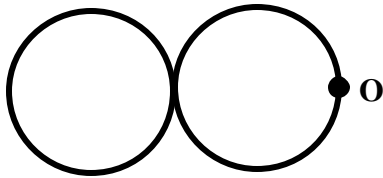


1. Two boys with masses of 40 kg and 60 kg are holding onto either end of a 10 m long massless pole which is initially at rest and floating in still water. They pull themselves along the pole toward each other until they meet. When they do meet, the 40 kg boy will have moved approximately how far relative to a stationary 300 kg toad on the shore:
- A. 4.0 m
B. 5.0 m
C. 6.0 m
D. 10 m
E. You can't tell because you don't know how hard each boy pulls.
2. The symbol for infinity can be made out of two uniform circular wire loops of radius R and mass M as shown. What is its moment of inertia around an axis perpendicular to the page and through the point O ?



- A. $2MR^2$
B. $4MR^2$
C. $6MR^2$
D. $8MR^2$
E. $12MR^2$

3. You are shown four objects:

72/8

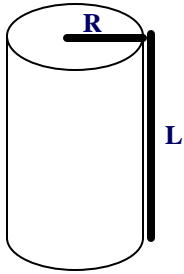
Object #1 is a hollow cylinder of mass 4 kg and radius $R = 4$ m and length $L = 2$ m

Object #2 is a hollow cylinder of mass 4 kg and radius $R = 2$ m and length $L = 4$ m

Object #3 is a solid cylinder of mass 4 kg and radius $R = 2$ m and length $L = 4$ m

Object #4 is a hollow cylinder of mass 8 kg and radius $R = 2$ m and length $L = 8$ m

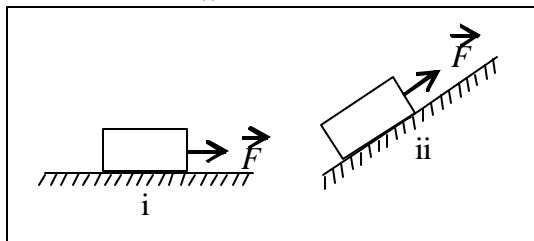
Rank these objects in order of increasing rotational inertia (from smallest to biggest):



- A. 3,2,1,4
- B. 3,2,4,1
- C. 1,4,2,3
- D. 4,1,2,3
- E. 2,3,1,4

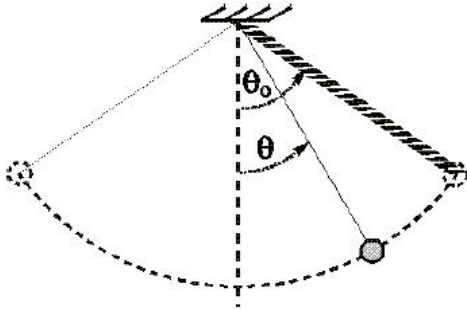
4. A heavy wooden block is dragged by a force F along a rough steel plate, as shown for two cases. The magnitude of the applied force F is the same for both cases. The normal force in (ii), as compared with the normal force in (i) is:

31/7



- A. the same.
- B. greater.
- C. less.
- D. less for some angles of the incline and greater for others.
- E. less or greater, depending on the magnitude of the applied force F .

5. The diagram below shows a simple pendulum consisting of a mass M suspended by a thin string. The magnitude of the tension is T . The mass swings back and forth between $\pm\theta_0$. Which of the following statements is *false*? 37/8



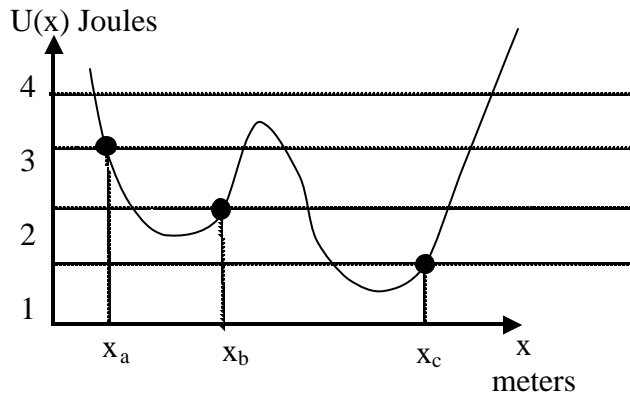
- A. T depends on θ .
 B. T is largest at the bottom $\theta = 0$.
 C. T equals Mg when $\theta = \theta_0$.
 D. T is smallest when $\theta = \pm\theta_0$.
 E. $T = Mg$ at some angle between zero and θ_0 .
6. The coefficient of kinetic friction in the figure below is $\mu_k = 0.90$, and the slope angle is 60° . 35/17



