نموذج اختبار رسمي انسباير





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موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الحادي عشر المتقدم ⇦ فيزياء ⇦ الفصل الأول ⇦ ملفات متنوعة ⇦ الملف	
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المزيد من مادة فيزياء:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

التواصل الاجتماعي بحسب الصف الحادي عشر المتقدم					
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المزيد من الملفات بحسب الصف الحادي عشر المتقدم والمادة فيزياء في الفصل الأول	
1	تدريبات هيكل – الوحدة الأولى الحركة الدورانية
2	هيكل مراجعة الحركة الدورانية
3	مراجعة مركزة في الراديان وتحويل الزوايا
4	ملخص وشرح درس الزخم وحفظه مع أمثلة تدريبية
5	ملخص وشرح القوى الكهروستاتيكية والكهرباء الساكنة

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GRADE 11 ADVANCED PHYSICS

Term 1 • Official Exam Model • 16 Multiple-Choice Questions + 4 Free-Response Questions

SECTION 1 | MULTIPLE-CHOICE QUESTIONS (1–16)

QUESTION 01

Learning outcome · Define a radian and convert between degrees and radians.

An angle measures 135°. What is its measure in radians?

A) $3\pi/4$ rad B) $3\pi/2$ rad

C) $\pi/4$ rad D) $2\pi/3$ rad

Correct answer: A

QUESTION 02

Learning outcome · Relate tangential speed to angular speed and distance from the rotation axis ($v = \omega r$).

A point on a rotating wheel is 0.40 m from its axis. If the angular speed is 5.0 rad/s, what is the tangential speed of that point?

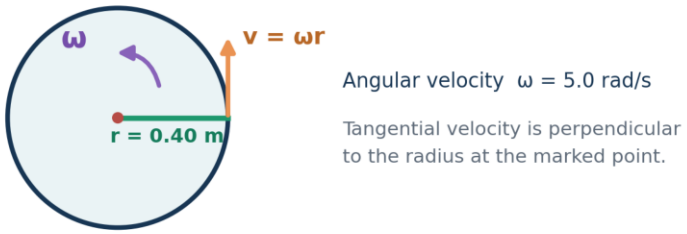


Figure 1 | Rotating wheel: radius and tangential direction

A) 0.80 m/s B) 2.0 m/s

C) 12.5 m/s D) 1.25 m/s

Correct answer: B

QUESTION 03

Learning outcome · Relate tangential acceleration to angular acceleration and radius ($a_t = \alpha r$).

A point on a rotating disk is 0.25 m from the axis and has a tangential acceleration of 1.5 m/s^2. What is the disk's angular acceleration, α?

A) 0.375 rad/s^2 B) 2.5 rad/s^2

C) 6.0 rad/s^2 D) 1.5 rad/s^2

Correct answer: C

QUESTION 04

Learning outcome · Relate frequency to angular frequency ($\omega = 2\pi f$).

A motor shaft rotates at a constant frequency of 30 Hz. What is its angular speed, ω?

A) 15π rad/s B) 30π rad/s

C) 60π rad/s D) 120π rad/s

Correct answer: C

QUESTION 05

Learning outcome · Explain why all points on a rigid rotating object undergo the same angular displacement in a given time.

Points A and B lie on a rigid rotating disk. Point A is 0.10 m from the centre, and point B is 0.30 m from the centre. Which statement correctly describes their motion?

A) Point A has a greater angular speed than point B.

B) Point A travels a greater arc length than point B in the same time.

C) Both points undergo the same angular displacement, Δθ, over any given time interval.

D) Point A has a greater tangential speed than point B.

Correct answer: C

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QUESTION 06

Learning outcome · Identify the standard sign convention for clockwise and counterclockwise torque.

A force turns a bolt clockwise about its axis using a wrench. Under the usual planar torque sign convention (counterclockwise is positive), what sign does this torque have?

A) Positive B) Negative

C) Zero D) Vector only

Correct answer: B

QUESTION 07

Learning outcome · Calculate the moment of inertia of a point mass about a rotation axis ($I = mr^2$).

