

AP Physics C: Mechanics Practice Test 2

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 particle moves with velocity $v(t) = 6t^2 + 4$ m/s, where t is in seconds. What is its displacement from $t = 0$ to $t = 4$ s?

- (A) 144 m
- (B) 180 m
- (C) 154 m
- (D) 108 m

Q2. A car moves with velocity $v(t) = 12 - 4t$ m/s, where t is in seconds. At what time does the car momentarily come to rest?

- (A) 3.3 s
- (B) 9 s
- (C) 1.8 s
- (D) 3 s

Q3. A particle has velocity $v(t) = 2t^2 + 3t$ m/s, where t is in seconds. What is its acceleration at $t = 3$ s?

- (A) 25 m/s^2
- (B) 30 m/s^2
- (C) 18.75 m/s^2
- (D) 15 m/s^2

Q4. A ball is thrown horizontally with speed 13 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) 28.89 m
- (B) 31.26 m
- (C) 26.26 m
- (D) 6.57 m

Q5. A particle moves along a straight line with position $x(t) = 5t^2 + 5t$ metres, where t is in seconds. What is the velocity of the particle at $t = 3$ s?

- (A) 35 m/s
- (B) 26.25 m/s
- (C) 30 m/s
- (D) 17.5 m/s

Q6. A particle has position $x(t) = 3t^3 - 5t^2$ metres, where t is in seconds. What is its acceleration at $t = 2$ s?

- (A) 32.5 m/s^2
- (B) 21 m/s^2
- (C) 36 m/s^2
- (D) 26 m/s^2

Q7. A body moves with velocity $v(t) = 6t + 6 \text{ m/s}$, where t is in seconds. What is its displacement from $t = 0$ to $t = 3$ s?

- (A) 45 m
- (B) 135 m
- (C) 35 m
- (D) 49.5 m

Unit 2: Force and Translational Dynamics

Q8. A person of mass 41 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) 239.85 N
- (B) 255.84 N
- (C) 159.9 N
- (D) 319.8 N

Q9. A 7 kg object moves in a horizontal circle of radius 2 m at a constant speed of 11 m/s. What is the magnitude of the centripetal force on it?

- (A) 105.88 N
- (B) 423.5 N
- (C) 338.8 N
- (D) 465.85 N

Q10. A spring of spring constant 200 N/m is stretched by 0.2 m from its natural length. What is the magnitude of the spring force?

- (A) 45 N
- (B) 60 N
- (C) 30 N
- (D) 40 N

Q11. A planet has surface gravity 10 m/s^2 . At a height of 3 planet radii above the surface, what is the acceleration due to gravity there?

- (A) 1.88 m/s^2
- (B) 1.25 m/s^2
- (C) 0.62 m/s^2
- (D) 0.78 m/s^2

Q12. A 5 kg object moves in a circle of radius 3 m with a period of 2 s. What is the magnitude of the centripetal force on it?

- (A) 158.04 N
- (B) 148.04 N
- (C) 296.09 N
- (D) 444.13 N

Q13. A time-varying force $F(t) = 3t + 12$ N acts on a 6 kg mass. What is the acceleration of the mass at $t = 4$ s?

- (A) 1 m/s^2
- (B) 6 m/s^2
- (C) 4 m/s^2
- (D) 5 m/s^2

Q14. An object of mass 14 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) 548.8 N
- (B) 274.4 N
- (C) 543.8 N
- (D) 603.68 N

Q15. A net force acts on a 11 kg mass and gives it an acceleration of 5 m/s^2 . What is the magnitude of the net force?

- (A) 55 N
- (B) 82.5 N
- (C) 60.5 N
- (D) 45 N

Q16. Two horizontal forces, 53 N to the right and 9 N to the left, act on a 10 kg block on a frictionless surface. What is the acceleration of the block?

- (A) 4.4 m/s^2
- (B) 4.84 m/s^2
- (C) 3.3 m/s^2
- (D) 13.2 m/s^2

Q17. A 9 kg block rests on a horizontal surface with coefficient of static friction $\mu = 0.5$. What is the maximum static friction force that can act on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 44.1 N
- (B) 22.05 N
- (C) 26.46 N
- (D) 132.3 N

Q18. A block slides down a plane inclined at 60° to the horizontal. The coefficient of kinetic friction is 0.2. What is the acceleration of the block down the plane? Take $g = 9.8 \text{ m/s}^2$.

