

AP Physics C: Mechanics Practice Test 6

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 along the x-axis with velocity $v(t) = 3 + 4t + 2t^2$ m/s, where t is in seconds. What is its displacement between $t = 2$ s and $t = 6$ s?

- (A) 107 m
- (B) 215 m
- (C) 234 m
- (D) 322 m

Q2. A cart starts with velocity 0 m/s and has acceleration $a(t) = 3 + 2t$ m/s². What is its velocity at $t = 3$ s?

- (A) 9 m/s
- (B) 27 m/s
- (C) 18 m/s
- (D) 30.5 m/s

Q3. The position of a block is $x(t) = 4t^3 - 1t^2 + 4t$ metres. What is its velocity at $t = 2$ s?

- (A) 94 m/s
- (B) 24 m/s
- (C) 52 m/s
- (D) 48 m/s

Q4. A projectile is launched at 25 m/s at 30° above the horizontal. What is its speed at $t = 1$ s? Take $g = 9.8$ m/s².

- (A) 26.2 m/s
- (B) 21.8 m/s
- (C) 25 m/s
- (D) 28.2 m/s

Q5. A particle has velocity $v(t) = 10t - 1t^2$ m/s. What is its displacement from $t = 0$ until it first comes to rest again (apart from $t = 0$)?

- (A) 167 m
- (B) 83.3 m
- (C) 500 m
- (D) 333 m

Q6. A glider experiences acceleration $a = -2v$, where v is its velocity in m/s. It starts at 15 m/s. How far does it travel in the first 2 s?

- (A) 10.3 m
- (B) 7.5 m
- (C) 7.36 m
- (D) 30 m

Q7. Two runners start from opposite ends of a straight track. Runner A has position $x_A = 2t^2$ m and runner B has position $x_B = 60 - 10t$ m, measured from A's start. At what time do they meet?

- (A) 6 s
- (B) 3.52 s
- (C) 5.28 s
- (D) 5.48 s

Unit 2: Force and Translational Dynamics

Q8. A 2 kg block slides down a rough incline at 45° to the horizontal. The coefficient of kinetic friction is 0.2. What is its acceleration down the slope?

- (A) 5.54 m/s^2
- (B) 2.77 m/s^2
- (C) 8.32 m/s^2
- (D) 6.93 m/s^2

Q9. Two masses 3 kg and 6 kg hang from a light pulley (Atwood machine). What is the magnitude of their acceleration?

- (A) 6.53 m/s^2
- (B) 3.27 m/s^2
- (C) 5.54 m/s^2
- (D) 4.9 m/s^2

Q10. A horizontal force of 20 N is applied at 45° above the horizontal to a 3 kg block on a frictionless floor. What is the block's horizontal acceleration?

- (A) 4.71 m/s^2
- (B) 5.33 m/s^2
- (C) 6.67 m/s^2
- (D) 7.07 m/s^2

Q11. A 4 kg object experiences a time-varying force $F(t) = 10 + 5t$ N. What is its acceleration at $t = 3$ s?

- (A) 3.12 m/s^2
- (B) 6.25 m/s^2
- (C) 2.5 m/s^2
- (D) 13.8 m/s^2

Q12. A 2 kg mass hangs at rest from a vertical spring of constant 400 N/m. By how much is the spring stretched from its natural length?

- (A) 0.005 m
- (B) 0.0245 m
- (C) 0.098 m
- (D) 0.049 m

Q13. A car travels on a flat circular bend of radius 25 m. The coefficient of static friction is 0.3. What is the maximum speed without slipping?

- (A) 8.57 m/s
- (B) 15.7 m/s
- (C) 6.06 m/s
- (D) 12.9 m/s

Q14. A road is banked so that a car at 25 m/s can round a curve of radius 50 m with no sideways friction. What banking angle is required?

- (A) 77.9°
- (B) 38.1°
- (C) 26°
- (D) 51.9°

Q15. A planet has mass 3 times Earth's mass and radius 1 times Earth's radius. What is the gravitational field strength at its surface? (Earth's $g = 9.8 \text{ m/s}^2$.)

- (A) 37.5 m/s^2
- (B) 9.8 m/s^2
- (C) 29.4 m/s^2
- (D) 33.2 m/s^2

Q16. A 70 kg person stands on a scale in a lift accelerating upwards at 2 m/s^2 . What is the scale reading (normal force)?

