

AP Physics C: Mechanics Practice Test 3

60 original multiple-choice questions covering all 7 AP Physics C: Mechanics units. All questions are calculus-based. Choose one answer for each question. The full answer key is on the last page — worked explanations for every question are free on the test page at QuaidianPoint.com.

Name: _____ Class: _____ Score: _____ / 60

Unit 1: Kinematics

Q1. A ball is thrown horizontally with speed 14 m/s from a cliff 20 m high. How far from the base of the cliff does it land? Take $g = 9.8 \text{ m/s}^2$.

- (A) 28.28 m
- (B) 31.11 m
- (C) 42.43 m
- (D) 14.14 m

Q2. A particle moves along a straight line with position $x(t) = 4t^2 + 7t$ metres, where t is in seconds. What is the velocity of the particle at $t = 3 \text{ s}$?

- (A) 36 m/s
- (B) 31 m/s
- (C) 93 m/s
- (D) 46.5 m/s

Q3. A particle has position $x(t) = 3t^3 - 2t^2$ metres, where t is in seconds. What is its acceleration at $t = 3 \text{ s}$?

- (A) 12.5 m/s^2
- (B) 25 m/s^2
- (C) 40 m/s^2
- (D) 50 m/s^2

Q4. A body moves with velocity $v(t) = 6t + 3 \text{ m/s}$, where t is in seconds. What is its displacement from $t = 0$ to $t = 4 \text{ s}$?

- (A) 48 m
- (B) 66 m
- (C) 15 m
- (D) 60 m

Q5. A body starts with velocity 5 m/s and has acceleration $a(t) = 2t + 4 \text{ m/s}^2$. What is its velocity at $t = 3 \text{ s}$?

- (A) 16 m/s
- (B) 32.5 m/s
- (C) 26 m/s
- (D) 39 m/s

Q6. A projectile is launched from level ground with speed 31 m/s at 30° above the horizontal. What is its horizontal range? Take $g = 9.8 \text{ m/s}^2$.

- (A) 106.15 m
- (B) 42.46 m
- (C) 84.92 m
- (D) 254.77 m

Q7. A stone is dropped from rest from a height of 70 m. How long does it take to reach the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 4.16 s
- (B) 1.89 s
- (C) 2.83 s
- (D) 3.78 s

Unit 2: Force and Translational Dynamics

Q8. A planet has surface gravity 9.8 m/s^2 . At a height of 3 planet radii above the surface, what is the acceleration due to gravity there?

- (A) 0.49 m/s^2
- (B) 0.67 m/s^2
- (C) 0.15 m/s^2
- (D) 0.61 m/s^2

Q9. A 5 kg object moves in a circle of radius 4 m with a period of 5 s. What is the magnitude of the centripetal force on it?

- (A) 31.58 N
- (B) 39.48 N
- (C) 41.58 N
- (D) 23.69 N

Q10. A time-varying force $F(t) = 3t + 4 \text{ N}$ acts on a 2 kg mass. What is the acceleration of the mass at $t = 4 \text{ s}$?

- (A) 10 m/s^2
- (B) 24 m/s^2
- (C) 6 m/s^2
- (D) 8 m/s^2

Q11. An object of mass 18 kg is on a planet where the acceleration due to gravity is 4 times that on Earth. What is its weight on that planet? Take $g = 9.8 \text{ m/s}^2$ on Earth.

- (A) 705.6 N
- (B) 882 N
- (C) 700.6 N
- (D) 695.6 N

Q12. A net force acts on a 5 kg mass and gives it an acceleration of 5 m/s^2 . What is the magnitude of the net force?

- (A) 25 N
- (B) 6.25 N
- (C) 18.75 N
- (D) 75 N

Q13. Two horizontal forces, 21 N to the right and 9 N to the left, act on a 6 kg block on a frictionless surface. What is the acceleration of the block?

- (A) 2.5 m/s^2
- (B) 0.5 m/s^2
- (C) 2 m/s^2
- (D) 6 m/s^2

Q14. A 12 kg block rests on a horizontal surface with coefficient of static friction $\mu = 0.3$. What is the maximum static friction force that can act on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 52.92 N
- (B) 35.28 N
- (C) 28.22 N
- (D) 40.28 N

Q15. A block slides down a plane inclined at 60° to the horizontal. The coefficient of kinetic friction is 0.3. What is the acceleration of the block down the plane? Take $g = 9.8 \text{ m/s}^2$.

