

AP Physics C: Mechanics Practice Test 4

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

- (A) 62 m
- (B) 90 m
- (C) 67 m
- (D) 72 m

Q2. A body starts with velocity 4 m/s and has acceleration $a(t) = 4t + 2$ m/s². What is its velocity at $t = 3$ s?

- (A) 7 m/s
- (B) 23 m/s
- (C) 14 m/s
- (D) 28 m/s

Q3. A projectile is launched from level ground with speed 36 m/s at 30° above the horizontal. What is its horizontal range? Take $g = 9.8$ m/s².

- (A) 114.53 m
- (B) 91.62 m
- (C) 124.53 m
- (D) 68.72 m

Q4. A stone is dropped from rest from a height of 50 m. How long does it take to reach the ground? Take $g = 9.8$ m/s².

- (A) 3.19 s
- (B) 3.51 s
- (C) 2.4 s
- (D) 2.56 s

Q5. A particle moves with velocity $v(t) = 3t^2 + 2$ m/s, where t is in seconds. What is its displacement from $t = 0$ to $t = 4$ s?

- (A) 82 m
- (B) 108 m
- (C) 54 m
- (D) 72 m

Q6. A car moves with velocity $v(t) = 20 - 4t$ m/s, where t is in seconds. At what time does the car momentarily come to rest?

- (A) 4 s
- (B) 7.5 s
- (C) 15 s
- (D) 5 s

Q7. A particle has velocity $v(t) = 3t^2 + 6t$ m/s, where t is in seconds. What is its acceleration at $t = 4$ s?

- (A) 25 m/s^2
- (B) 30 m/s^2
- (C) 18 m/s^2
- (D) 35 m/s^2

Unit 2: Force and Translational Dynamics

Q8. An object of mass 11 kg is on a planet where the acceleration due to gravity is 2 times that on Earth. What is its weight on that planet? Take $g = 9.8 \text{ m/s}^2$ on Earth.

- (A) 215.6 N
- (B) 323.4 N
- (C) 161.7 N
- (D) 237.16 N

Q9. A net force acts on a 12 kg mass and gives it an acceleration of 2 m/s^2 . What is the magnitude of the net force?

- (A) 19.2 N
- (B) 18 N
- (C) 24 N
- (D) 30 N

Q10. Two horizontal forces, 37 N to the right and 7 N to the left, act on a 6 kg block on a frictionless surface. What is the acceleration of the block?

- (A) 7.5 m/s^2
- (B) 2.5 m/s^2
- (C) 15 m/s^2
- (D) 5 m/s^2

Q11. A 10 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) 29.4 N
- (B) 88.2 N
- (C) 44.1 N
- (D) 14.7 N

Q12. A block slides down a plane inclined at 45° 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) 16.63 m/s^2
- (B) 15.54 m/s^2
- (C) 6.93 m/s^2
- (D) 5.54 m/s^2

Q13. A 7 kg block rests on a plane inclined at 30° to the horizontal. What is the normal force on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 59.41 N
- (B) 47.53 N
- (C) 74.26 N
- (D) 14.85 N

Q14. Two masses, 2 kg and 5 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) 4.2 m/s^2
- (B) 5.25 m/s^2
- (C) 4.62 m/s^2
- (D) 6.3 m/s^2

Q15. A person of mass 69 kg stands on a scale in a lift accelerating upwards at 3 m/s^2 . What is the scale reading in newtons? Take $g = 9.8 \text{ m/s}^2$.

- (A) 441.6 N
- (B) 883.2 N
- (C) 1766.4 N
- (D) 878.2 N

Q16. A person of mass 50 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) 400 N
- (B) 292.5 N
- (C) 390 N
- (D) 234 N

Q17. A 4 kg object moves in a horizontal circle of radius 4 m at a constant speed of 6 m/s. What is the magnitude of the centripetal force on it?

- (A) 9 N
- (B) 36 N
- (C) 54 N
- (D) 21.6 N

Q18. A spring of spring constant 50 N/m is stretched by 0.4 m from its natural length. What is the magnitude of the spring force?

- (A) 16 N
- (B) 10 N
- (C) 20 N
- (D) 60 N

- Q19. A planet has surface gravity 20 m/s^2 . At a height of 2 planet radii above the surface, what is the acceleration due to gravity there?**
- (A) 2.78 m/s^2
 - (B) 2.22 m/s^2
 - (C) 3.33 m/s^2
 - (D) 2.44 m/s^2