What is the magnitude of the **acceleration** of the block (*parallel* to the surface) if it has been given an upward shove and is still sliding up the slope? Remember that $\sin(60^\circ) = 0.866$ and $\cos(60^\circ) = 0.5$.

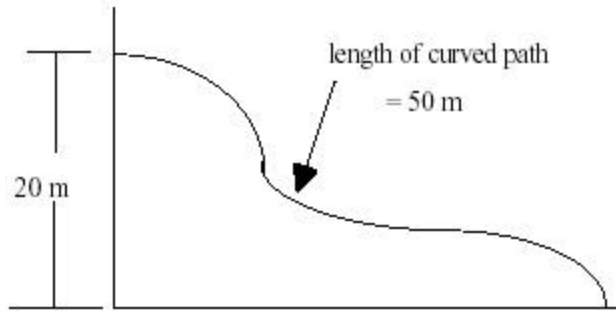
- A. 17.0 m/s^2
 B. 9.81 m/s^2
 C. 4.08 m/s^2
 D. 12.9 m/s^2
 E. 15.3 m/s^2

7. A particle moving in one dimension is subject to the potential energy curve shown in the plot. Which of the following statements is true? 49/4



- A. At point x_a , the force on the particle is in the negative x direction.
- B. If the particle has total energy of 4 Joules at point x_c and its velocity is in the positive x direction, it will eventually reach point x_a .
- C. If the particle has kinetic energy of 2 Joules at point x_c it can reach point x_b .
- D. If the total energy of the particle at point x_b is 3 Joules it can reach point x_c .
- E. If the particle is released from rest at x_c , it will travel in the positive x direction.
8. A 0.50 kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12 J. The greatest extension of the spring from its equilibrium length is: 47/4
- A. 0.003 m
- B. 0.039 m
- C. 0.0015 m
- D. 0.054 m
- E. 0.118 m

9. A 150 kg skier starts from rest at the top of a ski slope that is 50 m long. If her final speed at the bottom of the slope is 10 m/s, where the bottom of the slope is 20 m below the top, what is the average force of friction between the skis and the slope? 50/3

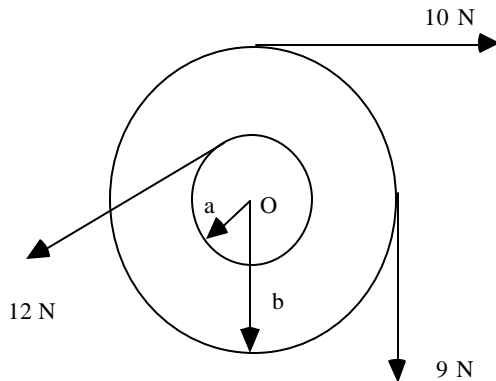


- A. 0 N
 B. 1500 N
 C. 150 N
 D. 600 N
 E. 450 N
10. A slider of mass $10M$ is moving to the right with a velocity of 10 m/s on an air track. Another slider of mass M is moving to the left at 50 m/s. The two sliders collide and stick together making one slider of mass $11M$. What is the velocity of this resultant block (moving right is the + direction)? 63/1
- A. -50 m/s
 B. -4.5 m/s
 C. 0 m/s
 D. 4.5 m/s
 E. 50 m/s
11. A hawk and a quail are moving directly toward each other. The hawk has mass of 2.0 kg and speed of 50 m/s 63/7 while the quail has mass 4.0 kg and a speed of 25 m/s. The birds collide and stick together (via the hawk's talons). The kinetic energy lost in the collision is approximately:
- A. 0 J
 B. 100 J
 C. 1250 J
 D. 2500 J
 E. 3750 J