A point mass of 2.0 kg is attached to a light rod at a distance of 3.0 m from the rotation axis. What is its moment of inertia about that axis?

A) 6.0 $kg \cdot m^2$ B) 12 $kg \cdot m^2$

C) 18 $kg \cdot m^2$ D) 36 $kg \cdot m^2$

Correct answer: C

QUESTION 08

Learning outcome · Explain how a restoring torque and the position of the centre of mass determine stability.

An upright object is tilted slightly and then released. It returns to its original position because the tilt raises its centre of mass and gravity creates a restoring torque. What type of equilibrium does it have?

A) Unstable equilibrium B) Stable equilibrium

C) Neutral equilibrium D) Rotational acceleration

Correct answer: B

QUESTION 09

Learning outcome · State the conditions for static equilibrium of a rigid body.

Which pair of conditions must both be satisfied for a rigid body to remain in static equilibrium?

A) $\Sigma F = 0$ and $\Sigma v = 0$ B) $\Sigma F = 0$ and $\Sigma \tau = 0$

C) $\Sigma \tau = 0$ and $\Sigma p = 0$ D) $\Sigma a = 0$ and $\Sigma \alpha = 1$

Correct answer: B

QUESTION 10

Learning outcome · Describe the Coriolis force as an apparent force in a rotating reference frame.

A rider on a rotating merry-go-round throws a ball straight toward a friend opposite them. To the rider, the ball appears to curve away from a straight path. Which effect explains this apparent deflection?

A) Centripetal force B) Gravity

C) Coriolis force D) Net external torque

Correct answer: C

QUESTION 11

Learning outcome · Apply the impulse–momentum theorem and identify the SI unit of impulse.

Starting with Newton's second law, $F = \Delta p/\Delta t$, which SI unit is correct for impulse, $J = F\Delta t$, when F is the average net force?

A) $kg \cdot m/s^2$ B) N·s (equivalent to kg·m/s)

C) N/s D) J·s

Correct answer: B

QUESTION 12

Learning outcome · Calculate impulse from the area under a force–time graph.

The force–time graph shows a triangular pulse: the force rises linearly from 0 N at t = 0 s to 100 N at t = 2 s, then falls to 0 N at t = 4 s. What is the total impulse delivered?

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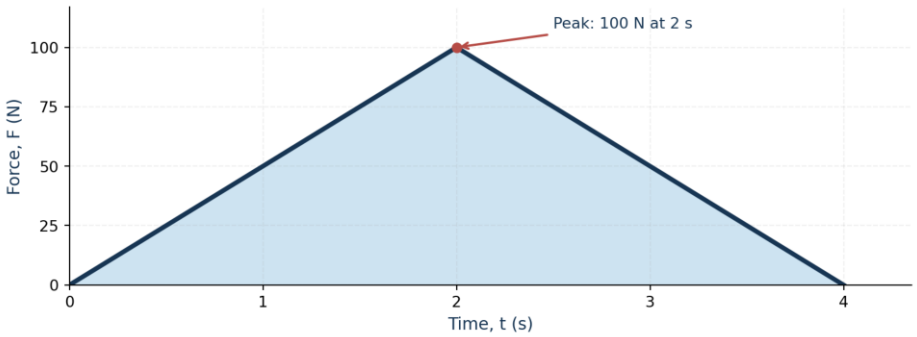


Figure 2 | Force–time graph

A) 400 N·s B) 200 N·s

C) 100 N·s D) 50 N·s

Correct answer: B

QUESTION 13

Learning outcome · Apply conservation of linear momentum to recoil in one dimension.

A cannon of mass M = 500 kg fires a projectile of mass m = 10 kg horizontally to the right at 50 m/s relative to the ground. Assuming the cannon–projectile system was initially at rest and has negligible external horizontal impulse, what is the cannon's recoil velocity? (Take right as positive.)

A) −1.0 m/s B) −5.0 m/s

C) +1.0 m/s D) −10 m/s

Correct answer: A

QUESTION 14

Learning outcome · Explain how airbags reduce force using the impulse–momentum theorem.

During a car collision, an airbag inflates to protect the driver. Why does it reduce the average force on the driver?

