

AP Physics C: Mechanics Practice Test 1

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 starts with velocity 4 m/s and has acceleration $a(t) = 4t + 1 \text{ m/s}^2$. What is its velocity at $t = 4 \text{ s}$?

- (A) 50 m/s
- (B) 45 m/s
- (C) 30 m/s
- (D) 40 m/s

Q2. A projectile is launched from level ground with speed 35 m/s at 60° above the horizontal. What is its horizontal range? Take $g = 9.8 \text{ m/s}^2$.

- (A) 86.6 m
- (B) 108.25 m
- (C) 64.95 m
- (D) 98.25 m

Q3. A stone is dropped from rest from a height of 30 m. How long does it take to reach the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 2.47 s
- (B) 2.72 s
- (C) 1.48 s
- (D) 1.24 s

Q4. A particle moves with velocity $v(t) = 3t^2 + 4 \text{ m/s}$, where t is in seconds. What is its displacement from $t = 0$ to $t = 2 \text{ s}$?

- (A) 9.6 m
- (B) 16 m
- (C) 24 m
- (D) 11 m

Q5. A car moves with velocity $v(t) = 24 - 2t \text{ m/s}$, where t is in seconds. At what time does the car momentarily come to rest?

- (A) 9.6 s
- (B) 7.2 s
- (C) 17 s
- (D) 12 s

Q6. A particle has velocity $v(t) = 2t^2 + 1t$ m/s, where t is in seconds. What is its acceleration at $t = 3$ s?

- (A) 26 m/s^2
- (B) 13 m/s^2
- (C) 18 m/s^2
- (D) 3.25 m/s^2

Q7. A ball is thrown horizontally with speed 12 m/s from a cliff 80 m high. How far from the base of the cliff does it land? Take $g = 9.8 \text{ m/s}^2$.

- (A) 48.49 m
- (B) 60.61 m
- (C) 58.49 m
- (D) 24.24 m

Unit 2: Force and Translational Dynamics

Q8. A 10 kg block rests on a plane inclined at 60° to the horizontal. What is the normal force on the block? Take $g = 9.8 \text{ m/s}^2$.

- (A) 98 N
- (B) 49 N
- (C) 44 N
- (D) 61.25 N

Q9. Two masses, 6 kg and 12 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) 2.45 m/s^2
- (B) 3.27 m/s^2
- (C) 4.08 m/s^2
- (D) 1.96 m/s^2

Q10. A person of mass 73 kg stands on a scale in a lift accelerating upwards at 2 m/s^2 . What is the scale reading in newtons? Take $g = 9.8 \text{ m/s}^2$.

- (A) 215.35 N
- (B) 861.4 N
- (C) 1722.8 N
- (D) 1292.1 N

Q11. A person of mass 60 kg stands on a scale in a lift accelerating downwards at 3 m/s^2 . What is the scale reading in newtons? Take $g = 9.8 \text{ m/s}^2$.

- (A) 326.4 N
- (B) 102 N
- (C) 408 N
- (D) 398 N

Q12. A 3 kg object moves in a horizontal circle of radius 6 m at a constant speed of 7 m/s . What is the magnitude of the centripetal force on it?

- (A) 24.5 N
- (B) 29.5 N
- (C) 30.62 N
- (D) 18.38 N

Q13. A spring of spring constant 200 N/m is stretched by 0.3 m from its natural length. What is the magnitude of the spring force?

- (A) 60 N
- (B) 55 N
- (C) 30 N
- (D) 50 N

Q14. A planet has surface gravity 15 m/s^2 . At a height of 2 planet radii above the surface, what is the acceleration due to gravity there?

- (A) 0.42 m/s^2
- (B) 1 m/s^2
- (C) 0.83 m/s^2
- (D) 1.67 m/s^2

Q15. A 4 kg object moves in a circle of radius 2 m with a period of 6 s. What is the magnitude of the centripetal force on it?