Unit 3: Work, Energy, and Power

- Q20. A force of 48 N acts at 60° to the direction of motion as a block moves 4 m. How much work is done by the force?**
- (A) 96 J
 - (B) 72 J
 - (C) 48 J
 - (D) 57.6 J
- Q21. A variable force $F(x) = 40x \text{ N}$ stretches a spring from $x = 0$ to $x = 0.4 \text{ m}$. How much work is done? Here x is in metres.**
- (A) 2.4 J
 - (B) 3.2 J
 - (C) 9.6 J
 - (D) 3.52 J
- Q22. A force $F(x) = 6x^2 \text{ N}$ acts on a particle as it moves from $x = 0$ to $x = 4 \text{ m}$. How much work is done by the force?**
- (A) 32 J
 - (B) 138 J
 - (C) 140.8 J
 - (D) 128 J
- Q23. What is the kinetic energy of a 9 kg object moving at 10 m/s?**
- (A) 450 J
 - (B) 460 J
 - (C) 1350 J
 - (D) 270 J
- Q24. A spring of spring constant 80 N/m is compressed by 0.15 m. What is the elastic potential energy stored in the spring?**
- (A) 0.22 J
 - (B) 0.99 J
 - (C) 0.9 J
 - (D) 2.7 J
- Q25. A 9 kg object is raised vertically by 8 m. By how much does its gravitational potential energy increase? Take $g = 9.8 \text{ m/s}^2$.**
- (A) 2116.8 J
 - (B) 176.4 J
 - (C) 705.6 J
 - (D) 695.6 J

Q26. An object is dropped from rest from a height of 30 m. Ignoring air resistance, what is its speed just before it hits the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 24.25 m/s
- (B) 19.4 m/s
- (C) 26.67 m/s
- (D) 14.55 m/s

Q27. A motor does 453 J of work in 10 s. What is its average power output?

- (A) 67.95 W
- (B) 27.18 W
- (C) 45.3 W
- (D) 49.83 W

Q28. A constant force of 30 N moves an object at a steady speed of 2 m/s in the direction of the force. What power is delivered by the force?

- (A) 55 W
- (B) 120 W
- (C) 70 W
- (D) 60 W

Q29. A 5 kg block slides 8 m across a horizontal surface with coefficient of kinetic friction 0.2. What is the magnitude of the work done by friction? Take $g = 9.8 \text{ m/s}^2$.

- (A) 39.2 J
- (B) 78.4 J
- (C) 83.4 J
- (D) 62.72 J

Q30. A 1 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) 2.12 m/s
- (B) 4.67 m/s
- (C) 3.39 m/s
- (D) 4.24 m/s

Unit 4: Linear Momentum

Q31. A rifle of mass 3 kg fires a bullet of mass 0.02 kg at 385 m/s. What is the recoil speed of the rifle?

- (A) 0.64 m/s
- (B) 7.7 m/s
- (C) 3.85 m/s
- (D) 2.57 m/s

Q32. A 2 kg object moving at 4 m/s collides head-on with a 3 kg object moving at 5 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) -2.1 m/s
- (B) -1.05 m/s
- (C) -1.54 m/s
- (D) -1.4 m/s

Q33. A 4 kg object changes its velocity by 4 m/s in 2 s. What is the average force acting on it?

- (A) 3 N
- (B) 18 N
- (C) 8 N
- (D) 8.8 N

Q34. A force acting on a body rises linearly from zero to 80 N over 2 s and then stops. What is the impulse delivered?

- (A) 60 N·s
- (B) 80 N·s
- (C) 20 N·s
- (D) 48 N·s

Q35. A 2 kg ball hits a wall at 4 m/s and rebounds at 3 m/s in the opposite direction. What is the magnitude of the change in its momentum?

- (A) 9 kg·m/s
- (B) 14 kg·m/s
- (C) 10.5 kg·m/s
- (D) 8.4 kg·m/s

Q36. What is the momentum of a 5 kg object moving at 6 m/s?

- (A) 15 kg·m/s
- (B) 30 kg·m/s
- (C) 33 kg·m/s
- (D) 45 kg·m/s

Q37. A constant force of 25 N acts on an object for 3 s. What is the magnitude of the impulse delivered?

- (A) 75 N·s
- (B) 225 N·s
- (C) 85 N·s
- (D) 18.75 N·s

Q38. A force $F(t) = 2t + 9$ N acts on a body from $t = 0$ to $t = 3$ s. What is the impulse delivered to the body?

- (A) 36 N·s
- (B) 39.6 N·s
- (C) 26 N·s
- (D) 9 N·s

Unit 5: Torque and Rotational Dynamics

Q39. A net torque of 18 N·m acts on a body with moment of inertia 3 kg·m². What is its angular acceleration?

- (A) 7.5 rad/s²
- (B) 6 rad/s²
- (C) 9 rad/s²
- (D) 18 rad/s²

Q40. A wheel starts with angular velocity 1 rad/s and has a constant angular acceleration of 2 rad/s². What is its angular velocity after 4 s?

- (A) 19 rad/s
- (B) 9 rad/s
- (C) 9.9 rad/s
- (D) 2.25 rad/s

Q41. A disc starts with angular velocity 1 rad/s and angular acceleration 3 rad/s². Through what angle does it turn in 2 s?

- (A) 12 rad
- (B) 8 rad
- (C) 16 rad
- (D) 6.4 rad

Q42. The angular momentum of a body varies as $L(t) = 3t^2$ kg·m²/s. What is the net torque on the body at $t = 3$ s?