A) It reduces the total change in momentum, Δp.

B) It increases the stopping time, Δt, so the average force is smaller for the same Δp.

C) It increases the impulse, J, delivered to the driver.

D) It reduces the mass of the driver.

Correct answer: B

QUESTION 15

Learning outcome · Apply conservation of angular momentum when moment of inertia changes.

An ice skater rotates with her arms extended. When she pulls her arms inward, her moment of inertia falls to half its original value ($I_f = 0.5I_i$). If the net external torque is zero, what happens to her final angular speed, ω_f?

A) It decreases to half its initial value.

B) It remains unchanged.

C) It doubles ($\omega_f = 2\omega_i$).

D) It increases to four times its initial value.

Correct answer: C

QUESTION 16

Learning outcome · Apply conservation of angular momentum in rotating systems.

A spinning top rotates on a smooth surface. If the net external torque about a fixed reference point is zero, which physical quantity remains conserved?

A) Linear kinetic energy B) Angular displacement

C) Angular momentum, L D) Tangential acceleration

Correct answer: C

SECTION 2 | FREE-RESPONSE QUESTIONS (17–20)

QUESTION 17 | Rotational Kinematics and Torque

PART 1 · Angular displacement

Define angular displacement, Δθ. A wheel turns through Δθ = 12π rad in Δt = 4.0 s. Calculate its average angular velocity, ω_{avg}.

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PART 2 · Torque and rotational equilibrium

A force of F = 40 N is applied at the end of a wrench of length r = 0.25 m. The force makes an angle θ = 30° with the wrench, as shown below.

1. State the torque equation, $\tau = Fr\sin\theta$, and calculate the magnitude of the torque.

2. State the condition for rotational equilibrium.

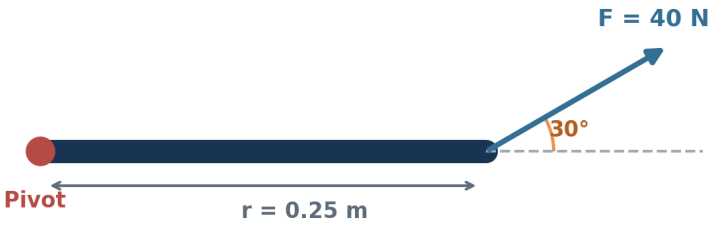


Figure 3 | Force applied to a wrench

MODEL ANSWER

Part 1. Angular displacement is the change in angular position about a chosen axis of rotation.

$\omega_{avg} = \Delta\theta / \Delta t = 12\pi / 4.0 = 3\pi$ rad/s ≈ 9.42 rad/s

Part 2. Torque magnitude:

$\tau = Fr\sin\theta = (40)(0.25)\sin30° = 5.0$ N·m

Rotational equilibrium requires zero net external torque: $\Sigma\tau = 0$.

□

QUESTION 18 | Rotational Dynamics and Angular Momentum

PART 1 · Moment of inertia and angular acceleration

A uniform solid cylinder of mass M = 4.0 kg and radius R = 0.20 m rotates about its central symmetry axis. Its moment of inertia is $I = \frac{1}{2}MR^2$.

1. Calculate the moment of inertia, I, of the cylinder.

2. If the net applied torque is τ = 0.80 N·m, find the angular acceleration, α, using $\tau = I\alpha$.

PART 2 · Angular momentum

Define angular momentum for rotation about a fixed principal axis ($L = I\omega$) and state its SI unit. Calculate the cylinder's angular momentum when ω = 10 rad/s.

