

Practice Physics 111 Common Exam 3, Spring 2023
April 24, 2023

Name (Print): _____ UCID: _____ Section: _____

Honors Code Pledge: For ethical and fairness reasons all students are pledged to comply with the provisions of the NJIT Academic Honor Code. You must answer the exam questions entirely by yourself. **Turn off all cell phones, pagers, or other communication devices.** Use only your own calculator.

Instructions:

- First, write your name and section number on **both** the Scantron card and this exam booklet.
 - Use the formula sheet (last page of exam booklet) and no other materials.
 - All questions are worth 1 point each. You need to answer a total of 16 questions correctly for a 100% score on the exam. No partial credit.
 - **Briefly show work on this set of exam sheets for problems which require calculations.** Use the backs of pages if necessary.
 - **Some answers may be approximate;** select the closest one.
 - Answer each question on the Scantron card using #2 pencil. Also circle your answers on question papers.
 - Do not hesitate to ask for clarification of any exam question, if needed, from your proctor or Professor.
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1. A bat strikes a 0.145 kg baseball. Just before impact, the ball is traveling horizontally to the right at 40.0 m/s; when it leaves the bat, the ball is traveling to the left at an angle of 30° above horizontal with a speed of 52.0 m/s. The ball and bat are in contact for 1.75 ms. Find the x component of the average force on the ball. Suppose that the +x axis is directed to the right.

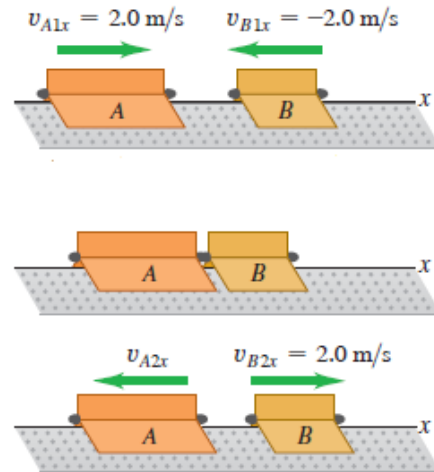
- A) -7050 N
- B) 1823 N
- C) -2103 N
- D) 3064 N
- E) 2434 N

2. Three particles each of mass 1.0 kg are located at the following coordinates (in meters): (14, 4), (14, 8), and (17, 6). The center of mass (X_{CM} , Y_{CM}) for these particles (in meters) is:

- A) (17, 5)
- B) (14, 5)
- C) (15, 6)
- D) (14, 6)
- E) (16, 6)

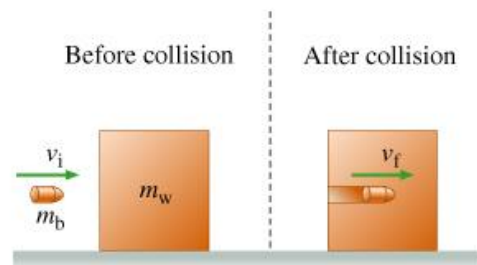
3. Two gliders with different masses $m_A = 0.60$ kg and $m_B = 0.40$ kg move toward each other on a frictionless air track. After they collide, glider B has a final velocity of $+2.0$ m/s. What is the final velocity of glider A?

- A) $+4.72$ m/s
 B) -3.52 m/s
 C) $+2.34$ m/s
 D) $+0.40$ m/s
 E) -0.66 m/s



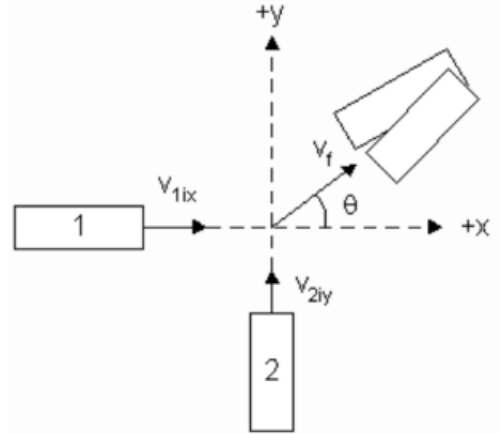
4. A 5.00 g bullet is fired horizontally into a 1.20 kg wooden block resting on a horizontal surface. The coefficient of kinetic friction between block and surface is 0.20 . The bullet remains embedded in the block, which is observed to slide 0.310 m along the surface before stopping. What was the initial speed of the bullet?

- A) 472 m/s
 B) 387 m/s
 C) 334 m/s
 D) 266 m/s
 E) 166 m/s



5. A 900 kg car traveling east (+x) at 15.0 m/s collides with a 750 kg car traveling north at 20.0 m/s (+y). The cars stick together. Assume that any other unbalanced forces are negligible. What is the speed of the wreckage and the angle θ just after the collision?

- A) 9.34 m/s, 56.0°
- B) 12.2 m/s, 48.0°
- C) 41.7 m/s, 32.0°
- D) 35.3 m/s, 30.0°
- E) 17.6 m/s, 25.0°



6. When a cannon fires a cannonball, the cannon will recoil backward because:

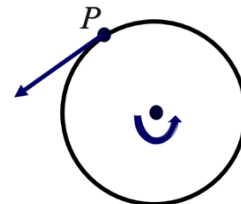
- A) energy of the cannonball and cannon is conserved.
- B) momentum of the cannonball and cannon is conserved.
- C) energy of the cannon is greater than the energy of the cannonball.
- D) momentum of the cannon is greater than the energy of the cannonball.
- E) None of the above.

