maintain a constant volume of blood flow? Model the blood as an ideal incompressible fluid.

A) 48% B) 46% C) 52% D) 54%

ID: ppa7g 10.2–69

59) A pressurized cylindrical tank, 5.0 m in diameter, contains water that emerges from the pipe at point C with a speed of 13 m/s as shown in the figure. Point A is 10 m above point B and point C is 3.0 m above point B. The area of the pipe at point B is 0.080 m^2 and the pipe narrows to an area of 0.040 m^2 at point C. Assume that the water is an ideal fluid in laminar flow. The density of water is 1000 kg/m^3 The mass flow rate in the pipe is closest to



A) 360 Kg/s. B) 470 Kg/s. C) 520 Kg/s. D) 420 Kg/s. E) 310 Kg/s.

ID: ppa7g 10.2–78

Ch 11 Oscillations

60) What is the frequency of a pressure wave of wavelength 2.5 m that is traveling at 1400 m/s?

ID: ppa7g 11.2–78+

61) The density of aluminum is 2700 kg/m^3. If transverse waves travel at 38 m/s in an aluminum wire of diameter 4.6 mm, what is the tension on the wire?

ID: ppa7g 11.2–86+

Ch 12 Sound

62) An organ pipe of length L that is open at one end resonates in its third harmonic with a wavelength of $2L/3$. Is the other end of the pipe closed or open?

A) open
B) closed
C) We cannot tell from the information provided.

ID: ppa7g 12.1–6

63) Consider a pipe of length L that is open at one end and closed at the other end. What are the wavelengths of the three lowest-pitch tones produced by this pipe?

A) $2L, L, L/2$ B) $4L, 2L, L$ C) $2L, L, 2L/3$ D) $4L, 4L/3, 4L/5$

ID: ppa7g 12.1–15

64) You drop a stone down a well that is 9.5 m deep. How long is it before you hear the splash? The speed of sound in air is 343 m/s and air resistance is negligible.

ID: ppa7g 12.2–2+

65) What is the ratio of the intensities of two sounds with intensity levels of 70 dB and 40 dB?

ID: ppa7g 12.2–8+

66) The intensity at a distance of 6.0 m from a source that is radiating equally in all directions is 6.0×10^{-10} W/m^2. What is the power emitted by the source?

ID: ppa7g 12.2–10+

67) A barking dog delivers about 1.0 mW of power, which is assumed to be uniformly distributed in all directions. What is the intensity level in decibels at a distance 5.00 m from the dog? The threshold of human hearing is 1.0×10^{-12} W/m^2.

ID: ppa7g 12.2–12+

68) A 2.0-g string that is 0.67 m long is under tension. The string vibrates at 700 Hz tone in its third harmonic, and this vibration causes a sound wave. What is the wavelength of the sound? The speed of sound in air is 344 m/s.

ID: ppa7g 12.2–38+

69) A violin with string length 32 cm and string density 1.5 g/cm resonates in its fundamental with the first overtone of a 2.0-m organ pipe with one end closed and one end open. What is the tension in the string if the speed of sound in air is 344 m/s?

ID: ppa7g 12.2–42+

70) Two in-phase loudspeakers are 3.0 m apart. They emit sound with a frequency of 490 Hz. A microphone is placed half-way between the speakers and then moved along the line joining the two speakers until the first point of constructive interference is found. At what distance from that midpoint is that first point? The speed of sound in air is 343 m/s.

ID: ppa7g 12.2–66+

Ch 14 Heat

71) How much heat is required to raise the temperature of a 225-g lead ball from 15.0°C to 25.0°C? The specific heat of lead is 128 J/kg • K.

ID: ppa7g 14.2–4+

72) An aluminum electric tea kettle with a mass of 500 g is heated with a 500–W heating coil. How long will it take to heat up 1.0 kg of water from 18°C to 98°C in the tea kettle? The specific heat of aluminum is 900 J/kg • K and that of water is 4186 J/kg • K.

ID: ppa7g 14.2–8+

73) On his honeymoon, James Joule attempted to explore the relationships between various forms of energy by measuring the rise of temperature of water which had fallen down a waterfall on Mount Blanc. What maximum temperature rise would one expect for a waterfall with a vertical drop of 20 m? The specific heat of water is 4186 J/kg • K.

ID: ppa7g 14.2–16+

74) The 200–L electric water heater i your garage uses 2.0 kW. Assuming no heat loss, how many hours would it take to heat the water in this tank from 23°C to 75°C? The specific heat of water is 4186 J/kg • K and its density is 1000 kg/m^3.

ID: ppa7g 14.2–19+

75) A runner generates 1260 W of thermal energy. If this heat has to be removed only by evaporation, how much water does this runner lose in 15 minutes of running? The latent heat of vaporization of water is 22.6×10^5 J/kg.

ID: ppa7g 14.2–22+

76) A 90–g aluminum calorimeter contains 390 g of water at an equilibrium temperature of 20°C. A 160–g piece of metal, initially at 305° C, is added to the calorimeter. The final temperature at equilibrium is 32° C. Assume there is no external heat exchange. The specific heat capacities of aluminum and water are 910 J/kg • K (aluminum) and 4190 J/kg • K (water). What is the specific heat capacity of the 160–g piece of metal?

ID: ppa7g 14.2–43+

77) Some properties of a certain glass are listed here:

Density 2300 kg/m^3
Specific heat capacity 840 J/kg • C°
Coefficient of thermal expansion 8.5×10^{-6} (C°)$^{-1}$
Thermal conductivity 0.80 W/m • C°

A glass window pane is 2.7 m high, 2.4 m wide, and 9.0 mm thick. The temperature at the inner surface of the glass is 19°C and at the outer surface 4°C. How much heat is lost each hour through the window?