- (A) 6.01 m/s^2
- (B) 7.51 m/s^2
- (C) 9.38 m/s^2
- (D) 11.26 m/s^2

Q19. A 8 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) 65.44 N
- (B) 50.44 N
- (C) 27.72 N
- (D) 55.44 N

Unit 3: Work, Energy, and Power

Q20. A motor does 417 J of work in 3 s. What is its average power output?

- (A) 139 W
- (B) 129 W
- (C) 152.9 W
- (D) 34.75 W

Q21. A constant force of 60 N moves an object at a steady speed of 3 m/s in the direction of the force. What power is delivered by the force?

- (A) 135 W
- (B) 108 W
- (C) 180 W
- (D) 270 W

Q22. A 4 kg block slides 3 m across a horizontal surface with coefficient of kinetic friction 0.4. What is the magnitude of the work done by friction? Take $g = 9.8 \text{ m/s}^2$.

- (A) 94.08 J
- (B) 37.63 J
- (C) 47.04 J
- (D) 28.22 J

Q23. A 4 kg block attached to a spring of spring constant 50 N/m is released from rest with the spring compressed by 0.2 m on a frictionless surface. What is the speed of the block as it passes the equilibrium position?

- (A) 0.71 m/s
- (B) 0.88 m/s
- (C) 0.57 m/s
- (D) 0.18 m/s

Q24. A 3 kg object speeds up from 3 m/s to 8 m/s. How much net work is done on the object?

- (A) 247.5 J
- (B) 82.5 J
- (C) 92.5 J
- (D) 165 J

Q25. A constant force of 25 N pushes a crate 7 m along a horizontal floor in the direction of the force. How much work is done by the force?

- (A) 170 J
- (B) 185 J
- (C) 175 J
- (D) 131.25 J

Q26. A force of 21 N acts at 30° to the direction of motion as a block moves 9 m. How much work is done by the force?

- (A) 153.68 J
- (B) 163.68 J
- (C) 180.05 J
- (D) 173.68 J

Q27. A variable force $F(x) = 40x$ N stretches a spring from $x = 0$ to $x = 0.2$ m. How much work is done? Here x is in metres.

- (A) 1 J
- (B) 0.6 J
- (C) 2.4 J
- (D) 0.8 J

Q28. A force $F(x) = 12x^2$ N acts on a particle as it moves from $x = 0$ to $x = 4$ m. How much work is done by the force?

- (A) 256 J
- (B) 64 J
- (C) 153.6 J
- (D) 128 J

Q29. What is the kinetic energy of a 4 kg object moving at 10 m/s?

- (A) 200 J
- (B) 205 J
- (C) 50 J
- (D) 600 J

Q30. A spring of spring constant 80 N/m is compressed by 0.25 m. What is the elastic potential energy stored in the spring?

- (A) 2 J
- (B) 1.88 J
- (C) 2.5 J
- (D) 2.75 J

Unit 4: Linear Momentum

Q31. A 2 kg ball hits a wall at 10 m/s and rebounds at 6 m/s in the opposite direction. What is the magnitude of the change in its momentum?

- (A) 40 kg·m/s
- (B) 48 kg·m/s
- (C) 24 kg·m/s
- (D) 32 kg·m/s

Q32. What is the momentum of a 9 kg object moving at 10 m/s?

- (A) 100 kg·m/s
- (B) 90 kg·m/s
- (C) 180 kg·m/s
- (D) 270 kg·m/s

Q33. A constant force of 48 N acts on an object for 2 s. What is the magnitude of the impulse delivered?

- (A) 96 N·s
- (B) 288 N·s
- (C) 24 N·s
- (D) 105.6 N·s

Q34. A force $F(t) = 4t + 5$ N acts on a body from $t = 0$ to $t = 2$ s. What is the impulse delivered to the body?

- (A) 8 N·s
- (B) 18 N·s
- (C) 36 N·s
- (D) 14.4 N·s

Q35. An impulse of 60 N·s is delivered to a 5 kg object initially at rest. What is its final speed?