- (A) 4.39 N
- (B) 13.16 N
- (C) 8.77 N
- (D) 3.77 N

Q16. A time-varying force $F(t) = 4t + 6 \text{ N}$ acts on a 5 kg mass. What is the acceleration of the mass at $t = 4 \text{ s}$?

- (A) 3.52 m/s^2
- (B) 5.5 m/s^2
- (C) 3.3 m/s^2
- (D) 4.4 m/s^2

Q17. An object of mass 8 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) 117.6 N
- (B) 172.48 N
- (C) 156.8 N
- (D) 235.2 N

Q18. A net force acts on a 2 kg mass and gives it an acceleration of 7 m/s^2 . What is the magnitude of the net force?

- (A) 19 N
- (B) 28 N
- (C) 24 N
- (D) 14 N

Q19. Two horizontal forces, 32 N to the right and 17 N to the left, act on a 8 kg block on a frictionless surface. What is the acceleration of the block?

- (A) 2.81 m/s^2
- (B) 1.12 m/s^2
- (C) 1.41 m/s^2
- (D) 1.88 m/s^2

Unit 3: Work, Energy, and Power

Q20. A spring of spring constant 50 N/m is compressed by 0.2 m. What is the elastic potential energy stored in the spring?

- (A) 0.5 J
- (B) 0.6 J
- (C) 1 J
- (D) 2 J

Q21. A 2 kg object is raised vertically by 9 m. By how much does its gravitational potential energy increase? Take $g = 9.8 \text{ m/s}^2$.

- (A) 176.4 J
- (B) 529.2 J
- (C) 105.84 J
- (D) 220.5 J

Q22. An object is dropped from rest from a height of 5 m. Ignoring air resistance, what is its speed just before it hits the ground? Take $g = 9.8 \text{ m/s}^2$.

- (A) 4.95 m/s
- (B) 12.37 m/s
- (C) 14.9 m/s
- (D) 9.9 m/s

Q23. A motor does 201 J of work in 7 s. What is its average power output?

- (A) 43.07 W
- (B) 31.59 W
- (C) 14.36 W
- (D) 28.71 W

Q24. A constant force of 30 N moves an object at a steady speed of 4 m/s in the direction of the force. What power is delivered by the force?

- (A) 120 W
- (B) 72 W
- (C) 30 W
- (D) 96 W

Q25. A 10 kg block slides 9 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) 441 J
- (B) 342.8 J
- (C) 1058.4 J
- (D) 352.8 J

Q26. A 1 kg block attached to a spring of spring constant 100 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) 1.8 m/s
- (B) 3 m/s
- (C) 3.75 m/s
- (D) 6 m/s

Q27. A 6 kg object speeds up from 4 m/s to 6 m/s. How much net work is done on the object?

- (A) 60 J
- (B) 70 J
- (C) 48 J
- (D) 30 J

Q28. A constant force of 45 N pushes a crate 10 m along a horizontal floor in the direction of the force. How much work is done by the force?

- (A) 445 J
- (B) 1350 J
- (C) 360 J
- (D) 450 J

Q29. A force of 37 N acts at 30° to the direction of motion as a block moves 7 m. How much work is done by the force?

- (A) 134.58 J
- (B) 214.3 J
- (C) 234.3 J
- (D) 224.3 J

Q30. A variable force $F(x) = 20x$ N stretches a spring from $x = 0$ to $x = 0.5$ m. How much work is done? Here x is in metres.

- (A) 3.75 J
- (B) 2.5 J
- (C) 5 J
- (D) 2 J

Unit 4: Linear Momentum

Q31. A 4 kg object moving at 5 m/s collides head-on with a 5 kg object moving at 3 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) 1.11 m/s
- (B) 0.33 m/s
- (C) 0.56 m/s
- (D) 0.69 m/s

Q32. A 3 kg object changes its velocity by 5 m/s in 0.5 s. What is the average force acting on it?

- (A) 30 N
- (B) 24 N
- (C) 15 N
- (D) 37.5 N

Q33. A force acting on a body rises linearly from zero to 40 N over 3 s and then stops. What is the impulse delivered?