- (A) 7.02 m/s^2
- (B) 4.21 m/s^2
- (C) 2.02 m/s^2
- (D) 17.02 m/s^2

Q16. A 20 kg block rests on a plane inclined at 45° to the horizontal. What is the normal force on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 103.94 N
- (B) 173.24 N
- (C) 138.59 N
- (D) 277.19 N

Q17. Two masses, 5 kg and 9 kg, are connected by a light string over a frictionless pulley. What is the magnitude of their acceleration? Take $g = 9.8 \text{ m/s}^2$.

- (A) 0.7 m/s^2
- (B) 2.8 m/s^2
- (C) 1.4 m/s^2
- (D) 5.6 m/s^2

Q18. A person of mass 45 kg stands on a scale in a lift accelerating upwards at 1 m/s^2 . What is the scale reading in newtons? Take $g = 9.8 \text{ m/s}^2$.

- (A) 486 N
- (B) 972 N
- (C) 607.5 N
- (D) 388.8 N

Q19. A person of mass 60 kg stands on a scale in a lift accelerating downwards at 2 m/s^2 . What is the scale reading in newtons? Take $g = 9.8 \text{ m/s}^2$.

- (A) 514.8 N
- (B) 473 N
- (C) 468 N
- (D) 463 N

Unit 3: Work, Energy, and Power

Q20. A 4 kg block attached to a spring of spring constant 200 N/m is released from rest with the spring compressed by 0.3 m on a frictionless surface. What is the speed of the block as it passes the equilibrium position?

- (A) 1.7 m/s
- (B) 4.24 m/s
- (C) 2.12 m/s
- (D) 1.27 m/s

Q21. A 5 kg object speeds up from 3 m/s to 7 m/s. How much net work is done on the object?

- (A) 25 J
- (B) 90 J
- (C) 100 J
- (D) 60 J

Q22. A constant force of 39 N pushes a crate 2 m along a horizontal floor in the direction of the force. How much work is done by the force?

- (A) 68 J
- (B) 78 J
- (C) 85.8 J
- (D) 58.5 J

Q23. A force of 53 N acts at 30° to the direction of motion as a block moves 5 m. How much work is done by the force?

- (A) 183.6 J
- (B) 234.5 J
- (C) 458.99 J
- (D) 229.5 J

Q24. A variable force $F(x) = 40x$ N stretches a spring from $x = 0$ to $x = 0.5$ m. How much work is done? Here x is in metres.

- (A) 15 J
- (B) 5 J
- (C) 7.5 J
- (D) 3 J

Q25. A force $F(x) = 6x^2$ N acts on a particle as it moves from $x = 0$ to $x = 3$ m. How much work is done by the force?

- (A) 40.5 J
- (B) 44 J
- (C) 54 J
- (D) 162 J

Q26. What is the kinetic energy of a 3 kg object moving at 5 m/s?

- (A) 27.5 J
- (B) 56.25 J
- (C) 46.88 J
- (D) 37.5 J

Q27. A spring of spring constant 100 N/m is compressed by 0.1 m. What is the elastic potential energy stored in the spring?

- (A) 0.5 J
- (B) 0.3 J
- (C) 0.4 J
- (D) 0.38 J

Q28. A 7 kg object is raised vertically by 7 m. By how much does its gravitational potential energy increase? Take $g = 9.8 \text{ m/s}^2$.

- (A) 240.1 J
- (B) 480.2 J
- (C) 470.2 J
- (D) 1440.6 J

Q29. An object is dropped from rest from a height of 40 m. Ignoring air resistance, what is its speed just before it hits the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 56 m/s
- (B) 23 m/s
- (C) 33 m/s
- (D) 28 m/s

Q30. A motor does 123 J of work in 10 s. What is its average power output?

- (A) 6.15 W
- (B) 22.3 W
- (C) 12.3 W
- (D) 15.38 W

Unit 4: Linear Momentum

Q31. A force $F(t) = 2t + 6 \text{ N}$ acts on a body from $t = 0$ to $t = 3 \text{ s}$. What is the impulse delivered to the body?

- (A) 40.5 N·s
- (B) 21.6 N·s
- (C) 33.75 N·s
- (D) 27 N·s

Q32. An impulse of 30 N·s is delivered to a 7 kg object initially at rest. What is its final speed?

- (A) 3.43 m/s
- (B) 4.29 m/s
- (C) 12.86 m/s
- (D) 1.07 m/s

Q33. A 4 kg trolley moving at 9 m/s collides with a stationary 5 kg trolley and the two stick together. What is their common speed after the collision?

