

AP Physics C: Mechanics Practice Test 19

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 position $x(t) = 2.7 t^2 + 2.9 t$, where x is in metres and t is in seconds. What is its velocity at $t = 2.7$ s?

- (A) 14.58 m/s
- (B) 10.19 m/s
- (C) 17.48 m/s
- (D) 11.68 m/s

Q2. A particle has velocity $v(t) = 3.3 + 2.6 t + 0.4 t^2$, with v in m/s and t in seconds. What is its displacement from $t = 0$ to $t = 2.6$ s?

- (A) 33.19 m
- (B) 17.37 m
- (C) 10.92 m
- (D) 19.71 m

Q3. A cart starts with velocity 3.9 m/s and has acceleration $a(t) = 2.9 + 0.8 t$, with a in m/s^2 and t in seconds. What is its velocity at $t = 3.6$ s?

- (A) 24.71 m/s
- (B) 14.34 m/s
- (C) 15.62 m/s
- (D) 19.52 m/s

Q4. An object starts from rest at the origin with acceleration $a(t) = 1.9 t^2$, with a in m/s^2 and t in seconds. What is its position at $t = 3.0$ s?

- (A) 17.10 m
- (B) 38.48 m
- (C) 6.41 m
- (D) 12.83 m

Q5. A projectile is launched with horizontal velocity 11.9 m/s and vertical velocity 13.2 m/s. What is its speed at $t = 2.4$ s? Take $g = 9.8 \text{ m/s}^2$.

- (A) 15.75 m/s
- (B) 22.22 m/s
- (C) 17.77 m/s
- (D) 10.32 m/s

Q6. A particle has position $x(t) = 0.7 t^3 - 5.3 t^2$, with x in metres and t in seconds. At what positive time is its velocity zero?

- (A) 5.05 s
- (B) 2.52 s
- (C) 7.57 s
- (D) 15.14 s

Q7. A ball is thrown vertically upward with speed 19.9 m/s from ground level. What is its maximum height? Take $g = 9.8 \text{ m/s}^2$.

- (A) 20.20 m
- (B) 40.41 m
- (C) 2.03 m
- (D) 10.10 m

Unit 2: Force and Translational Dynamics

Q8. A block of mass 2.7 kg on a frictionless surface is acted on by a horizontal force $F(t) = 26 + 4 t$, with F in newtons and t in seconds. What is its acceleration at $t = 3.1 \text{ s}$?

- (A) 7.11 m/s^2
- (B) 14.22 m/s^2
- (C) 9.63 m/s^2
- (D) 38.40 m/s^2

Q9. A block slides down a rough plane inclined at 37 degrees to the horizontal. The coefficient of kinetic friction is 0.14. What is its acceleration down the plane? Take $g = 9.8 \text{ m/s}^2$.

- (A) 5.90 m/s^2
- (B) 6.99 m/s^2
- (C) 7.83 m/s^2
- (D) 4.80 m/s^2

Q10. A horizontal force of 51 N pushes a 10.1 kg crate across a floor with coefficient of kinetic friction 0.28. What is the acceleration of the crate? Take $g = 9.8 \text{ m/s}^2$.

- (A) 5.05 m/s^2
- (B) 7.79 m/s^2
- (C) 2.74 m/s^2
- (D) 2.31 m/s^2

Q11. A 1.6 kg mass is whirled in a horizontal circle of radius 1.1 m at speed 4.8 m/s by a string. What is the tension in the string?

- (A) 36.86 N
- (B) 6.98 N
- (C) 33.51 N
- (D) 15.68 N

Q12. A satellite of mass 725 kg orbits Earth (mass 6.0×10^{24} kg) at a distance of 8.5 million metres from Earth's centre. What is the gravitational force on the satellite? Use $G = 6.67 \times 10^{-11}$ N m²/kg².

- (A) 2008 N
- (B) 8032 N
- (C) 4016 N
- (D) 40158 N

Q13. A 1.3 kg block is held against a spring of spring constant 184 N/m compressed by 0.17 m on a frictionless surface. What is the magnitude of its acceleration the instant it is released?

- (A) 31.28 m/s²
- (B) 24.06 m/s²
- (C) 40.66 m/s²
- (D) 0.131 m/s²

Q14. A person of mass 65.9 kg stands on a scale in a lift accelerating upward at 2.0 m/s². What is the scale reading in newtons? Take $g = 9.8$ m/s².