ID: ppa7g 14.2–67+

78) Two identical objects are placed in a room with a temperature of 20°C. Object A has a temperature of 50°C, while object B has a temperature of 90°C. What is the ratio of the net power emitted by object B to the power emitted by object A?

ID: ppa7g 14.2–89+

Ch 15 Thermodynamics

79) A compression at a constant pressure of 200 kPa is performed on 8.00 moles of an ideal monatomic gas. The compression reduces the volume of the gas from 0.200 m^3 to 0.120 m^3. How much work was done by the gas during this process?

A) 16 kJ B) 40 kJ C) –16 kJ D) –40 kJ E) 0 kJ

ID: ppa7g 15.2–8

80) An ideal gas undergoes an adiabatic process while doing 25 J of work. What is the change in the internal (thermal) energy of the gas?

A) –25 J B) 25 J C) 50 J D) 0 J E) –50 J

ID: ppa7g 15.2–20

81) In an isochoric process, the internal (thermal) energy of a gas decreases by 50 J. How much work is done by the gas during this process?

A) 0 J B) 25 J C) –25 J D) 50 J E) –50 J

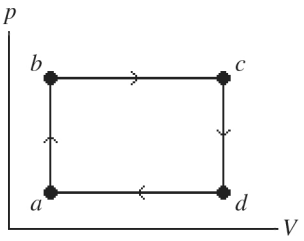
ID: ppa7g 15.2–21

82) A fluid in an insulated, flexible bottle is heated by a high resistance wire and expands. If 9.0 kJ of heat is applied to the system and it does 5.0 kJ of work, how much does the internal (thermal) energy of the fluid change?

A) 45 kJ B) –4.0 kJ C) 4.0 kJ D) 14 kJ

ID: ppa7g 15.2–26

83) The figure shows a pV diagram of a gas for a complete cycle. During part bc of the cycle, 1190 J of heat flows into a system, and at the same time the system expands against a constant external pressure of 7.00×10^4 Pa as its volume increases from 0.0200 m^3 to 0.0800 m^3. Calculate the change in internal (thermal) energy of the system during part bc of the cycle. If the change is nonzero, be sure to indicate whether the change is positive or negative.



ID: ppa7g 15.2–27

84) A 40.0–L container is divided into two equal parts by a rubber membrane. One half of the container has 1.50 moles of an ideal monatomic gas at 250 K, and the other half is a vacuum. The container is well insulated, so there is no exchange of heat with the surroundings. The membrane breaks, and eventually the gas reaches a new equilibrium condition occupying the entire volume. What is the final temperature of the gas?

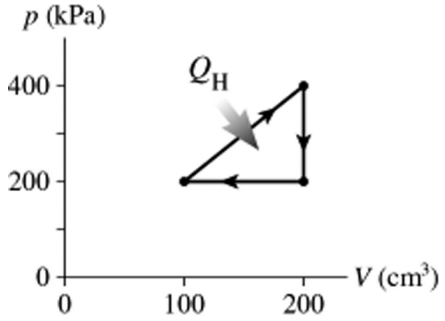
A) 157 K B) 180 K C) 100 K D) 250 K E) 125 K

ID: ppa7g 15.2–31

85) A certain automobile engine takes in 4.00 kJ of heat and performs 1.10 kJ of mechanical work in each cycle.
(a) Calculate the engine's efficiency.
(b) How much heat is "wasted" in each cycle?

ID: ppa7g 15.2–37

86) The figure shows a pV diagram for a cycle of a heat engine for which $Q_H = 59$ J. What is the thermal efficiency of the engine?



A) 14% B) 34% C) 17% D) 8.5%

ID: ppa7g 15.2–42

87) A heat engine having the maximum possible efficiency has an efficiency of 35.0% when operating between two heat reservoirs. If the temperature of the hot reservoir is 700 K, what is the temperature of the cold reservoir?

A) 245 K B) 600 K C) 455 K D) 200 K E) 350 K

ID: ppa7g 15.2–49

Answer Key
Testname: FINAL_BIG_STUDY_POOL

1) C
2) (a) 67 m/s (b) 0 m/s
3) (a) 1.25×10^6 m/s^2 (b) 0.400 ms
4) D
5) E
6) 190 m
7) (a) 22.6° (b) 13.0 m
8) 6.6 lb at 68° clockwise from rope A
9) 68 m
10) (a) 75.0 cm (b) 0.505 s
11) C
12) B
13) (a) 5 (b) the top wire
14) E
15) B
16) C
17) B
18) B
19) D
20) C
21) (a) 37° (b) 9200 N (normal force), 0 N (friction)
22) D
23) E
24) B
25) C
26) A
27) A
28) C
29) C
30) D
31) C
32) 4.3 m/s
33) D
34) D
35) A
36) B
37) B
38) B
39) C
40) A
41) A
42) B
43) A
44) C
45) E
46) B
47) C
48) A: 1.7 kN downward, B: 2.5 kN upward
49) 0.49
50) C

Answer Key
Testname: FINAL_BIG_STUDY_POOL

51) A
52) A
53) 13 m
54) 10.6 kg
55) D
56) B
57) A
58) C
59) C
60) 560 Hz
61) 65 N
62) A
63) D
64) 1.4 s
65) 1000:1
66) 2.7×10^{-7} W
67) 65 dB
68) 0.49
69) 1000 N
70) 0.35 m
71) 288 J
72) 12 minutes
73) 0.047 C°
74) 6.0 hours
75) 500 g
76) 470 J/kg • K
77) 3.1×10^{7} J
78) 2.8
79) C
80) A
81) A
82) C
83) –3010 J
84) D
85) (a) 27.5% (b) 2.90 kJ
86) C
87) C