12. A 2.0 g coin is placed on a flat, horizontal turntable. The turntable is observed to make three revolutions in 3.0 s. The coin is observed to slide off the turntable when it is more than 8.0 cm from the center of the turntable. What is the coefficient of static friction between the coin and the turntable? 70/4

- A. 2.90
- B. 1.32
- C. 0.899
- D. 0.322
- E. 6.45×10^{-4}

13. Find the net torque on the wheel shown below about the axle through O if $a=10$ cm and $b=25$ cm? (A clockwise rotation is negative) 73/1

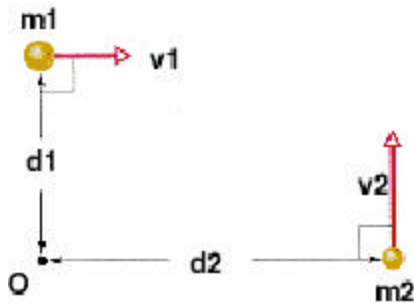


- A. 1.2 Nm
- B. 3.45 Nm
- C. 5.95 Nm
- D. -3.55 Nm
- E. -1.2 Nm

14. Force $\vec{F} = 8N\hat{i} + 6N\hat{j}$ acts on a particle with position vector $r = 5m\hat{i} + 6m\hat{j}$. What is the magnitude of the torque on the particle about the origin? 80/3

- A. 78 Nm
- B. 4 Nm
- C. 76 Nm
- D. 18 Nm
- E. 0 Nm

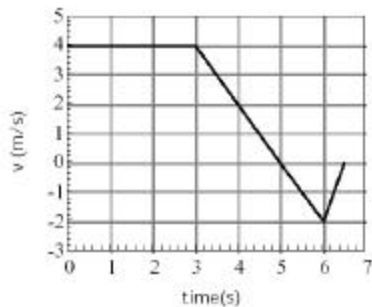
15. A certain wheel has a moment of inertia of $12 \text{ kg}\cdot\text{m}^2$. As it turns through 5.0 revolutions its angular velocity increases from 5.0 rad/s to 6.0 rad/s . If the net torque on the wheel is constant during this change in angular velocity, the magnitude of the torque is most nearly: 74/5
- A. $0.48 \text{ N}\cdot\text{m}$
 B. $2.1 \text{ N}\cdot\text{m}$
 C. $2.4 \text{ N}\cdot\text{m}$
 D. $12 \text{ N}\cdot\text{m}$
 E. $69 \text{ N}\cdot\text{m}$
16. A car is being towed by a horizontal force and its speed is increasing. What must be true for the wheels to roll without slipping? 78/1
- A. The coefficient of kinetic friction must be sufficiently small.
 B. The coefficient of static friction must be sufficiently large.
 C. The coefficient of static friction must be sufficiently small.
 D. The linear acceleration of the car must be larger than the wheel radius multiplied by the angular acceleration of the wheels.
 E. none of the above
17. Two objects are moving as shown in the figure. If the top object has mass $m_1 = 5 \text{ kg}$, velocity $v_1 = 5 \text{ m/s}$, and distance $d_1 = 7.5 \text{ m}$ from the origin, and the rightmost object has mass $m_2 = 9 \text{ kg}$, velocity $v_2 = 8 \text{ m/s}$, and distance $d_2 = 3.5 \text{ m}$ from the origin, what is the two-body system's total angular momentum about the origin? 83/1



- A. $439.5 \text{ kg m}^2/\text{s}$
 B. $64.5 \text{ kg m}^2/\text{s}$
 C. $97.0 \text{ kg m}^2/\text{s}$
 D. $47.0 \text{ kg m}^2/\text{s}$
 E. $187.5 \text{ kg m}^2/\text{s}$