- (A) 777.6 N
- (B) 645.8 N
- (C) 514.0 N
- (D) 131.8 N

Q15. Two masses 3 kg and 7 kg are connected by a light string over a frictionless pulley. What is the magnitude of their acceleration? Take $g = 9.8$ m/s².

- (A) 5.60 m/s²
- (B) 3.92 m/s²
- (C) 24.50 m/s²
- (D) 9.80 m/s²

Q16. A car travels around a banked curve of radius 9.3 m banked at 45 degrees with no reliance on friction. What speed is required?

- (A) 9.55 m/s
- (B) 11.16 m/s
- (C) 91.14 m/s
- (D) 12.98 m/s

Q17. A 8 kg block on a horizontal table (coefficient of kinetic friction 0.18) is connected by a string over a pulley to a hanging 2 kg block. What is the acceleration of the system? Take $g = 9.8$ m/s².

- (A) 1.96 m/s²
- (B) 3.37 m/s²
- (C) 1.76 m/s²
- (D) 0.549 m/s²

Q18. A skydiver of mass 86.8 kg experiences air resistance $F = bv$ with $b = 11.7$ kg/s. What is the terminal velocity? Take $g = 9.8$ m/s².

- (A) 9952 m/s
- (B) 0.014 m/s
- (C) 8.53 m/s
- (D) 72.70 m/s

Q19. A planet has mass 7.9×10^{23} kg and radius 5.3 million metres. What is the gravitational field strength at its surface? Use $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$.

- (A) 3.75 m/s^2
- (B) 0.938 m/s^2
- (C) 1.88 m/s^2
- (D) 9942075 m/s^2

Unit 3: Work, Energy, and Power

Q20. A variable force $F(x) = 15 + 11x$, with F in newtons and x in metres, acts on an object as it moves from $x = 0$ to $x = 2.9$ m. How much work is done?

- (A) 43.50 J
- (B) 89.75 J
- (C) 136.0 J
- (D) 75.40 J

Q21. A force $F(x) = 1.4x^2$, with F in newtons and x in metres, pushes an object from $x = 0$ to $x = 3.1$ m. How much work is done?

- (A) 13.90 J
- (B) 41.71 J
- (C) 6.73 J
- (D) 20.85 J

Q22. A spring of constant 172 N/m is stretched from 0.06 m to 0.37 m. How much work is done by the spring force during this stretch? Give the signed work.

- (A) 11.46 J
- (B) -11.46 J
- (C) 11.77 J
- (D) -11.77 J

Q23. A 2.6 kg block moving at 9.8 m/s slides 3.8 m while a constant friction force of 20 N opposes it. What is its final speed?

- (A) 12.43 m/s
- (B) -19.43 m/s
- (C) 9.80 m/s
- (D) 6.13 m/s

Q24. A constant force of 54 N acts in the direction of motion on an object moving at 7.4 m/s. What is the instantaneous power delivered?

- (A) 7.30 W
- (B) 61.40 W
- (C) 399.6 W
- (D) 199.8 W

Q25. A motor delivers power $P(t) = 77 + 21t$, with P in watts and t in seconds. How much work does it do from $t = 0$ to $t = 3.3$ s?

- (A) 254.1 J
- (B) 482.8 J
- (C) 368.4 J
- (D) 323.4 J

Q26. A particle has potential energy $U(x) = 3.2 x^2 + 1.5 x^3$, with U in joules and x in metres. What is the force on the particle at $x = 2.1$ m?

- (A) 33.29 N
- (B) -13.44 N
- (C) -33.29 N
- (D) -19.85 N

Q27. A 1.3 kg block attached to a spring of constant 132 N/m is released from rest with the spring compressed by 0.19 m on a frictionless surface. What is its speed as it passes equilibrium?

- (A) 1.91 m/s
- (B) 0.019 m/s
- (C) 19.29 m/s
- (D) 10.08 m/s

Q28. A 9.7 kg crate is lifted vertically at constant speed through a height of 4.1 m. How much work is done by the lifting force? Take $g = 9.8 \text{ m/s}^2$.

- (A) 95.06 J
- (B) 39.77 J
- (C) 194.9 J
- (D) 389.7 J

Q29. A motor lifts a 50.6 kg load through 5.5 m in 6.4 s at constant speed. What is its average power output? Take $g = 9.8 \text{ m/s}^2$.

- (A) 426.1 W
- (B) 2727 W
- (C) 17455 W
- (D) 77.48 W

Q30. A force $F(x) = 14 + 4 x + 1.2 x^2$, with F in newtons and x in metres, acts from $x = 0$ to $x = 2.7$ m. How much work is done?

