

AP Physics C: Mechanics Practice Test 5

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 stone is dropped from rest from a height of 45 m. How long does it take to reach the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 6.06 s
- (B) 3.03 s
- (C) 2.27 s
- (D) 3.33 s

Q2. A particle moves with velocity $v(t) = 6t^2 + 6 \text{ m/s}$, where t is in seconds. What is its displacement from $t = 0$ to $t = 4 \text{ s}$?

- (A) 167.2 m
- (B) 190 m
- (C) 142 m
- (D) 152 m

Q3. A car moves with velocity $v(t) = 12 - 6t \text{ m/s}$, where t is in seconds. At what time does the car momentarily come to rest?

- (A) 2 s
- (B) 1.2 s
- (C) 4 s
- (D) 6 s

Q4. A particle has velocity $v(t) = 2t^2 + 4t \text{ m/s}$, where t is in seconds. What is its acceleration at $t = 3 \text{ s}$?

- (A) 11 m/s^2
- (B) 16 m/s^2
- (C) 12 m/s^2
- (D) 12.8 m/s^2

Q5. A ball is thrown horizontally with speed 12 m/s from a cliff 45 m high. How far from the base of the cliff does it land? Take $g = 9.8 \text{ m/s}^2$.

- (A) 72.73 m
- (B) 46.37 m
- (C) 36.37 m
- (D) 40 m

Q6. A particle moves along a straight line with position $x(t) = 3t^2 + 4t$ metres, where t is in seconds. What is the velocity of the particle at $t = 5$ s?

- (A) 44 m/s
- (B) 34 m/s
- (C) 37.4 m/s
- (D) 17 m/s

Q7. A particle has position $x(t) = 2t^3 - 5t^2$ metres, where t is in seconds. What is its acceleration at $t = 4$ s?

- (A) 38 m/s^2
- (B) 76 m/s^2
- (C) 22.8 m/s^2
- (D) 57 m/s^2

Unit 2: Force and Translational Dynamics

Q8. A 9 kg block rests on a horizontal surface with coefficient of static friction $\mu = 0.4$. What is the maximum static friction force that can act on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 40.28 N
- (B) 35.28 N
- (C) 26.46 N
- (D) 21.17 N

Q9. A block slides down a plane inclined at 30° to the horizontal. The coefficient of kinetic friction is 0.1. What is the acceleration of the block down the plane? Take $g = 9.8 \text{ m/s}^2$.

- (A) 2.43 m/s^2
- (B) 4.46 m/s^2
- (C) 4.05 m/s^2
- (D) 3.24 m/s^2

Q10. A 5 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) 34.65 N
- (B) 29.65 N
- (C) 69.3 N
- (D) 38.11 N

Q11. Two masses, 5 kg and 10 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) 3.27 m/s^2
- (B) 1.96 m/s^2
- (C) 6.53 m/s^2
- (D) 4.9 m/s^2

- Q12.** A person of mass 75 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) 960 N
 - (B) 1200 N
 - (C) 576 N
 - (D) 480 N
- Q13.** A person of mass 48 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) 1123.2 N
 - (B) 379.4 N
 - (C) 374.4 N
 - (D) 364.4 N
- Q14.** A 7 kg object moves in a horizontal circle of radius 2 m at a constant speed of 9 m/s. What is the magnitude of the centripetal force on it?
- (A) 283.5 N
 - (B) 293.5 N
 - (C) 278.5 N
 - (D) 288.5 N
- Q15.** A spring of spring constant 200 N/m is stretched by 0.1 m from its natural length. What is the magnitude of the spring force?
- (A) 30 N
 - (B) 15 N
 - (C) 20 N
 - (D) 60 N
- Q16.** A planet has surface gravity 15 m/s^2 . At a height of 3 planet radii above the surface, what is the acceleration due to gravity there?
- (A) 0.75 m/s^2
 - (B) 0.94 m/s^2
 - (C) 1.03 m/s^2
 - (D) 0.23 m/s^2
- Q17.** A 3 kg object moves in a circle of radius 2 m with a period of 2 s. What is the magnitude of the centripetal force on it?
- (A) 54.22 N
 - (B) 74.02 N
 - (C) 59.22 N
 - (D) 64.22 N
- Q18.** A time-varying force $F(t) = 3t + 13 \text{ N}$ acts on a 2 kg mass. What is the acceleration of the mass at $t = 4 \text{ s}$?
- (A) 15.62 m/s^2
 - (B) 17.5 m/s^2
 - (C) 12.5 m/s^2
 - (D) 37.5 m/s^2

Q19. An object of mass 6 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) 470.4 N
- (B) 240.2 N
- (C) 141.12 N
- (D) 235.2 N

Unit 3: Work, Energy, and Power

Q20. What is the kinetic energy of a 5 kg object moving at 7 m/s?

- (A) 122.5 J
- (B) 30.62 J
- (C) 117.5 J
- (D) 367.5 J

Q21. A spring of spring constant 80 N/m is compressed by 0.2 m. What is the elastic potential energy stored in the spring?