- (A) 19.8 N·m
- (B) 10.8 N·m
- (C) 8 N·m
- (D) 18 N·m

Q43. A force of 40 N is applied at a distance of 0.3 m from a pivot, at 90° to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 7 N·m
- (B) 2 N·m
- (C) 12 N·m
- (D) 9 N·m

Q44. Two forces act on a beam pivoted at its centre: 41 N at 0.4 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) 39.6 N·m
- (B) 13.2 N·m
- (C) 18.2 N·m
- (D) 23.2 N·m

Q45. Two point masses, 2 kg at 1 m and 3 kg at 1 m from an axis, rotate about that axis. What is their total moment of inertia about the axis?

- (A) 1.25 kg·m²
- (B) 15 kg·m²
- (C) 3 kg·m²
- (D) 5 kg·m²

Q46. A uniform rod of mass 6 kg and length 1 m rotates about an axis through one end, perpendicular to the rod. What is its moment of inertia?

- (A) 1.2 kg·m²
- (B) 2 kg·m²
- (C) 2.2 kg·m²
- (D) 6 kg·m²

Unit 6: Energy and Momentum of Rotating Systems

- Q47. How much work is needed to spin a solid disc of mass 7 kg and radius 0.2 m from rest to an angular velocity of 7 rad/s?**
- (A) 2.06 J
 - (B) 6.86 J
 - (C) 3.43 J
 - (D) 1.72 J
- Q48. A solid disc of mass 5 kg and radius 0.4 m rotates at 4 rad/s about its central axis. What is its rotational kinetic energy?**
- (A) 4.8 J
 - (B) 4 J
 - (C) 3.2 J
 - (D) 2.4 J
- Q49. A body with moment of inertia $2 \text{ kg}\cdot\text{m}^2$ rotates at 8 rad/s. What is its angular momentum?**
- (A) $6 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (B) $12 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (C) $16 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (D) $21 \text{ kg}\cdot\text{m}^2/\text{s}$
- Q50. A spinning skater with moment of inertia $2 \text{ kg}\cdot\text{m}^2$ rotates at 5 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) 15 rad/s
 - (B) 10 rad/s
 - (C) 8 rad/s
 - (D) 12.5 rad/s
- Q51. A satellite orbits a planet with period 1 days at orbital radius r . A second satellite orbits the same planet at radius $2r$. What is the second satellite's orbital period in days?**
- (A) 2.83 days
 - (B) 3.54 days
 - (C) 2.26 days
 - (D) 2.12 days
- Q52. A satellite in a circular orbit of radius r has orbital speed 10 km/s. What is the orbital speed of a satellite in a circular orbit of radius $2r$ around the same planet, in km/s?**
- (A) 7.07 km/s
 - (B) -2.93 km/s
 - (C) 10.61 km/s
 - (D) 2.07 km/s
- Q53. A solid disc of mass 5 kg rolls without slipping at 4 m/s. What is its total kinetic energy?**
- (A) 180 J
 - (B) 75 J
 - (C) 60 J
 - (D) 90 J

Unit 7: Oscillations

Q54. A 1 kg mass on a spring of spring constant 50 N/m oscillates on a frictionless surface. What is the period of oscillation?

- (A) 0.22 s
- (B) 0.71 s
- (C) 0.89 s
- (D) 1.11 s

Q55. A simple pendulum of length 1.5 m oscillates with small amplitude. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 3.07 s
- (B) 1.84 s
- (C) 0.61 s
- (D) 2.46 s

Q56. A mass of 1 kg oscillates on a spring of spring constant 64 N/m. What is the angular frequency of the oscillation?

- (A) 18 rad/s
- (B) 13 rad/s
- (C) 8 rad/s
- (D) 4.8 rad/s

Q57. A 1 kg mass oscillates on a spring of spring constant 49 N/m with amplitude 0.2 m. What is its maximum speed?

- (A) 2.1 m/s
- (B) 0.84 m/s
- (C) 1.4 m/s
- (D) 1.75 m/s

Q58. A 2 kg mass oscillates on a spring of spring constant 49 N/m with amplitude 0.3 m. What is the magnitude of its maximum acceleration?

- (A) 7.35 m/s^2
- (B) 1.84 m/s^2
- (C) 5.88 m/s^2
- (D) 9.19 m/s^2

Q59. A particle in simple harmonic motion satisfies $d^2x/dt^2 = -16x$, where x is in metres and t is in seconds. What is the period of the motion?

- (A) 0.79 s
- (B) 3.14 s
- (C) 2.36 s
- (D) 1.57 s

Q60. A spring of spring constant 100 N/m oscillates with amplitude 0.25 m. What is the total mechanical energy of the oscillator?

- (A) 3.12 J
- (B) 4.69 J
- (C) 6.25 J
- (D) 2.34 J

Answer Key

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

Worked explanations for all 60 questions:

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