- (A) 5 m/s
- (B) 3.2 m/s
- (C) 6 m/s
- (D) 4 m/s

Q34. A rifle of mass 3 kg fires a bullet of mass 0.01 kg at 372 m/s. What is the recoil speed of the rifle?

- (A) 0.99 m/s
- (B) 1.86 m/s
- (C) 1.36 m/s
- (D) 1.24 m/s

Q35. A 5 kg object moving at 5 m/s collides head-on with a 3 kg object moving at 2 m/s in the opposite direction, and they stick together. What is their velocity after the collision, taking the first object's direction as positive?

- (A) 2.38 m/s
- (B) 1.9 m/s
- (C) 2.97 m/s
- (D) 3.56 m/s

Q36. A 3 kg object changes its velocity by 8 m/s in 4 s. What is the average force acting on it?

- (A) 4.5 N
- (B) 11 N
- (C) 4.8 N
- (D) 6 N

Q37. A force acting on a body rises linearly from zero to 40 N over 4 s and then stops. What is the impulse delivered?

- (A) 80 N·s
- (B) 70 N·s
- (C) 40 N·s
- (D) 85 N·s

Q38. A 0.5 kg ball hits a wall at 4 m/s and rebounds at 2 m/s in the opposite direction. What is the magnitude of the change in its momentum?

- (A) 1.5 kg·m/s
- (B) 3 kg·m/s
- (C) 3.3 kg·m/s
- (D) 9 kg·m/s

Unit 5: Torque and Rotational Dynamics

Q39. A uniform rod of mass 7 kg and length 3 m rotates about an axis through one end, perpendicular to the rod. What is its moment of inertia?

- (A) $21 \text{ kg}\cdot\text{m}^2$
- (B) $11 \text{ kg}\cdot\text{m}^2$
- (C) $10.5 \text{ kg}\cdot\text{m}^2$
- (D) $16.8 \text{ kg}\cdot\text{m}^2$

Q40. A uniform solid disc of mass 7 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) $0.56 \text{ kg}\cdot\text{m}^2$
- (B) $1.68 \text{ kg}\cdot\text{m}^2$
- (C) $0.28 \text{ kg}\cdot\text{m}^2$
- (D) $0.84 \text{ kg}\cdot\text{m}^2$

Q41. A thin hoop of mass 3 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) $0.48 \text{ kg}\cdot\text{m}^2$
- (B) $0.24 \text{ kg}\cdot\text{m}^2$
- (C) $0.12 \text{ kg}\cdot\text{m}^2$
- (D) $0.96 \text{ kg}\cdot\text{m}^2$

Q42. A net torque of $30 \text{ N}\cdot\text{m}$ acts on a body with moment of inertia $6 \text{ kg}\cdot\text{m}^2$. What is its angular acceleration?

- (A) 4 rad/s^2
- (B) 3.75 rad/s^2
- (C) 7.5 rad/s^2
- (D) 5 rad/s^2

Q43. A wheel starts with angular velocity 5 rad/s and has a constant angular acceleration of 1 rad/s^2 . What is its angular velocity after 5 s?

- (A) 15 rad/s
- (B) 30 rad/s
- (C) 10 rad/s
- (D) 20 rad/s

Q44. A disc starts with angular velocity 5 rad/s and angular acceleration 2 rad/s^2 . Through what angle does it turn in 2 s?

- (A) 19 rad
- (B) 9 rad
- (C) 14 rad
- (D) 11.2 rad

Q45. The angular momentum of a body varies as $L(t) = 4t^2 \text{ kg}\cdot\text{m}^2/\text{s}$. What is the net torque on the body at $t = 4 \text{ s}$?

- (A) $19.2 \text{ N}\cdot\text{m}$
- (B) $32 \text{ N}\cdot\text{m}$
- (C) $24 \text{ N}\cdot\text{m}$
- (D) $25.6 \text{ N}\cdot\text{m}$

Q46. A force of 20 N is applied at a distance of 0.4 m from a pivot, at 90° to the lever arm. What is the magnitude of the torque about the pivot?

- (A) $10 \text{ N}\cdot\text{m}$
- (B) $8 \text{ N}\cdot\text{m}$
- (C) $24 \text{ N}\cdot\text{m}$
- (D) $13 \text{ N}\cdot\text{m}$

Unit 6: Energy and Momentum of Rotating Systems

Q47. A solid disc of mass 5 kg rolls without slipping at 5 m/s . What is its total kinetic energy?