- (A) 0.8 J
- (B) 1.6 J
- (C) 1.76 J
- (D) 2.4 J

Q22. A 4 kg object is raised vertically by 11 m. By how much does its gravitational potential energy increase? Take $g = 9.8 \text{ m/s}^2$.

- (A) 421.2 J
- (B) 215.6 J
- (C) 431.2 J
- (D) 107.8 J

Q23. An object is dropped from rest from a height of 80 m. Ignoring air resistance, what is its speed just before it hits the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 31.68 m/s
- (B) 39.6 m/s
- (C) 29.7 m/s
- (D) 79.2 m/s

Q24. A motor does 237 J of work in 3 s. What is its average power output?

- (A) 69 W
- (B) 79 W
- (C) 118.5 W
- (D) 98.75 W

Q25. A constant force of 67 N moves an object at a steady speed of 5 m/s in the direction of the force. What power is delivered by the force?

- (A) 167.5 W
- (B) 251.25 W
- (C) 335 W
- (D) 330 W

Q26. A 6 kg block slides 7 m across a horizontal surface with coefficient of kinetic friction 0.3. What is the magnitude of the work done by friction? Take $g = 9.8 \text{ m/s}^2$.

- (A) 118.48 J
- (B) 74.09 J
- (C) 370.44 J
- (D) 123.48 J

Q27. A 2 kg block attached to a spring of spring constant 100 N/m is released from rest with the spring compressed by 0.1 m on a frictionless surface. What is the speed of the block as it passes the equilibrium position?

- (A) 0.71 m/s
- (B) 0.42 m/s
- (C) 1.06 m/s
- (D) 0.88 m/s

Q28. A 8 kg object speeds up from 3 m/s to 6 m/s. How much net work is done on the object?

- (A) 113 J
- (B) 108 J
- (C) 216 J
- (D) 162 J

Q29. A constant force of 25 N pushes a crate 3 m along a horizontal floor in the direction of the force. How much work is done by the force?

- (A) 60 J
- (B) 150 J
- (C) 225 J
- (D) 75 J

Q30. A force of 46 N acts at 60° to the direction of motion as a block moves 7 m. How much work is done by the force?

- (A) 96.6 J
- (B) 483 J
- (C) 128.8 J
- (D) 161 J

Unit 4: Linear Momentum

Q31. A force acting on a body rises linearly from zero to 20 N over 4 s and then stops. What is the impulse delivered?

- (A) 40 N·s
- (B) 60 N·s
- (C) 50 N·s
- (D) 44 N·s

Q32. A 2 kg ball hits a wall at 5 m/s and rebounds at 5 m/s in the opposite direction. What is the magnitude of the change in its momentum?

- (A) 12 kg·m/s
- (B) 30 kg·m/s
- (C) 5 kg·m/s
- (D) 20 kg·m/s

Q33. What is the momentum of a 11 kg object moving at 11 m/s?

- (A) 121 kg·m/s
- (B) 363 kg·m/s
- (C) 72.6 kg·m/s
- (D) 96.8 kg·m/s

Q34. A constant force of 37 N acts on an object for 2 s. What is the magnitude of the impulse delivered?

- (A) 18.5 N·s
- (B) 222 N·s
- (C) 79 N·s
- (D) 74 N·s

Q35. A force $F(t) = 4t + 9$ N acts on a body from $t = 0$ to $t = 3$ s. What is the impulse delivered to the body?

- (A) 49.5 N·s
- (B) 50 N·s
- (C) 56.25 N·s
- (D) 45 N·s

Q36. An impulse of 40 N·s is delivered to a 2 kg object initially at rest. What is its final speed?

- (A) 20 m/s
- (B) 60 m/s
- (C) 30 m/s
- (D) 25 m/s

Q37. A 3 kg trolley moving at 10 m/s collides with a stationary 3 kg trolley and the two stick together. What is their common speed after the collision?

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

Q38. A rifle of mass 3 kg fires a bullet of mass 0.02 kg at 333 m/s. What is the recoil speed of the rifle?

- (A) 1.33 m/s
- (B) 1.67 m/s
- (C) 2.22 m/s
- (D) 3.33 m/s

Unit 5: Torque and Rotational Dynamics

Q39. The angular momentum of a body varies as $L(t) = 5t^2$ kg·m²/s. What is the net torque on the body at $t = 4$ s?

- (A) 20 N·m
- (B) 60 N·m
- (C) 40 N·m
- (D) 50 N·m

Q40. A force of 43 N is applied at a distance of 0.5 m from a pivot, at 90° to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 26.88 N·m
- (B) 16.5 N·m
- (C) 32.25 N·m
- (D) 21.5 N·m

Q41. Two forces act on a beam pivoted at its centre: 28 N at 0.5 m on one side and 30 N at 0.2 m on the other side, in opposite rotational senses. What is the magnitude of the net torque?

