PHYSICS PRACTICE QUESTION FOR G -12: ROTATIONAL MOTION, KEPLER'S LAW AND NEWTON'S LAW OF UNIVERSAL GRAVITATION

1. An angle of 2 rad at the center of a circle subtends an arc length of 40 mm at the circumference of the circle. The radius of the circle is:
   A. 40π mm B. 80 mm C. 20 mm D. $40/\pi$ mm
2. A point on a wheel has a constant angular velocity of 3 rad/s. The angle turned through in 15 seconds is:
   A. 45 rad B. 10π rad C. 5 rad D. 90π rad
3. An angular velocity of 60 revolutions per minute is the same as:
   A. $1/2\pi$ rad/s B. 120π rad/s C. $30/\pi$ rad/s D. 2π rad/s
4. A wheel of radius 15 mm has an angular velocity of 10 rad/s. A point on the rim of the wheel has a linear velocity of:
   A. 300π mm/s B. 2/3 mm/s C. 150 mm/s D . 1.5 mm/s
5. The shaft of an electric motor is rotating at 20 rad/s and its speed is increased uniformly to 40 rad/s in 5 s. The angular acceleration of the shaft is:
   A. 4000 rad/s^2 B. 4 rad/s^2 C. 160 rad/s^2 D. 12 rad/s^2
6. A point on a flywheel of radius 0.5 m has a uniform linear acceleration of 2 m/s^2. Its angular acceleration is:
   A. 2.5 rad/s^2 B. 0.25 rad/s^2 C.1 rad/s^2 D. 4 rad/s^2

Questions 7–10 refer to the following data.

A car accelerates uniformly from 10 m/s to 20 m/s over a distance of 150 m. The wheels of the car each have a radius of 250 mm.

7. The time the car is accelerating is:
   A. 0.2 s B. 15 s C. 10 s D. 5 s
8. The initial angular velocity of each of the wheels is:
   A. 20 rad/s B. 40 rad/s C. 2.5 rad/s D. 0.04 rad/s
9. The angular acceleration of each of the wheels is:
   A. 1 rad/s^2 B. 0.25 rad/s^2 C. 400 rad/s^2 D. 4 rad/s^2
10. The linear acceleration of a point on each of the wheels is:
    A. 1 m/s^2 B. 4 m/s^2 C. 3 m/s^2 D. 100 m/s^2
11. Angular displacement is measured in:
    A. Degrees B. radians C. rev/s D. meters
12. An angle of $\frac{3\pi}{4}$ radians is equivalent to:
    A. 270° B. 67.5° C. 135° D. 2.356°
13. An angle of 120° is equivalent to:
    A. $\frac{2\pi}{3}\ rad$ B. $\frac{\pi}{3}\ rad$ C. $\frac{3\pi}{4}\ rad$ D. $\frac{1}{3}\ rad$
14. In 30 seconds, a potter's wheel may go from rest to an angular speed of 16 rev/s with uniform movement. Calculate the angular acceleration in radians per second.
    A. 3.34 rad/s B. 33.4 rad/s C. 0.334 rad/s D. 334 rad/s
15. An electric motor rotating a workshop grinding wheel at $1.06 \times 10^2\ rev/min$ is switched off. Assume the wheel has a constant negative angular acceleration of magnitude $1.96\frac{rad}{s^2}$. How long does it take the grinding wheel to stop?

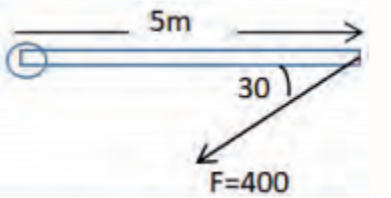
A. 5.66 s B. 56.6 s C. 566 s D. *0.5*66 s