18. A merry-go-round of radius $R = 2$ m has a moment of inertia $I = 200$ kg m², and is rotating at $\omega = 4$ rev/min. 85/6
A child whose mass is 30 kg jumps onto the edge of the merry-go-round, heading directly toward the center at 6 m/s. What is the new **angular speed** of the merry-go-round *immediately* after the child has boarded it?
- A. 1.76 rev/min
 - B. 3.64 rev/min
 - C. 2.50 rev/min
 - D. 6.40 rev/min
 - E. 4.00 rev/min
19. In a science fiction story I once read, Mars had a third moon orbiting the planet. This moon orbited the planet 95/2
at a height of 1 m above the surface (making it very dangerous for any unsuspecting astronaut standing in the path of the moon). The acceleration due to gravity on the surface of Mars is $g_m = 3.72$ m/s². The speed this moon would need to have in order to maintain this orbit is?
- A. 1.27×10^3 m/s
 - B. 3.56×10^3 m/s
 - C. 1.27×10^4 m/s
 - D. 1.42×10^4 m/s
 - E. 9.33×10^7 m/s
20. The transverse displacement for a standing wave on a string is given by: 102/4
 $y(x,t) = (4.2 \text{ m})\sin [(\pi/2 \text{ m}^{-1})x]\cos [(2.0\text{s}^{-1})t]$. The velocity of a piece of the string at $x = 5.0$ meters at time $t = \pi/4$ seconds is most nearly given by which of the following?
- A. 0 m/s
 - B. 4.2 m/s in the +y direction
 - C. 4.2 m/s in the -y direction
 - D. 8.4 m/s in the +y direction
 - E. 8.4 m/s in the -y direction
21. When a mass of 10 kg is attached to the end of a particular spring the natural frequency is found to be 4 Hz. 103/9
If the 10 kg is replaced by a 5 kg mass, the new natural frequency is:
- A. 16 Hz
 - B. 8 Hz
 - C. 5.65 Hz
 - D. 2.82 Hz
 - E. 2 Hz

22. The wavefunction of a harmonic wave on a string is $y(x,t) = 0.004 \sin(59.7x + 293.0t)$, where x and y are in m and t is in s . What is the speed and direction of the wave (taking positive to be in the $+x$ direction and negative to be in the $-x$ direction). 114/1
- A. 4.91 m/s
 B. 0.128 m/s
 C. 0 m/s
 D. -0.125 m/s
 E. -4.91 m/s
23. A 1.0 kg ball moving at 2.0 m/s perpendicular to a wall rebounds from the wall at 1.5 m/s. The change in the momentum of the ball is: 55/6
- A. 0.5 kg · m/s away from wall
 B. 0.5 kg · m/s toward wall
 C. 0.0 kg · m/s
 D. 3.5 kg · m/s toward wall
 E. 3.5 kg · m/s away from wall
24. The figure shows the velocity as a function of time for a particle. At which of the following times is the magnitude of the acceleration the greatest? 6/3

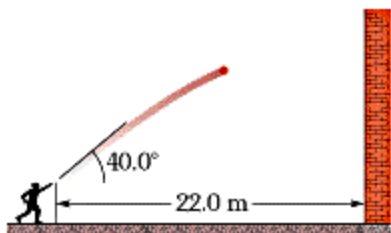


- A. 2.25 s
 B. 4.75 s
 C. 5.50 s
 D. 6.25 s
 E. all four times have the same acceleration

25. At the Sydney Olympics, a sprinter runs the 100 m dash. Assuming he accelerates from rest at 10 m/s^2 during $\frac{7}{4}$ the first second and runs at constant speed afterwards, how long does it take him to reach the finish line?

A. 9.0 s
B. 10.0 s
C. 10.3 s
D. 10.5 s
E. 10.9 s

26. You throw a ball with a speed of 15 m/s at an angle of 40.0° above the horizontal directly toward a wall (as in $\frac{22}{12}$ the figure). The wall is 22.0 m from the release point of the ball. How far above the release point does the ball hit the wall?



A. 2.71 m
B. -7.1 m
C. 36.4 m
D. 5.76 m
E. 0.50 m

Answer Key for Test "P211FA04Final.tst", 11/24/2004

No. in Q-Bank	No. on Test	Correct Answer
56	1	C
72	4	E
72	8	B
31	7	C
37	8	C
35	17	D
49	4	B
47	4	D
50	3	E
63	1	D
63	7	E
70	4	D
73	1	D
80	3	D
74	5	B
78	1	B
83	1	B
85	6	C
95	2	B
102	4	E
103	9	C
114	1	E
55	6	E
6	3	D
7	4	D
22	12	E