- (A) 93.75 J
- (B) 83.75 J
- (C) 88.75 J
- (D) 75 J

Q48. A thin hoop of mass 6 kg rolls without slipping at 4 m/s. What is its total kinetic energy?

- (A) 96 J
- (B) 106 J
- (C) 144 J
- (D) 105.6 J

Q49. A torque $\tau(t) = 3t$ N·m acts on a body from $t = 0$ to $t = 4$ s. What is the change in its angular momentum?

- (A) $12 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $24 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $72 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $19 \text{ kg}\cdot\text{m}^2/\text{s}$

Q50. How much work is needed to spin a solid disc of mass 5 kg and radius 0.3 m from rest to an angular velocity of 4 rad/s?

- (A) 2.25 J
- (B) 0.45 J
- (C) 1.8 J
- (D) 1.08 J

Q51. A solid disc of mass 4 kg and radius 0.3 m rotates at 3 rad/s about its central axis. What is its rotational kinetic energy?

- (A) 1.62 J
- (B) 0.81 J
- (C) 2.43 J
- (D) 0.49 J

Q52. A body with moment of inertia $4 \text{ kg}\cdot\text{m}^2$ rotates at 5 rad/s. What is its angular momentum?

- (A) $16 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $20 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $5 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $30 \text{ kg}\cdot\text{m}^2/\text{s}$

Q53. A spinning skater with moment of inertia $2 \text{ kg}\cdot\text{m}^2$ rotates at 7 rad/s, then pulls in her arms so her moment of inertia becomes $1 \text{ kg}\cdot\text{m}^2$. What is her new angular velocity, assuming no external torque?

- (A) 14 rad/s
- (B) 15.4 rad/s
- (C) 10.5 rad/s
- (D) 8.4 rad/s

Unit 7: Oscillations

Q54. A spring of spring constant 80 N/m oscillates with amplitude 0.3 m. What is the total mechanical energy of the oscillator?

- (A) 1.8 J
- (B) 2.16 J
- (C) 3.6 J
- (D) 5.4 J

Q55. An oscillator completes one full oscillation in 1 s. What is its frequency?

- (A) 0.75 Hz
- (B) 0.6 Hz
- (C) 0.8 Hz
- (D) 1 Hz

Q56. A simple pendulum has a period of 0.5 s for small oscillations. What is its length? Take $g = 9.8 \text{ m/s}^2$.

- (A) 0.05 m
- (B) 0.06 m
- (C) 0.19 m
- (D) 0.03 m

Q57. A 4 kg mass on a spring of spring constant 200 N/m oscillates on a frictionless surface. What is the period of oscillation?

- (A) 1.78 s
- (B) 1.11 s
- (C) 0.89 s
- (D) 0.98 s

Q58. A simple pendulum of length 0.4 m oscillates with small amplitude. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 1.02 s
- (B) 0.63 s
- (C) 1.27 s
- (D) 1.4 s

Q59. A mass of 1 kg oscillates on a spring of spring constant 100 N/m. What is the angular frequency of the oscillation?

- (A) 20 rad/s
- (B) 12.5 rad/s
- (C) 8 rad/s
- (D) 10 rad/s

Q60. A 2 kg mass oscillates on a spring of spring constant 36 N/m with amplitude 0.3 m. What is its maximum speed?

- (A) 1.02 m/s
- (B) 1.27 m/s
- (C) 1.4 m/s
- (D) 1.91 m/s

Answer Key

Q1: A	Q11: A	Q21: C	Q31: D	Q41: A	Q51: B
Q2: B	Q12: A	Q22: B	Q32: B	Q42: D	Q52: B
Q3: D	Q13: C	Q23: D	Q33: D	Q43: C	Q53: A
Q4: D	Q14: B	Q24: B	Q34: D	Q44: C	Q54: C
Q5: C	Q15: A	Q25: C	Q35: A	Q45: B	Q55: D

Q6: C	Q16: C	Q26: D	Q36: D	Q46: B	Q56: B
Q7: D	Q17: B	Q27: A	Q37: A	Q47: A	Q57: C
Q8: D	Q18: A	Q28: B	Q38: B	Q48: A	Q58: C
Q9: A	Q19: C	Q29: D	Q39: A	Q49: B	Q59: D
Q10: D	Q20: C	Q30: C	Q40: A	Q50: C	Q60: B

Worked explanations for all 60 questions:

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