- (A) 7.2 m/s
- (B) 12 m/s
- (C) 13.2 m/s
- (D) 9 m/s

Q36. A 2 kg trolley moving at 8 m/s collides with a stationary 7 kg trolley and the two stick together. What is their common speed after the collision?

- (A) 1.33 m/s
- (B) 1.78 m/s
- (C) 2.22 m/s
- (D) 1.96 m/s

Q37. A rifle of mass 5 kg fires a bullet of mass 0.02 kg at 364 m/s. What is the recoil speed of the rifle?

- (A) 1.46 m/s
- (B) 1.09 m/s
- (C) 0.73 m/s
- (D) 2.18 m/s

Q38. A 3 kg object moving at 6 m/s collides head-on with a 6 kg object moving at 4 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) -1 m/s
- (B) -0.53 m/s
- (C) -0.73 m/s
- (D) -0.67 m/s

Unit 5: Torque and Rotational Dynamics

Q39. A force of 37 N is applied at a distance of 0.4 m from a pivot, at 60° to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 3.2 N·m
- (B) 14.1 N·m
- (C) 7.69 N·m
- (D) 12.82 N·m

Q40. Two forces act on a beam pivoted at its centre: 25 N at 0.3 m on one side and 16 N at 0.2 m on the other side, in opposite rotational senses. What is the magnitude of the net torque?

- (A) 6.45 N·m
- (B) 2.15 N·m
- (C) 4.3 N·m
- (D) 3.44 N·m

Q41. Two point masses, 2 kg at 1 m and 1 kg at 1 m from an axis, rotate about that axis. What is their total moment of inertia about the axis?

- (A) $2.25 \text{ kg}\cdot\text{m}^2$
- (B) $3.3 \text{ kg}\cdot\text{m}^2$
- (C) $3 \text{ kg}\cdot\text{m}^2$
- (D) $6 \text{ kg}\cdot\text{m}^2$

Q42. A uniform rod of mass 7 kg and length 1 m rotates about an axis through one end, perpendicular to the rod. What is its moment of inertia?

- (A) $1.87 \text{ kg}\cdot\text{m}^2$
- (B) $0.58 \text{ kg}\cdot\text{m}^2$
- (C) $2.33 \text{ kg}\cdot\text{m}^2$
- (D) $7 \text{ kg}\cdot\text{m}^2$

Q43. A uniform solid disc of mass 6 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) $0.6 \text{ kg}\cdot\text{m}^2$
- (B) $0.24 \text{ kg}\cdot\text{m}^2$
- (C) $0.48 \text{ kg}\cdot\text{m}^2$
- (D) $0.53 \text{ kg}\cdot\text{m}^2$

Q44. A solid sphere of mass 10 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) $0.38 \text{ kg}\cdot\text{m}^2$
- (B) $0.64 \text{ kg}\cdot\text{m}^2$
- (C) $0.32 \text{ kg}\cdot\text{m}^2$
- (D) $0.16 \text{ kg}\cdot\text{m}^2$

Q45. A net torque of 22 N·m acts on a body with moment of inertia $6 \text{ kg}\cdot\text{m}^2$. What is its angular acceleration?

- (A) 4.58 rad/s^2
- (B) 2.2 rad/s^2
- (C) 3.67 rad/s^2
- (D) 0.92 rad/s^2

Q46. A wheel starts with angular velocity 1 rad/s and has a constant angular acceleration of 1 rad/s^2 . What is its angular velocity after 4 s?

- (A) 3.75 rad/s
- (B) 2.5 rad/s
- (C) 3 rad/s
- (D) 5 rad/s

Unit 6: Energy and Momentum of Rotating Systems

Q47. A spinning skater with moment of inertia $3 \text{ kg}\cdot\text{m}^2$ rotates at 3 rad/s , then pulls in her arms so her moment of inertia becomes $2 \text{ kg}\cdot\text{m}^2$. What is her new angular velocity, assuming no external torque?

- (A) 4.5 rad/s
- (B) 4.95 rad/s
- (C) 1.12 rad/s
- (D) 13.5 rad/s

Q48. A satellite orbits a planet with period 1 days at orbital radius r . A second satellite orbits the same planet at radius $3r$. What is the second satellite's orbital period in days?

