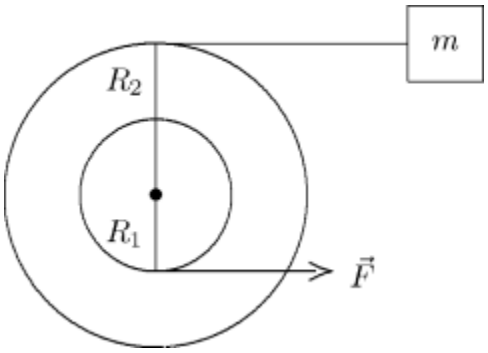
Name: _____ Date: _____

1. For a wheel spinning on an axis through its center, the ratio of the radial acceleration of a point on the rim to the radial acceleration of a point halfway between the center and the rim is:

A) 1
B) 2
C) 1/2
D) 4
E) 1/4

2. A small disk of radius R_1 is fastened coaxially to a larger disk of radius R_2. The combination is free to rotate on a fixed axle, which is perpendicular to a horizontal frictionless table top, as shown in the overhead view below. The rotational inertia of the combination is I. A string is wrapped around the larger disk and attached to a block of mass m, on the table. Another string is wrapped around the smaller disk and is pulled with a force $\vec{F}$ as shown. The tension in the string pulling the block is:

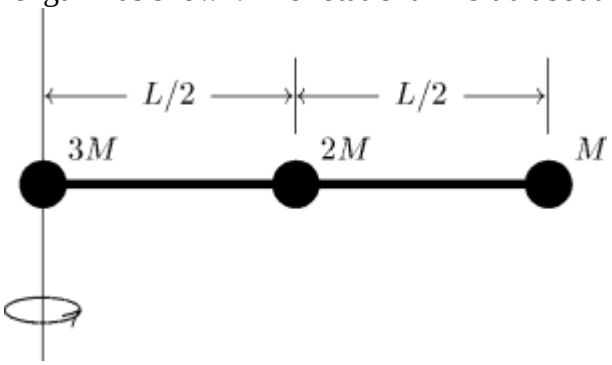


A) R_1F/R_2
B) $mR_1R_2F/(I–mR_2^2)$
C) $mR_1R_2F/(I + mR_2^2)$
D) $mR_1R_2F/(I–mR_1R_2)$
E) $mR_1R_2F/(I + mR_1R_2)$

3. A disk with a rotational inertia of 5.0 kg · m^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 along the axis. The rotational acceleration of the disk is:

A) 0
B) 0.40 rad/s^2
C) 0.60 rad/s^2
D) 1.0 rad/s^2
E) 2.5 rad/s^2

4. Three identical balls, with masses of *M*, 2*M*, and 3*M*, are fastened to a massless rod of length *L* as shown. The rotational inertia about the left end of the rod is:



A) $ML^2/2$
B) ML^2
C) $3ML^2/2$
D) $6ML^2$
E) $3ML^2/4$

5. A wheel starts from rest and has a rotational acceleration of 4.0 rad/s^2. When it has made 10 rev its rotational velocity is:

A) 16 rad/s
B) 22 rad/s
C) 32 rad/s
D) 250 rad/s
E) 500 rad/s

6. A wheel starts from rest and has a rotational acceleration of 4.0 rad/s^2. The time it takes to make 10 rev is:

A) 0.50 s
B) 0.71 s
C) 2.2 s
D) 2.8 s
E) 5.6 s

7. A wheel initially has a rotational velocity of 18 rad/s but it is slowing at a rate of 2.0 rad/s^2. By the time it stops it will have turned through:

A) 81 rad
B) 160 rad
C) 245 rad
D) 330 rad
E) 410 rad

8. The rotational inertia of a solid uniform sphere about a diameter is $(2/5)MR^2$, where M is its mass and R is its radius. If the sphere is pivoted about an axis that is tangent to its surface, its rotational inertia is:

A) MR^2
B) $(2/5)MR^2$
C) $(3/5)MR^2$
D) $(5/2)MR^2$
E) $(7/5)MR^2$

9. A disk with a rotational inertia of 2.0 kg · m^2 and a radius of 0.40 m rotates on a frictionless fixed axis perpendicular to the disk faces and through its center. A force of 5.0 N is applied tangentially to the rim. The rotational acceleration of the disk is:

A) 0.40 rad/s^2
B) 0.60 rad/s^2
C) 1.0 rad/s^2
D) 2.5 rad/s^2
E) 10 rad/s^2

10. A disk with a rotational inertia of 5.0 kg · m^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 tangentially to the rim. If the disk starts at rest, then after it has turned through half a revolution its rotational velocity is:

A) 0.57 rad/s
B) 0.64 rad/s
C) 0.80 rad/s
D) 1.6 rad/s
E) 3.2 rad/s

11. A radian is about:

A) 25º
B) 37º
C) 45º
D) 57º
E) 90º

12. The rotational velocity of a rotating wheel increases by 2 rev/s every minute. The rotational acceleration in rad/s^2 of this wheel is:

A) $4\pi^2$
B) 2π
C) 1/30
D) π/15
E) 4π

13. A flywheel of diameter 1.2 m has a constant rotational acceleration of 5.0 rad/s^2. The tangential acceleration of a point on its rim is:

A) 5.0 rad/s^2
B) 3.0 m/s^2
C) 5.0 m/s^2
D) 6.0 m/s^2
E) 12 m/s^2

14. A pulley with a radius of 3.0 cm and a rotational inertia of 4.5×10^{-3} kg · m^2 is suspended from the ceiling. A rope passes over it with a 2.0-kg block attached to one end and a 4.0-kg block attached to the other. The rope does not slip on the pulley. When the speed of the heavier block is 2.0 m/s the kinetic energy of the pulley is:

A) 0.15 J
B) 0.30 J
C) 1.0 J
D) 10 J
E) 20 J

15. When a thin uniform stick of mass M and length L is pivoted about its midpoint, its rotational inertia is $ML^2/12$. When pivoted about a parallel axis through one end, its rotational inertia is:

A) $ML^2/12$
B) $ML^2/6$
C) $ML^2/3$
D) $7ML^2/12$
E) $13ML^2/12$

16. A wheel initially has a rotational velocity of 36 rad/s but after 6.0 s its rotational velocity is 24 rad/s. If its rotational acceleration is constant its value is:

A) 2.0 rad/s^2
B) –2.0 rad/s^2
C) 3.0 rad/s^2
D) –3.0 rad/s^2
E) 6.0 rad/s^2

17. A wheel starts from rest and spins with a constant rotational acceleration. As time goes on the acceleration vector for a point on the rim:

A) decreases in magnitude and becomes more nearly tangent to the rim
B) decreases in magnitude and becomes more early radial
C) increases in magnitude and becomes more nearly tangent to the rim
D) increases in magnitude and becomes more nearly radial
E) increases in magnitude but retains the same angle with the tangent to the rim

18. A wheel starts from rest and has an rotational acceleration that is given by $\alpha(t) = (6\ \text{rad/s}^4)t^2$. The time it takes to make 10 rev is:

A) 2.8 s
B) 3.3 s
C) 4.0 s
D) 4.7 s
E) 5.3 s

19. Two wheels are identical but wheel B is spinning with twice the rotational speed of wheel A. The ratio of the magnitude of the radial acceleration of a point on the rim of B to the magnitude of the radial acceleration of a point on the rim of A is:

A) 1
B) 2
C) 1/2
D) 4
E) 1/4

20. The rotational inertia of a disk about its axis is 0.70 kg · m^2. When a 2.0-kg weight is added to its rim, 0.40 m from the axis, the rotational inertia becomes:

A) 0.38 kg · m^2
B) 0.54 kg · m^2
C) 0.70 kg · m^2
D) 0.86 kg · m^2
E) 1.0 kg · m^2

21. A disk is free to rotate on a fixed axis. A force of given magnitude *F*, in the plane of the disk, is to be applied. Of the following alternatives the greatest rotational acceleration is obtained if the force is:

A) applied tangentially halfway between the axis and the rim
B) applied tangentially at the rim
C) applied radially halfway between the axis and the rim
D) applied radially at the rim
E) applied at the rim but neither radially nor tangentially

22. A disk starts from rest and rotates about a fixed axis, subject to a constant net torque. The work done by the torque during the second revolution is _____ as the work done during the first revolution.

A) the same
B) twice as much
C) half as much
D) four times as much
E) one-fourth as much

23. One revolution is the same as:

A) 1 rad
B) 57 rad
C) $\pi/2$ rad
D) π rad
E) 2π rad

24. The magnitude of the acceleration of a point on a spinning wheel is increased by a factor of 4 if:

A) the magnitudes of the rotational velocity and the rotational acceleration are each increased by a factor of 4
B) the magnitude of the rotational velocity is increased by a factor of 4 and the magnitude of the rotational acceleration is not changed
C) the magnitudes of the rotational velocity and the rotational acceleration are each increased by a factor of 2
D) the magnitude of the rotational velocity is increased by a factor of 2 and the magnitude of the rotational acceleration is not changed
E) the rotational velocity is increased by a factor of 2 and the rotational acceleration is increased by a factor of 4

25. A certain wheel has a rotational inertia of 12 kg $\cdot$ m^2. As it turns through 5.0 rev its rotational velocity increases from 5.0 rad/s to 6.0 rad/s. If the net torque is constant its value is:

A) 0.016 N $\cdot$ m
B) 0.18 N $\cdot$ m
C) 0.57 N $\cdot$ m
D) 2.1 N $\cdot$ m
E) 3.6 N $\cdot$ m

Answer Key

1. B
2. C
3. A
4. E
5. B
6. E
7. A
8. E
9. C
10. D
11. D
12. D
13. B
14. D
15. C
16. B
17. D
18. B
19. D
20. E
21. B
22. A
23. E
24. E
25. D