16. A swinging door's angular position during a certain period of time is given by $\boldsymbol{\theta = 4.95 + 9.4t + 2.05t^2}$, where θ is expressed in radians and t is expressed in seconds. What are the door's angular position, angular speed, and angular acceleration $t = 0$ respectively?
    A. 9.4 rad, 4.95 rad/s, 4.1rad/s^2
    B. 4.95 rad, 9.4 rad/s, 4.1 rad/s^2
    C. 4.95 rad, 4.1 rad/s, 9.4rad/s^2
    D. 4.1 rad, 9.4 rad/s, 4.95 rad/s^2
17. A globe is spun at 2.5 rad/s, and it is then accelerated to 3.0 rad/s. What is the tangential acceleration of a globe with a radius of 0.35 meters and a change in speed that takes 0.20 seconds?
    A. 0.5 m/s^2 B. 3.6 m/s^2 C. 0.88 m/s^2 D. 0.15 m/s^2
18. The propeller of the aircraft is rotating at 350 m/s. The propeller has a 3.5 m radius of rotation. What is the propeller blade tips' centripetal acceleration?
    A. 5000 m/s^2 B. 3600 m/s^2 C. 3500 m/s^2 D. 35000 m/s^2
19. 1. According to Newton's law of universal gravitation, the force of gravity between two objects is directly proportional to:
    A. The mass of both objects
    B. The distance between the objects
    C. The square of the distance between the objects
    D. Both a and b
20. According to Newton's law of universal gravitation, as the distance between two objects increases, the gravitational force between them:
    A. Increases
    B. Decreases
    C. Remains constant
    D. Becomes repulsive
21. According to Newton's law of universal gravitation, if the mass of one object is doubled, and the distance between the two objects remains the same, the gravitational force between them:
    A. Doubles
    B. Quadruples
    C. Halves
    D. Remains the same
22. According to Newton's law of universal gravitation, the gravitational force between two objects is inversely proportional to:
    A. The mass of both objects
    B. The square of the distance between the objects
    C. The cube of the distance between the objects
    D. The square root of the distance between the objects
23. According to Newton's law of universal gravitation, if the distance between two objects is tripled, the gravitational force between them:
    A. Triples
    B. Becomes 1/3 of the original force
    C. Becomes 1/9 of the original force
    D. Becomes 1/6 of the original force
24. The velocity of a ball thrown horizontally from the top of a building at any time is expressed by the equation $\vec{v}$ = (80$\hat{\imath}$) m/s + (10t$\hat{\jmath}$) m/s^2. Suppose it is thrown from a 2km distance from the ground level away from the foot of the building. What will be the magnitude if its velocity after t=6sec.?

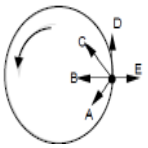
    A. 64m/s B. 100m/s C. 48m/s D. 12m/s

25. A 1 kg mass and a 1 kg mass are 1 meter apart. What is the force of attraction between them?
    A. $6.67x10^{11}N$
    B. $6.67x10^{-11}N$
    C. $6.67x10^{-13}N$
    D. $0.667x10^{-11}N$

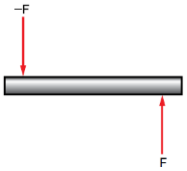
26. What is uniform circular motion?
    A. Uniform circular motion is when an object accelerates on a circular path at a constantly increasing velocity.
    B. Uniform circular motion is when an object travels on a circular path at a variable acceleration.
    C. Uniform circular motion is when an object travels on a circular path at a constant speed.
    D. Uniform circular motion is when an object travels on a circular path at a variable speed.
27. What is the centripetal acceleration felt by the passengers of a car moving at 12 m/s along a curve with radius 2.0 m?
    A. 3 m/s^2 B. 6 m/s^2 C. 36 m/s^2 D. 72 m/s^2
28. The point at which a planet is nearest the Sun is called_____.
    A. Aphelion B. Perihelion C. Centre of mass D. Focal point
29. A car mechanic applies a force of 800 N to a wrench for the purpose of loosening a bolt. He applies the force which is **perpendicular** to the arm of the wrench. The distance from the bolt to the mechanic's hand is 0.40 m. Find out the magnitude of the torque applied? $\boldsymbol{sin90^0 = 1}$
    A. $320N$ B. $32N$ C. $3.20N$ D. $3200N$
30. Which of the following is a statement of Kepler's first law of planetary motion?
    A. The line joining a planet and the Sun sweeps out equal areas in equal times
    B. The square of the orbital period of a planet is proportional to the cube of its semi-major axis
    C. The force of gravity between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers
    D. The planets move in elliptical orbits with the Sun at one focus
31. What is the direction of centripetal force in relation to the motion of an object?
    A. It acts in the same direction as the object's velocity
    B. It acts opposite to the direction of the object's velocity
    C. It acts perpendicular to the object's velocity
    D. It acts at an angle to the object's velocity
32. A force of 400 N is applied to a beam at a distance of 5 m from the pivot point, as shown in Figure shown below. What is the magnitude of the torque which turns the bar around pivot?



    A. 1,000Nm C. 1,600Nm
    B. 120Nm D. 3,200Nm
33. An object shown in the accompanying figure moves in uniform horizontal circular motion. Which arrow best depicts the net acceleration the object at the instant shown?



    A. A B. B C. C D. D
34. A disk of moment of inertia 1kg.m^2 is rotating freely with angular speed of 3rad/s when a second non-rotating disk with moment of inertia 0.5kg.m^2 is coupled on to it. The two then rotate together. What is the common angular speed of the couple?
    A. 2rad/s B. 6rad/s C. 10rad/s D. 0.12rad/s
35. Two forces of each 120N acts as a couple. The forces act at a distance of 30 cm from the center of the massless bar as shown below. What is the net torque produced by the couple?



    A. 72Nm in counterclockwise direction
    B. 120Nm in counterclockwise direction
    C. 160Nm in clockwise direction
    D. 60Nm in counterclockwise direction