- (A) 826 N
- (B) 991 N
- (C) 686 N
- (D) 546 N

Q17. A 4 kg crate on a rough floor ($\mu_k = 0.3$) is pushed by a horizontal force of 50 N. What is its acceleration?

- (A) 4.78 m/s^2
- (B) 9.56 m/s^2
- (C) 12.5 m/s^2
- (D) 15.4 m/s^2

Q18. A 1 kg bob on a string of length 1 m swings in a horizontal circle with the string at 60° to the vertical. What is the tension in the string?

- (A) 29.4 N
- (B) 19.6 N
- (C) 9.8 N
- (D) 4.9 N

Q19. A 3 kg object falls through air with drag force $1v \text{ N}$, where v is in m/s. What is its acceleration when its speed is 5 m/s?

- (A) 8.13 m/s^2
- (B) 9.8 m/s^2
- (C) 12.2 m/s^2
- (D) 1.67 m/s^2

Unit 3: Work, Energy, and Power

- Q20. A force $F(x) = 20 + 4x$ N acts on a particle as it moves from $x = 2$ m to $x = 4$ m along the x-axis. How much work is done?**
- (A) 88 J
 - (B) 64 J
 - (C) 40 J
 - (D) 32 J
- Q21. A variable force $F(x) = 10x^2$ N moves an object from $x = 2$ m to $x = 4$ m. What work is done?**
- (A) 60 J
 - (B) 560 J
 - (C) 93.3 J
 - (D) 187 J
- Q22. A spring of constant 100 N/m is compressed by 0.2 m from equilibrium. How much elastic potential energy is stored?**
- (A) 10 J
 - (B) 4.52 J
 - (C) 2 J
 - (D) 4 J
- Q23. A net work of 150 J is done on a 4 kg object initially moving at 0 m/s. What is its final speed?**
- (A) 13 m/s
 - (B) 37.5 m/s
 - (C) 8.66 m/s
 - (D) 9.79 m/s
- Q24. A constant force of 40 N pushes an object in the direction of its motion at 3 m/s. What power is delivered?**
- (A) 60 W
 - (B) 120 W
 - (C) 240 W
 - (D) 43 W
- Q25. An object is dropped from rest from a height of 8 m. Ignoring air resistance, what is its speed just before hitting the ground?**
- (A) 12.5 m/s
 - (B) 6.26 m/s
 - (C) 78.4 m/s
 - (D) 8.85 m/s
- Q26. A small bead slides on a frictionless vertical loop of radius 2 m. What is the minimum speed it must have at the top of the loop to stay in contact?**
- (A) 6.26 m/s
 - (B) 8.85 m/s
 - (C) 4.43 m/s
 - (D) 7 m/s

Q27. A 3 kg block attached to a spring ($k = 50 \text{ N/m}$) is released from rest when the spring is compressed 0.2 m. What is its maximum speed?

- (A) 4.08 m/s
- (B) 0.408 m/s
- (C) 3.33 m/s
- (D) 0.816 m/s

Q28. A 2 kg block slides 5 m across a rough horizontal surface with coefficient of kinetic friction 0.2. What is the magnitude of the work done by friction?

- (A) 2 J
- (B) 9.8 J
- (C) 98 J
- (D) 19.6 J

Q29. A motor lifts a 80 kg load through a height of 10 m in 5 s at constant speed. What is the average power output?

- (A) 160 W
- (B) $7.84 \times 10^3 \text{ W}$
- (C) 784 W
- (D) $1.57 \times 10^3 \text{ W}$

Q30. A force $F(x) = 20 \cos(\pi x / (2 \times 3)) \text{ N}$, where x is in metres, acts from $x = 0$ to $x = 3 \text{ m}$. How much work is done? Use $\pi = 3.14$.

- (A) 38.2 J
- (B) 19.1 J
- (C) 60 J
- (D) 76.4 J

Unit 4: Linear Momentum

Q31. A force $F(t) = 20 + 2t \text{ N}$ acts on an object from $t = 0$ to $t = 2 \text{ s}$. What impulse does it deliver?

- (A) 44 N·s
- (B) 22 N·s
- (C) 48 N·s
- (D) 40 N·s

Q32. A force-time graph is a triangle with peak force 200 N and base 0.3 s. What impulse does it deliver?