- (A) 60 N·s
- (B) 75 N·s
- (C) 48 N·s
- (D) 45 N·s

Q34. A 0.5 kg ball hits a wall at 8 m/s and rebounds at 2 m/s in the opposite direction. What is the magnitude of the change in its momentum?

- (A) 6.25 kg·m/s
- (B) 7.5 kg·m/s
- (C) 5 kg·m/s
- (D) 1.25 kg·m/s

Q35. What is the momentum of a 5 kg object moving at 3 m/s?

- (A) 16.5 kg·m/s
- (B) 5 kg·m/s
- (C) 15 kg·m/s
- (D) 45 kg·m/s

Q36. A constant force of 46 N acts on an object for 1 s. What is the magnitude of the impulse delivered?

- (A) 50.6 N·s
- (B) 27.6 N·s
- (C) 46 N·s
- (D) 36 N·s

Q37. A force $F(t) = 2t + 10$ N acts on a body from $t = 0$ to $t = 3$ s. What is the impulse delivered to the body?

- (A) 31.2 N·s
- (B) 39 N·s
- (C) 44 N·s
- (D) 42.9 N·s

Q38. An impulse of 30 N·s is delivered to a 5 kg object initially at rest. What is its final speed?

- (A) 6 m/s
- (B) 9 m/s
- (C) -4 m/s
- (D) 3.6 m/s

Unit 5: Torque and Rotational Dynamics

Q39. A wheel starts with angular velocity 6 rad/s and has a constant angular acceleration of 3 rad/s². What is its angular velocity after 2 s?

- (A) 15 rad/s
- (B) 22 rad/s
- (C) 12 rad/s
- (D) 13.2 rad/s

Q40. A disc starts with angular velocity 3 rad/s and angular acceleration 2 rad/s². Through what angle does it turn in 3 s?

- (A) 54 rad
- (B) 23 rad
- (C) 14.4 rad
- (D) 18 rad

Q41. The angular momentum of a body varies as $L(t) = 6t^2 \text{ kg}\cdot\text{m}^2/\text{s}$. What is the net torque on the body at $t = 5 \text{ s}$?

- (A) $60 \text{ N}\cdot\text{m}$
- (B) $70 \text{ N}\cdot\text{m}$
- (C) $75 \text{ N}\cdot\text{m}$
- (D) $180 \text{ N}\cdot\text{m}$

Q42. A force of 33 N is applied at a distance of 0.3 m from a pivot, at 60° to the lever arm. What is the magnitude of the torque about the pivot?

- (A) $4.29 \text{ N}\cdot\text{m}$
- (B) $25.72 \text{ N}\cdot\text{m}$
- (C) $8.57 \text{ N}\cdot\text{m}$
- (D) $18.57 \text{ N}\cdot\text{m}$

Q43. Two forces act on a beam pivoted at its centre: 43 N at 0.5 m on one side and 29 N at 0.3 m on the other side, in opposite rotational senses. What is the magnitude of the net torque?

- (A) $9.6 \text{ N}\cdot\text{m}$
- (B) $7.68 \text{ N}\cdot\text{m}$
- (C) $12.8 \text{ N}\cdot\text{m}$
- (D) $14.08 \text{ N}\cdot\text{m}$

Q44. Two point masses, 2 kg at 2 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) $40 \text{ kg}\cdot\text{m}^2$
- (B) $16 \text{ kg}\cdot\text{m}^2$
- (C) $25 \text{ kg}\cdot\text{m}^2$
- (D) $20 \text{ kg}\cdot\text{m}^2$

Q45. A uniform rod of mass 3 kg and length 2 m rotates about an axis through one end, perpendicular to the rod. What is its moment of inertia?

- (A) $4 \text{ kg}\cdot\text{m}^2$
- (B) $12 \text{ kg}\cdot\text{m}^2$
- (C) $6 \text{ kg}\cdot\text{m}^2$
- (D) $8 \text{ kg}\cdot\text{m}^2$

Q46. A uniform solid disc of mass 4 kg and radius 0.2 m rotates about its central axis. What is its moment of inertia?