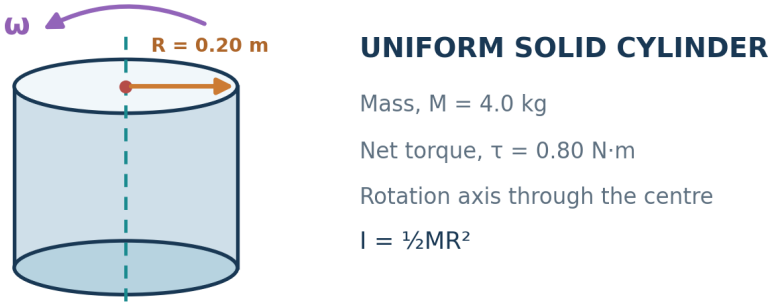


Figure 4 | Uniform solid cylinder rotating about its symmetry axis

MODEL ANSWER

Part 1. Moment of inertia:

$I = \frac{1}{2}MR^2 = \frac{1}{2}(4.0)(0.20)^2 = 0.080$ kg·m^2

Angular acceleration:

$\alpha = \tau / I = 0.80 / 0.080 = 10$ rad/s^2

Part 2. Angular momentum is the product of the moment of inertia and angular velocity about the stated axis; its SI unit is kg·m^2/s (equivalently, J·s).

$L = I\omega = (0.080)(10) = 0.80$ kg·m^2/s

□

QUESTION 19 | Impulse and Linear Momentum

PART 1 · Impulse–momentum theorem

A football of mass m = 0.40 kg initially approaches a player with velocity $v_i = -10$ m/s. The player kicks it so that it

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travels back in the opposite direction with velocity $v_f = +20$ m/s.

1. Calculate the initial and final linear momenta of the ball ($p = mv$).

2. Calculate the impulse, J, delivered to the ball by the kick.

3. If the contact time is $\Delta t = 0.05$ s, calculate the average force in the direction of motion, neglecting any other impulse during contact.



Figure 5 | Incoming and outgoing velocities of the football

MODEL ANSWER

1. $p_i = mv_i = (0.40)(-10) = -4.0$ kg·m/s

   $p_f = mv_f = (0.40)(+20) = +8.0$ kg·m/s

2. $J = \Delta p = p_f - p_i = 8.0 - (-4.0) = +12$ N·s

3. $F_{avg} = J / \Delta t = 12 / 0.05 = +240$ N

□

QUESTION 20 | One-Dimensional Collision and Momentum Conservation

PART 1 · Conservation law

State the law of conservation of linear momentum and write its general equation for an isolated system of two objects.

PART 2 · Completely inelastic collision

Car A ($m_A = 1200$ kg) travels east at $v_{Ai} = +15$ m/s and collides head-on with stationary car B ($m_B = 800$ kg; $v_{Bi} = 0$ m/s). The cars stick together immediately after the collision. Assume the net external impulse during the short collision is negligible.

1. Calculate their common velocity, v_f, immediately after the collision.

2. Explain why the system's total linear momentum is conserved during the collision.

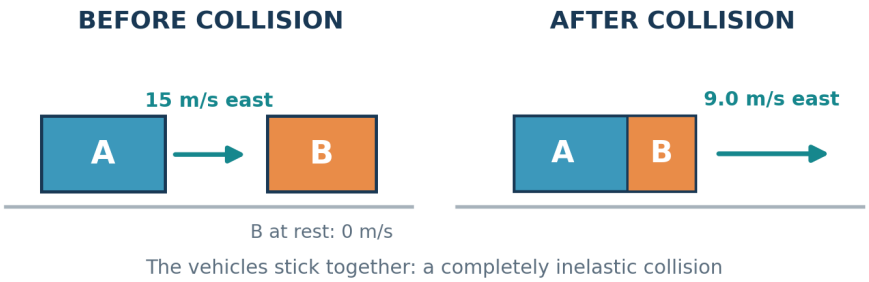


Figure 6 | Before and after a completely inelastic collision

MODEL ANSWER

Part 1. In an isolated system with zero net external impulse, total linear momentum remains constant: $p_i = p_f$.

$m_A v_{Ai} + m_B v_{Bi} = m_A v_{Af} + m_B v_{Bf}$

Part 2. Since both cars move together after impact:

$m_A v_{Ai} + m_B v_{Bi} = (m_A + m_B) v_f$

$(1200)(15) + (800)(0) = (1200 + 800)v_f$

$v_f = 18{,}000 / 2{,}000 = +9.0$ m/s (east)

The external impulse is negligible, so the total momentum of the two-car system is unchanged: $\Delta p_{total} \approx 0$.

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