- (A) 30 N·s
- (B) 15 N·s
- (C) 67.8 N·s
- (D) 60 N·s

Q33. A 2 kg ball moving at 6 m/s collides elastically head-on with a stationary 3 kg ball. What is the second ball's velocity after the collision?

- (A) -1.2 m/s
- (B) 2.4 m/s
- (C) 6 m/s
- (D) 4.8 m/s

Q34. A 3 kg cart at 4 m/s catches up and sticks to a 2 kg cart moving at 3 m/s in the same direction. What is their common velocity?

- (A) 5.4 m/s
- (B) 1.2 m/s
- (C) 2.4 m/s
- (D) 3.6 m/s

Q35. A 0.01 kg bullet at 200 m/s embeds in a 3 kg wooden block hanging as a pendulum. How high does the block rise?

- (A) 0.0225 m
- (B) 6.78 m
- (C) 0.0509 m
- (D) 0.0451 m

Q36. An object at rest explodes into a 1 kg fragment moving at 4 m/s and a 2 kg fragment. What is the speed of the second fragment?

- (A) 4.52 m/s
- (B) 4 m/s
- (C) 8 m/s
- (D) 2 m/s

Q37. Two masses 3 kg at $x = 1$ m and 6 kg at $x = 4$ m lie on the x-axis. Where is their centre of mass?

- (A) 3 m
- (B) 4.5 m
- (C) 13.5 m
- (D) 2 m

Q38. A 0.5 kg ball hits a wall at 10 m/s and rebounds at 10 m/s in the opposite direction. What is the magnitude of the impulse from the wall?

- (A) 5 N·s
- (B) 5.65 N·s
- (C) 10 N·s
- (D) 2.5 N·s

Unit 5: Torque and Rotational Dynamics

Q39. A force of 40 N is applied at a distance 0.5 m from a pivot, at 60° to the lever arm. What is the torque about the pivot?

- (A) 10 N·m
- (B) 17.3 N·m
- (C) 20 N·m
- (D) 34.6 N·m

Q40. A wheel starts from rest with angular acceleration $\alpha(t) = 2 + 2t$ rad/s². What is its angular velocity at $t = 2$ s?

- (A) 4.52 rad/s
- (B) 8 rad/s
- (C) 4 rad/s
- (D) 12 rad/s

Q41. Point masses 1 kg at 2 m and 3 kg at 1 m from an axis have what total moment of inertia about that axis?

- (A) $3.5 \text{ kg}\cdot\text{m}^2$
- (B) $12 \text{ kg}\cdot\text{m}^2$
- (C) $7 \text{ kg}\cdot\text{m}^2$
- (D) $5 \text{ kg}\cdot\text{m}^2$

Q42. A uniform rod of mass 2 kg and length 1 m has moment of inertia $0.167 \text{ kg}\cdot\text{m}^2$ about its centre. What is its moment of inertia about a parallel axis 1 m from the centre?

- (A) $0.667 \text{ kg}\cdot\text{m}^2$
- (B) $4.33 \text{ kg}\cdot\text{m}^2$
- (C) $2.17 \text{ kg}\cdot\text{m}^2$
- (D) $0.167 \text{ kg}\cdot\text{m}^2$

Q43. A net torque of $10 \text{ N}\cdot\text{m}$ acts on a body with moment of inertia $5 \text{ kg}\cdot\text{m}^2$. What is its angular acceleration?

- (A) 1 rad/s^2
- (B) 50 rad/s^2
- (C) 2 rad/s^2
- (D) 4 rad/s^2

Q44. A 1 kg particle moves at 4 m/s at a perpendicular distance 0.5 m from a point. What is its angular momentum about that point?

- (A) $4.52 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $2 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $1 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $4 \text{ kg}\cdot\text{m}^2/\text{s}$

Q45. A flywheel with $I = 6 \text{ kg}\cdot\text{m}^2$ spins at 12 rad/s . A constant opposing torque of $2 \text{ N}\cdot\text{m}$ is applied. How long until it stops?

- (A) 6 s
- (B) 18 s
- (C) 72 s
- (D) 36 s

Q46. A uniform rod of mass 2 kg and length 2 m is pivoted at one end and held at 60° to the vertical. What torque does gravity exert about the pivot?