- (A) 0.2 days
- (B) 5.2 days
- (C) 2.6 days
- (D) 10.2 days

Q49. A satellite in a circular orbit of radius r has orbital speed 6 km/s . What is the orbital speed of a satellite in a circular orbit of radius $4r$ around the same planet, in km/s ?

- (A) 3.3 km/s
- (B) 3 km/s
- (C) 1.5 km/s
- (D) 9 km/s

Q50. A solid disc of mass 5 kg rolls without slipping at 2 m/s . What is its total kinetic energy?

- (A) 20 J
- (B) 15 J
- (C) 3.75 J
- (D) 12 J

Q51. A thin hoop of mass 5 kg rolls without slipping at 3 m/s . What is its total kinetic energy?

- (A) 11.25 J
- (B) 50 J
- (C) 67.5 J
- (D) 45 J

Q52. A torque $\tau(t) = 2t \text{ N}\cdot\text{m}$ acts on a body from $t = 0$ to $t = 3 \text{ s}$. What is the change in its angular momentum?

- (A) $4 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $9 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $5.4 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $18 \text{ kg}\cdot\text{m}^2/\text{s}$

Q53. How much work is needed to spin a solid disc of mass 4 kg and radius 0.4 m from rest to an angular velocity of 7 rad/s ?

- (A) 17.84 J
- (B) 6.27 J
- (C) 7.84 J
- (D) 4.7 J

Unit 7: Oscillations

Q54. A 1 kg mass oscillates on a spring of spring constant 100 N/m with amplitude 0.3 m. What is its maximum speed?

- (A) 0.75 m/s
- (B) 3 m/s
- (C) 2.4 m/s
- (D) 1.5 m/s

Q55. A 1 kg mass oscillates on a spring of spring constant 36 N/m with amplitude 0.1 m. What is the magnitude of its maximum acceleration?

- (A) 3.6 m/s^2
- (B) 2.7 m/s^2
- (C) 1.8 m/s^2
- (D) 5.4 m/s^2

Q56. A particle in simple harmonic motion satisfies $d^2x/dt^2 = -49x$, where x is in metres and t is in seconds. What is the period of the motion?

- (A) 0.22 s
- (B) 0.45 s
- (C) 1.12 s
- (D) 0.9 s

Q57. A spring of spring constant 200 N/m oscillates with amplitude 0.25 m. What is the total mechanical energy of the oscillator?

- (A) 3.75 J
- (B) 4.69 J
- (C) 6.25 J
- (D) 12.5 J

Q58. An oscillator completes one full oscillation in 2 s. What is its frequency?

- (A) 0.75 Hz
- (B) 0.4 Hz
- (C) 1.5 Hz
- (D) 0.5 Hz

Q59. A simple pendulum has a period of 1 s for small oscillations. What is its length? Take $g = 9.8 \text{ m/s}^2$.

- (A) 0.37 m
- (B) 0.74 m
- (C) 0.27 m
- (D) 0.25 m

Q60. A 4 kg mass on a spring of spring constant 50 N/m oscillates on a frictionless surface. What is the period of oscillation?

- (A) 2.67 s
- (B) 1.33 s
- (C) 1.78 s
- (D) 1.42 s

Answer Key

Q1: A	Q11: C	Q21: C	Q31: D	Q41: C	Q51: D
Q2: D	Q12: B	Q22: C	Q32: B	Q42: C	Q52: B
Q3: D	Q13: C	Q23: A	Q33: A	Q43: C	Q53: C
Q4: C	Q14: A	Q24: B	Q34: B	Q44: B	Q54: B
Q5: A	Q15: A	Q25: C	Q35: B	Q45: C	Q55: A
Q6: D	Q16: A	Q26: B	Q36: B	Q46: D	Q56: D
Q7: A	Q17: A	Q27: D	Q37: A	Q47: A	Q57: C
Q8: D	Q18: B	Q28: A	Q38: D	Q48: B	Q58: D
Q9: B	Q19: D	Q29: A	Q39: D	Q49: B	Q59: D
Q10: D	Q20: A	Q30: C	Q40: C	Q50: B	Q60: C

Worked explanations for all 60 questions:

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