- (A) $0.12 \text{ kg}\cdot\text{m}^2$
- (B) $0.08 \text{ kg}\cdot\text{m}^2$
- (C) $0.02 \text{ kg}\cdot\text{m}^2$
- (D) $0.09 \text{ kg}\cdot\text{m}^2$

Unit 6: Energy and Momentum of Rotating Systems

Q47. How much work is needed to spin a solid disc of mass 2 kg and radius 0.2 m from rest to an angular velocity of 3 rad/s ?

- (A) 0.23 J
- (B) 0.05 J
- (C) 0.18 J
- (D) 0.27 J

- Q48. A solid disc of mass 2 kg and radius 0.4 m rotates at 2 rad/s about its central axis. What is its rotational kinetic energy?**
- (A) 0.32 J
 - (B) 0.96 J
 - (C) 0.19 J
 - (D) 0.64 J
- Q49. A body with moment of inertia $3 \text{ kg}\cdot\text{m}^2$ rotates at 3 rad/s. What is its angular momentum?**
- (A) $-1 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (B) $5.4 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (C) $6.75 \text{ kg}\cdot\text{m}^2/\text{s}$
 - (D) $9 \text{ kg}\cdot\text{m}^2/\text{s}$
- Q50. A spinning skater with moment of inertia $2 \text{ kg}\cdot\text{m}^2$ rotates at 4 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) 10 rad/s
 - (B) 16 rad/s
 - (C) -2 rad/s
 - (D) 8 rad/s
- Q51. A satellite orbits a planet with period 8 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) 45.73 days
 - (B) 41.57 days
 - (C) 51.57 days
 - (D) 46.57 days
- Q52. A satellite in a circular orbit of radius r has orbital speed 9 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) 2.7 km/s
 - (B) 2.25 km/s
 - (C) 4.5 km/s
 - (D) 9 km/s
- Q53. A solid disc of mass 2 kg rolls without slipping at 2 m/s. What is its total kinetic energy?**
- (A) 1.5 J
 - (B) 3 J
 - (C) 6 J
 - (D) 4.8 J
- Unit 7: Oscillations**
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Q54. A 1 kg mass on a spring of spring constant 100 N/m oscillates on a frictionless surface. What is the period of oscillation?

- (A) 0.79 s
- (B) 0.63 s
- (C) 0.69 s
- (D) 0.5 s

Q55. A simple pendulum of length 0.8 m oscillates with small amplitude. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 3.59 s
- (B) 2.69 s
- (C) 1.8 s
- (D) 2.24 s

Q56. A mass of 4 kg oscillates on a spring of spring constant 36 N/m. What is the angular frequency of the oscillation?

- (A) 3.75 rad/s
- (B) 3 rad/s
- (C) 1.8 rad/s
- (D) 2.4 rad/s

Q57. A 2 kg mass oscillates on a spring of spring constant 36 N/m with amplitude 0.2 m. What is its maximum speed?

- (A) 0.85 m/s
- (B) 1.27 m/s
- (C) 0.64 m/s
- (D) 0.21 m/s

Q58. A 1 kg mass oscillates on a spring of spring constant 49 N/m with amplitude 0.1 m. What is the magnitude of its maximum acceleration?

- (A) 7.35 m/s^2
- (B) 4.9 m/s^2
- (C) 3.92 m/s^2
- (D) 3.68 m/s^2

Q59. A particle in simple harmonic motion satisfies $d^2x/dt^2 = -9x$, where x is in metres and t is in seconds. What is the period of the motion?

- (A) 1.68 s
- (B) 2.09 s
- (C) 0.52 s
- (D) 6.28 s

Q60. A spring of spring constant 150 N/m oscillates with amplitude 0.2 m. What is the total mechanical energy of the oscillator?

- (A) 3 J
- (B) 1.5 J
- (C) 1.8 J
- (D) 3.75 J

Answer Key

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

Worked explanations for all 60 questions:

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