- (A) $19.6 \text{ N}\cdot\text{m}$
- (B) $33.9 \text{ N}\cdot\text{m}$
- (C) $17 \text{ N}\cdot\text{m}$
- (D) $8.49 \text{ N}\cdot\text{m}$

Unit 6: Energy and Momentum of Rotating Systems

Q47. A body with moment of inertia $6 \text{ kg}\cdot\text{m}^2$ rotates at 5 rad/s . What is its rotational kinetic energy?

- (A) 150 J
- (B) 15 J
- (C) 169 J
- (D) 75 J

Q48. A disk with $I = 4 \text{ kg}\cdot\text{m}^2$ spinning at 6 rad/s couples to a stationary disk with $I = 4 \text{ kg}\cdot\text{m}^2$ on the same axle, with no external torque. What is their common angular velocity?

- (A) 6.78 rad/s
- (B) 3 rad/s
- (C) 6 rad/s
- (D) 7.66 rad/s

Q49. A satellite orbits Earth at a radius of 8000 km from Earth's centre. What is its orbital speed? ($GM_{\text{Earth}} = 3.99 \times 10^{14} \text{ m}^3/\text{s}^2$.)

- (A) 7.06 km/s
- (B) 3.53 km/s
- (C) 10.6 km/s
- (D) 9.98 km/s

Q50. What is the orbital period, in hours, of a satellite at radius 10000 km from Earth's centre? ($GM_{\text{Earth}} = 3.99 \times 10^{14} \text{ m}^3/\text{s}^2$.)

- (A) 2.76 hours
- (B) 1.38 hours
- (C) 5.53 hours
- (D) 4.15 hours

Q51. A planet has mass 8 times Earth's mass and radius 1 times Earth's radius. What is its escape velocity if Earth's is 11.2 km/s?

- (A) 35.8 km/s
- (B) 11.2 km/s
- (C) 15.8 km/s
- (D) 31.7 km/s

Q52. A 1000 kg satellite orbits at radius 12000 km from Earth's centre. What is the magnitude of its total mechanical energy, in GJ? ($GM_{\text{Earth}} = 3.99 \times 10^{14} \text{ m}^3/\text{s}^2$.)

- (A) 33.2 GJ
- (B) 16.6 GJ
- (C) 8.3 GJ
- (D) 24.9 GJ

Q53. A 100 kg satellite moves from radius 7000 km to radius 14000 km from Earth's centre. By how much does its gravitational potential energy change, in MJ?

- (A) 5.69e+03 MJ
- (B) 3.42e+03 MJ
- (C) 2.85e+03 MJ
- (D) 1.42e+03 MJ

Unit 7: Oscillations

Q54. A mass oscillates with $x(t) = 0.2 \cos(10t)$ m. What is its maximum speed?

- (A) 20 m/s
- (B) 4 m/s
- (C) 0.02 m/s
- (D) 2 m/s

Q55. A 2 kg mass on a spring ($k = 400 \text{ N/m}$) oscillates horizontally. What is its period?

- (A) 88.9 s
- (B) 0.0707 s
- (C) 0.444 s
- (D) 0.222 s

Q56. A simple pendulum of length 0.5 m oscillates with small amplitude. What is its period?

- (A) 27.8 s
- (B) 2.84 s
- (C) 1.42 s
- (D) 0.226 s

Q57. A 1 kg mass on a spring ($k = 100 \text{ N/m}$) oscillates with amplitude 0.1 m. What is its speed when its displacement is 0.05 m?

- (A) 0.433 m/s
- (B) 1 m/s
- (C) 0.866 m/s
- (D) 0.5 m/s

Q58. A particle in SHM obeys $d^2x/dt^2 = -4^2x$. What is the magnitude of its acceleration when its displacement is 0.1 m?

- (A) 1.6 m/s^2
- (B) 3.2 m/s^2
- (C) 0.4 m/s^2
- (D) 0.8 m/s^2

Q59. A 4 kg mass on a spring oscillates with period 1 s. What is the spring constant?

- (A) 79 N/m
- (B) 158 N/m
- (C) 39.5 N/m
- (D) 178 N/m

Q60. A particle in SHM has $x(t) = 0.3 \cos(2t) \text{ m}$. What is its position at $t = 2 \text{ s}$?

- (A) 0.196 m
- (B) -0.227 m
- (C) -0.0437 m
- (D) -0.196 m

Answer Key

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

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

Worked explanations for all 60 questions:

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