- (A) 8 N·m
- (B) 12 N·m
- (C) 10 N·m
- (D) 6 N·m

Q42. Two point masses, 1 kg at 3 m and 3 kg at 2 m from an axis, rotate about that axis. What is their total moment of inertia about the axis?

- (A) 16.8 kg·m²
- (B) 26.25 kg·m²
- (C) 21 kg·m²
- (D) 5.25 kg·m²

Q43. A uniform rod of mass 5 kg and length 1 m rotates about an axis through one end, perpendicular to the rod. What is its moment of inertia?

- (A) 0.42 kg·m²
- (B) 1.25 kg·m²
- (C) 5 kg·m²
- (D) 1.67 kg·m²

Q44. A uniform solid disc of mass 2 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) 0.24 kg·m²
- (B) 0.16 kg·m²
- (C) 0.08 kg·m²
- (D) 0.1 kg·m²

Q45. A solid sphere of mass 5 kg and radius 0.4 m rotates about its central axis. What is its moment of inertia?

- (A) 0.96 kg·m²
- (B) 0.32 kg·m²
- (C) 0.24 kg·m²
- (D) 0.4 kg·m²

Q46. A net torque of 15 N·m acts on a body with moment of inertia 2 kg·m². What is its angular acceleration?

- (A) -2.5 rad/s²
- (B) 15 rad/s²
- (C) 8.25 rad/s²
- (D) 7.5 rad/s²

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 4 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) 1.5 rad/s
- (B) 6.6 rad/s
- (C) 4.8 rad/s
- (D) 6 rad/s

Q48. A satellite orbits a planet with period 8 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) 11.31 days
- (B) 22.63 days
- (C) 12.63 days
- (D) 27.63 days

Q49. A satellite in a circular orbit of radius r has orbital speed 4 km/s . What is the orbital speed of a satellite in a circular orbit of radius $3r$ around the same planet, in km/s ?

- (A) 6.93 km/s
- (B) 1.15 km/s
- (C) 1.85 km/s
- (D) 2.31 km/s

Q50. A solid disc of mass 3 kg rolls without slipping at 5 m/s . What is its total kinetic energy?

- (A) 84.38 J
- (B) 70.31 J
- (C) 56.25 J
- (D) 61.25 J

Q51. A thin hoop of mass 7 kg rolls without slipping at 2 m/s . What is its total kinetic energy?

- (A) 35 J
- (B) 22.4 J
- (C) 33 J
- (D) 28 J

Q52. A torque $\tau(t) = 6t \text{ N}\cdot\text{m}$ acts on a body from $t = 0$ to $t = 5 \text{ s}$. What is the change in its angular momentum?

- (A) $82.5 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $75 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $85 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $56.25 \text{ kg}\cdot\text{m}^2/\text{s}$

Q53. How much work is needed to spin a solid disc of mass 5 kg and radius 0.2 m from rest to an angular velocity of 3 rad/s ?

- (A) 0.45 J
- (B) 0.56 J
- (C) 0.5 J
- (D) 0.36 J

Unit 7: Oscillations

Q54. A 1 kg mass oscillates on a spring of spring constant 100 N/m with amplitude 0.1 m. What is its maximum speed?

- (A) 1.1 m/s
- (B) 1.5 m/s
- (C) 1 m/s
- (D) 0.25 m/s

Q55. A 1 kg mass oscillates on a spring of spring constant 25 N/m with amplitude 0.2 m. What is the magnitude of its maximum acceleration?

- (A) 5 m/s^2
- (B) 4 m/s^2
- (C) 3.75 m/s^2
- (D) 5.5 m/s^2

Q56. A particle in simple harmonic motion satisfies $d^2x/dt^2 = -64x$, where x is in metres and t is in seconds. What is the period of the motion?

- (A) 0.79 s
- (B) 1.57 s
- (C) 0.47 s
- (D) 0.2 s

Q57. A spring of spring constant 100 N/m oscillates with amplitude 0.2 m. What is the total mechanical energy of the oscillator?

- (A) 1.2 J
- (B) 2 J
- (C) 1.5 J
- (D) 2.2 J

Q58. An oscillator completes one full oscillation in 4 s. What is its frequency?

- (A) 0.12 Hz
- (B) 0.25 Hz
- (C) 0.19 Hz
- (D) 0.38 Hz

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

- (A) 1.24 m
- (B) 0.79 m
- (C) 0.74 m
- (D) 0.99 m

Q60. A 1 kg mass on a spring of spring constant 25 N/m oscillates on a frictionless surface. What is the period of oscillation?

- (A) 1.57 s
- (B) 2.51 s
- (C) 1.26 s
- (D) 0.75 s

Answer Key

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

Worked explanations for all 60 questions:

quaidianpoint.com/ap-physics-c-mechanics-practice-test-5/ — plus 80 free AP Physics practice tests at [QuaidianPoint.com](https://quaidianpoint.com).