- (A) 52.38 J
- (B) 45.67 J
- (C) 60.25 J
- (D) 37.80 J

Unit 4: Linear Momentum

Q31. A time-varying force $F(t) = 21 + 8 t$, with F in newtons and t in seconds, acts from $t = 0$ to $t = 3.6$ s. What is the impulse delivered?

- (A) 75.60 N s
- (B) 179.3 N s
- (C) 104.4 N s
- (D) 127.4 N s

Q32. A force-time graph shows a triangular pulse rising to 78 N and returning to zero over 0.6 s. What is the impulse delivered?

- (A) 46.80 N s
- (B) 11.70 N s
- (C) 23.40 N s
- (D) 15.60 N s

Q33. A 2.8 kg object moving at 5.0 m/s receives an impulse of 19 N s in the direction of motion. What is its final velocity?

- (A) 24.00 m/s
- (B) 58.20 m/s
- (C) 11.79 m/s
- (D) 6.79 m/s

Q34. A 5 kg cart moving at 7.4 m/s collides with and sticks to a stationary 6 kg cart. What is their common velocity after the collision?

- (A) 7.40 m/s
- (B) 3.36 m/s
- (C) 6.17 m/s
- (D) 16.28 m/s

Q35. An object of mass 7 kg at rest explodes into two fragments of masses 3 kg and 4 kg. The 3 kg fragment moves at 4.4 m/s. What is the velocity of the 4 kg fragment?

- (A) 3.30 m/s
- (B) -3.30 m/s
- (C) -4.40 m/s
- (D) 5.87 m/s

Q36. Two carts of masses 3 kg and 3 kg collide and stick together. Their x-velocities before the collision are 4.9 m/s and 1.9 m/s. What is the x-velocity of the combined carts after the collision?

- (A) 3.40 m/s
- (B) 6.80 m/s
- (C) 8.05 m/s
- (D) 1.50 m/s

Q37. Masses 2 kg at $x = 0.1$ m and 3 kg at $x = 4.2$ m lie on the x-axis. What is the x-coordinate of their centre of mass?

- (A) 6.40 m
- (B) 2.15 m
- (C) 2.56 m
- (D) 6.30 m

Q38. A 0.7 kg ball hits a wall at 4.6 m/s and rebounds at 3.0 m/s in the opposite direction. What is the magnitude of the impulse delivered by the wall?

- (A) -1.12 N s
- (B) 5.32 N s
- (C) 2.10 N s
- (D) 3.22 N s

Unit 5: Torque and Rotational Dynamics

Q39. A force of 54 N is applied at a distance 0.9 m from a pivot, at an angle of 45 degrees to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 34.37 N m
- (B) 48.60 N m
- (C) 39.20 N m
- (D) 68.73 N m

Q40. What is the moment of inertia of a uniform rod of mass 2.4 kg and length 1.7 m about an axis through one end perpendicular to the rod?

- (A) 0.578 kg m^2
- (B) 6.94 kg m^2
- (C) 3.47 kg m^2
- (D) 2.31 kg m^2

Q41. What is the moment of inertia of a solid disc of mass 2.4 kg and radius 0.4 m about its central axis?

- (A) 0.192 kg m^2
- (B) 0.384 kg m^2
- (C) 0.154 kg m^2
- (D) 0.768 kg m^2

Q42. A net torque of 38 N m acts on an object with moment of inertia 2.5 kg m^2 . What is its angular acceleration?

- (A) 95.00 rad/s^2
- (B) 15.20 rad/s^2
- (C) 40.50 rad/s^2
- (D) 0.066 rad/s^2

Q43. A wheel has angular acceleration $\alpha(t) = 2.8 + 0.5 t$, with α in rad/s^2 and t in seconds, and initial angular velocity 2.2 rad/s . What is its angular velocity at $t = 2.2 \text{ s}$?

- (A) 10.78 rad/s
- (B) 9.57 rad/s
- (C) 8.36 rad/s
- (D) 7.37 rad/s

Q44. An object has moment of inertia 1.1 kg m^2 about its centre of mass. What is its moment of inertia about a parallel axis 0.6 m away if its mass is 3.4 kg?

- (A) 2.32 kg m^2
- (B) 3.14 kg m^2
- (C) 1.10 kg m^2
- (D) 1.22 kg m^2

Q45. A horizontal beam is pivoted at its left end. A weight of 179 N hangs 0.8 m from the pivot, and an upward force is applied at the right end 3.8 m from the pivot. What upward force balances the beam?