7. A waterwheel turns at 360 revolutions per hour. Find its angular speed in rad/s.

- A) 0.1 rad/s
- B) $\pi/10$ rad/s
- C) π rad/s
- D) $\pi/2$ rad/s
- E) $\pi/5$ rad/s

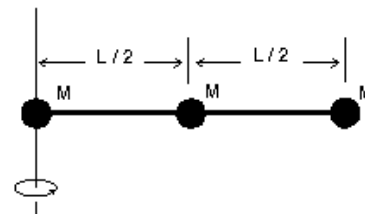
8. The figure shows a cylinder of radius 0.7 m rotating about its axis at 10 rad/s. Find the linear speed at the point P.

- A) 3.6 m/s
- B) 6.5 m/s
- C) 7.0 m/s
- D) 14.0 m/s
- E) 10.0 m/s



9. Three identical point objects of mass $M = 2.0$ kg are fastened to a massless rod with a length of $L = 1.0$ m. Find the moment of inertia when the rod rotates about the axis as shown.

- A) 1.0 kgm^2
- B) 2.5 kgm^2
- C) 3.0 kgm^2
- D) 3.5 kgm^2
- E) 4.0 kgm^2



10. The rod in the previous problem is rotating with an angular velocity of 2.0 rad/s. What is the rotational kinetic energy?

- A) 1.0 J
- B) 2.0 J
- C) 3.0 J
- D) 4.0 J
- E) 5.0 J

11. A wheel rotates with a constant angular acceleration of $\pi \text{ rad/s}^2$. During a certain time interval, its angular displacement is $\pi \text{ rad}$. At the end of the interval, its angular velocity is $2\pi \text{ rad/s}$. Find its angular velocity at the beginning of the interval.

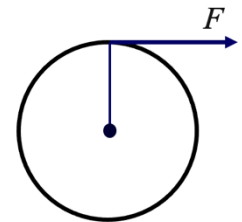
- A) zero
- B) $2\pi^2 \text{ rad/s}$
- C) $\pi \text{ rad/s}$
- D) $1.4\pi \text{ rad/s}$
- E) $2\pi \text{ rad/s}$

12. At $t = 0$, a wheel rotating about a fixed axis at a constant angular acceleration has an angular velocity of 2.0 rad/s . Two seconds later, it has completed 5.0 revolutions. Find the angular acceleration of this wheel.

- A) 14 rad/s^2
- B) 17 rad/s^2
- C) 20 rad/s^2
- D) 23 rad/s^2
- E) 12 rad/s^2

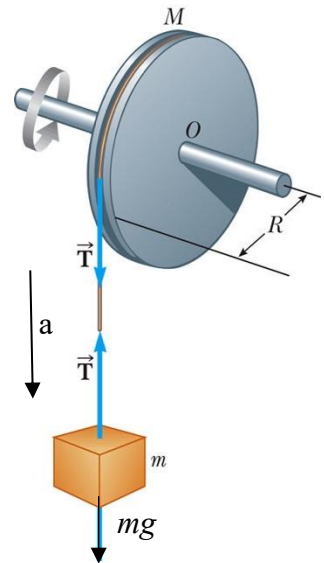
13. A disk with a moment of inertial of 5.0 kgm^2 and a radius of 0.25 m rotates on a frictionless fixed axis perpendicular to the disk and through its center. A force of 8.0 N is applied as indicated in the figure. Find the angular acceleration of the disk.

- A) 0 rad/s^2
- B) 0.4 rad/s^2
- C) 0.6 rad/s^2
- D) 1.0 rad/s^2
- E) 2.5 rad/s^2



14. A block with a mass of $m = 2$ kg is attached to a cord that is wrapped around a solid cylindrical pulley with a mass of $M = 10$ kg and a radius of $R = 0.5$ m. The moment of inertia of the pulley I is $MR^2/2$. When the block is released and the cord unwinds, what is the linear acceleration of the block?

- A) 0.75 m/s^2
- B) 1.15 m/s^2
- C) 2.80 m/s^2
- D) 3.75 m/s^2
- E) 5.15 m/s^2

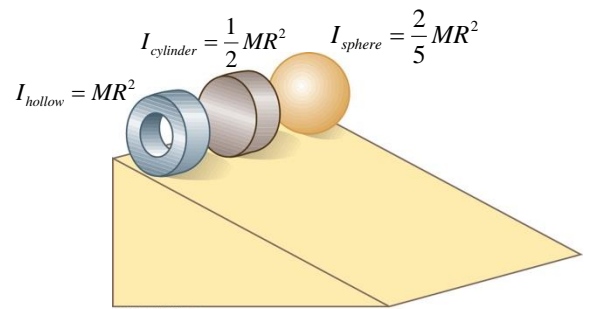


15. For the previous problem, find the magnitude of tension T in the cord.

- A) 14 N
- B) 20 N
- C) 35 N
- D) 78 N
- E) 118 N

16. Three objects with the same mass M and radius R roll without slipping down a slope from rest. Which one arrives at the bottom first? Their moment of inertia I are shown in the figure.

- A) The solid sphere
- B) The solid cylinder
- C) The hollow cylinder
- D) They take same time to get the bottom
- E) Not enough information



Answer Key

1. A
2. C
3. E
4. D
5. B
6. B
7. E
8. C
9. B
10. E
11. D
12. A
13. B
14. C
15. A
16. A