Angular Variables in Rotation

The following questions are concept based. For questions with higher level difficulty, watch videos in the course.

Q1. What is the relationship between linear velocity (v) and angular velocity (ω) for a point at a distance r from the axis of rotation?

A. v = ω / r
B. v = ω * r
C. v = ω + r
D. v = ω - r

Answer: B. v = ω * r
Explanation: The linear velocity (v) of a point at a distance (r) from the axis of rotation is given by the product of the angular velocity (ω) and the radius (r).

Q2. If an object is rotating with a constant angular velocity, what can be said about its angular acceleration?

A. It is zero
B. It is constant
C. It increases linearly with time
D. It is equal to the angular velocity

Answer: A. It is zero
Explanation: If an object rotates with a constant angular velocity, its angular acceleration is zero because there is no change in angular velocity. This is quite the way you establish acceleration in linear motion. That is, if there is no change in velocity, the acceleration will be zero.

Q3. A rigid body starts from rest and rotates with a constant angular acceleration. If it takes 10 seconds to reach an angular velocity of 5 rad/s, what is its angular acceleration?

A. 0.5 rad/s²
B. 1 rad/s²
C. 2 rad/s²
D. 5 rad/s²

Answer: A. 0.5 rad/s²
Explanation: Angular acceleration (α) is given by the change in angular velocity (Δω) divided by the time interval (Δt). Here, α = (5 rad/s) / (10 s) = 0.5 rad/s².

Q4. An object undergoes angular displacement of π/4 radians in 2 seconds. What is its average angular velocity?

A. π/8 rad/s
B. π/4 rad/s
C. π/2 rad/s
D. π rad/s

Answer: A. π/8 rad/s
Explanation: Average angular velocity (ω_avg) is the angular displacement (Δθ) divided by the time interval (Δt). Here, ω_avg = (π/4 radians) / (2 s) = π/8 rad/s.

Q5. The angular position θ(t) of a rotating body is given by θ(t) = 3t² - 2t + π/3. What is the angular velocity at t = 2 seconds?

A. 8 rad/s
B. 10 rad/s
C. 12 rad/s
D. 14 rad/s

Answer: B. 10 rad/s
Explanation: Angular velocity (ω) is the first derivative of angular position with respect to time. ω(t) = dθ/dt = 6t - 2. At t = 2 s, ω = 6(2) - 2 = 10 rad/s.

Q6. If a disk starts from rest and has a constant angular acceleration of 2 rad/s², what will be its angular velocity after 5 seconds?

A. 5 rad/s
B. 8 rad/s
C. 10 rad/s
D. 12 rad/s

Answer: C. 10 rad/s
Explanation: Angular velocity (ω) can be calculated using the formula ω = αt when the initial angular velocity is zero. Here, ω = 2 rad/s² * 5 s = 10 rad/s.

Q7. An object rotating with a constant angular velocity of 4 rad/s makes how many complete rotations in 10 seconds?

A. 4 rotations
B. 6.28 rotations
C. 20 rotations
D. 40 rotations

Answer: C. 20 rotations
Explanation: The number of complete rotations is given by the total angular displacement divided by 2π. The angular displacement in 10 seconds is 4 rad/s * 10 s = 40 radians. Thus, the number of complete rotations = 40 radians / 2π radians ≈ 6.28 rotations.

Q8. If a body has an angular acceleration given by α(t) = 4t, what will be the angular velocity at t = 3 seconds, assuming it starts from rest?

A. 6 rad/s
B. 12 rad/s
C. 18 rad/s
D. 24 rad/s

Answer: C. 18 rad/s
Explanation: Angular velocity (ω) is the integral of angular acceleration (α) with respect to time. $\omega(t) = \int \alpha(t)\, dt = \int 4t\, dt = 2t^2$. At t = 3 s, $\omega = 2(3)^2 = 18$ rad/s.

Q9. A rotating object experiences a torque that causes its angular velocity to change according to $\omega(t) = 6t - 4t^2$. At what time does the object come to rest?

A. 1/2 second
B. 1 second
C. 3/2 seconds
D. 2 seconds

Answer: A. 1/2 second
Explanation: The object comes to rest when ω(t) = 0. Setting $6t - 4t^2 = 0$ and solving for t gives t(6 - 4t) = 0, so t = 0 or t = 6/4 = 1.5 seconds.

Q10. The angular position of a particle is given by $\theta(t) = t^3 - 4t$. What is the angular acceleration at t = 2 seconds?

A. -4 rad/s²
B. 0 rad/s²
C. 4 rad/s²
D. 8 rad/s²

Answer: D. 8 rad/s²
Explanation: Angular acceleration (α) is the second derivative of angular position with respect to time. $\alpha(t) = d^2\theta/dt^2 = 6t$. At t = 2 s, $\alpha = 6(2) = 12$ rad/s².