- (A) 850.2 N
- (B) 37.68 N
- (C) 179.0 N
- (D) 143.2 N

Q46. A disc with moment of inertia 4.2 kg m^2 undergoes angular acceleration 2.3 rad/s^2 . What net torque acts on it?

- (A) 9.66 N m
- (B) 1.83 N m
- (C) 6.50 N m
- (D) 19.32 N m

Unit 6: Energy and Momentum of Rotating Systems

Q47. A rotating object has moment of inertia 4.4 kg m^2 and angular velocity 5.9 rad/s . What is its rotational kinetic energy?

- (A) 153.2 J
- (B) 76.58 J
- (C) 12.98 J
- (D) 25.96 J

Q48. A spinning skater with moment of inertia 4.3 kg m^2 rotates at 3.1 rad/s , then pulls in her arms so her moment of inertia becomes 2.5 kg m^2 . What is her new angular velocity? Neglect external torques.

- (A) 1.80 rad/s
- (B) 5.33 rad/s
- (C) 3.10 rad/s
- (D) 13.33 rad/s

Q49. A solid cylinder of mass 5.0 kg rolls without slipping at speed 6.8 m/s . What is its total kinetic energy? For a solid cylinder $I = 0.5MR^2$.

- (A) 115.6 J
- (B) 231.2 J
- (C) 173.4 J
- (D) 25.50 J

Q50. What is the orbital speed of a satellite in a circular orbit 11.2 million metres from Earth's centre? Earth mass = $6.0 \times 10^{24} \text{ kg}$, $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$.

- (A) 5978 m/s
- (B) 8966 m/s
- (C) 35732143 m/s
- (D) 2989 m/s

Q51. What is the orbital period of a satellite in a circular orbit 9.9 million metres from Earth's centre? Earth mass = $6.0 \times 10^{24} \text{ kg}$, $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$.

- (A) 4892 s
- (B) 19567 s
- (C) 0.001 s
- (D) 9783 s

Q52. What is the escape velocity from a distance of 7.1 million metres from Earth's centre? Earth mass = $6.0 \times 10^{24} \text{ kg}$, $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$.

- (A) 7508 m/s
- (B) 5309 m/s
- (C) 10618 m/s
- (D) 15015 m/s

Q53. A 1.9 kg particle moves at 6.5 m/s on a line whose perpendicular distance from a fixed point is 0.8 m. What is its angular momentum about that point?

- (A) 12.35 kg m²/s
- (B) 1.52 kg m²/s
- (C) 5.20 kg m²/s
- (D) 9.88 kg m²/s

Unit 7: Oscillations

Q54. A 1.2 kg mass on a spring of constant 65 N/m oscillates on a frictionless surface. What is its period?

- (A) 46.24 s
- (B) 0.136 s
- (C) 0.854 s
- (D) 0.116 s

Q55. A simple pendulum of length 1.9 m undergoes small oscillations. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 14.27 s
- (B) 2.77 s
- (C) 0.440 s
- (D) 1.22 s

Q56. A mass of 0.9 kg on a spring of constant 37 N/m oscillates with amplitude 0.19 m. What is its maximum speed?

- (A) 0.609 m/s
- (B) 2.44 m/s
- (C) 1.22 m/s
- (D) 0.030 m/s

Q57. An oscillator with amplitude 0.38 m and angular frequency 5.97 rad/s is at displacement 0.19 m from equilibrium. What is its speed there?

- (A) 2.27 m/s
- (B) 1.13 m/s
- (C) 2.54 m/s
- (D) 1.96 m/s

Q58. A mass of 0.6 kg on a spring of constant 38 N/m oscillates with amplitude 0.22 m. What is its maximum acceleration?

- (A) 13.93 m/s²
- (B) 1.75 m/s²
- (C) 63.33 m/s²
- (D) 0.875 m/s²

Q59. A physical pendulum has moment of inertia 1.1 kg m² about its pivot, mass 3.8 kg, and its centre of mass is 0.6 m from the pivot. What is its period for small oscillations? Take $g = 9.8 \text{ m/s}^2$.

- (A) 28.32 s
- (B) 1.39 s
- (C) 0.222 s
- (D) 0.309 s

Q60. A mass of 1.2 kg on a spring of constant 64 N/m oscillates as $x = A \sin(\omega t)$, starting from equilibrium. How long does it first take to reach $x = A/2$?

- (A) 0.215 s
- (B) 0.143 s
- (C) 0.430 s
- (D) 0.072 s

Answer Key

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

Worked explanations for all 60 questions:

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