

AP Physics C: Mechanics Practice Test 18

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 $x(t) = 1.2 t^2 + 1.9 t$, where x is in metres and t is in seconds. What is its velocity at $t = 3.5$ s?

- (A) 10.30 m/s
- (B) 8.40 m/s
- (C) 6.10 m/s
- (D) 6.50 m/s

Q2. A particle has velocity $v(t) = 2.8 + 1.4 t + 0.5 t^2$, with v in m/s and t in seconds. What is its displacement from $t = 0$ to $t = 2.2$ s?

- (A) 18.26 m
- (B) 9.55 m
- (C) 11.32 m
- (D) 7.93 m

Q3. A cart starts with velocity 1.2 m/s and has acceleration $a(t) = 3.7 + 1.2 t$, with a in m/s^2 and t in seconds. What is its velocity at $t = 2.9$ s?

- (A) 16.98 m/s
- (B) 22.02 m/s
- (C) 11.93 m/s
- (D) 15.78 m/s

Q4. An object starts from rest at the origin with acceleration $a(t) = 1.7 t^2$, with a in m/s^2 and t in seconds. What is its position at $t = 2.0$ s?

- (A) 4.53 m
- (B) 2.27 m
- (C) 6.80 m
- (D) 1.13 m

Q5. A projectile is launched with horizontal velocity 6.9 m/s and vertical velocity 14.0 m/s. What is its speed at $t = 1.7$ s? Take $g = 9.8 \text{ m/s}^2$.

- (A) 9.56 m/s
- (B) 7.39 m/s
- (C) 15.61 m/s
- (D) 2.66 m/s

Q6. A particle has position $x(t) = 0.6 t^3 - 3.5 t^2$, with x in metres and t in seconds. At what positive time is its velocity zero?

- (A) 3.89 s
- (B) 1.94 s
- (C) 5.83 s
- (D) 11.67 s

Q7. A ball is thrown vertically upward with speed 18.5 m/s from ground level. What is its maximum height? Take $g = 9.8 \text{ m/s}^2$.

- (A) 34.92 m
- (B) 17.46 m
- (C) 1.89 m
- (D) 8.73 m

Unit 2: Force and Translational Dynamics

Q8. A block of mass 4.4 kg on a frictionless surface is acted on by a horizontal force $F(t) = 30 + 5 t$, with F in newtons and t in seconds. What is its acceleration at $t = 2.4 \text{ s}$?

- (A) 4.77 m/s^2
- (B) 6.82 m/s^2
- (C) 42.00 m/s^2
- (D) 9.55 m/s^2

Q9. A block slides down a rough plane inclined at 35 degrees to the horizontal. The coefficient of kinetic friction is 0.2. What is its acceleration down the plane? Take $g = 9.8 \text{ m/s}^2$.

- (A) 5.62 m/s^2
- (B) 7.23 m/s^2
- (C) 4.02 m/s^2
- (D) 8.03 m/s^2

Q10. A horizontal force of 58 N pushes a 7.7 kg crate across a floor with coefficient of kinetic friction 0.2. What is the acceleration of the crate? Take $g = 9.8 \text{ m/s}^2$.

- (A) 5.57 m/s^2
- (B) 7.53 m/s^2
- (C) 9.49 m/s^2
- (D) 1.96 m/s^2

Q11. A 2.0 kg mass is whirled in a horizontal circle of radius 0.9 m at speed 6.2 m/s by a string. What is the tension in the string?

- (A) 76.88 N
- (B) 13.78 N
- (C) 19.60 N
- (D) 85.42 N

Q12. A satellite of mass 534 kg orbits Earth (mass 6.0×10^{24} kg) at a distance of 8.9 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) 1349 N
- (B) 5396 N
- (C) 2698 N
- (D) 26980 N

Q13. A 1.9 kg block is held against a spring of spring constant 196 N/m compressed by 0.24 m on a frictionless surface. What is the magnitude of its acceleration the instant it is released?

- (A) 47.04 m/s²
- (B) 89.38 m/s²
- (C) 0.126 m/s²
- (D) 24.76 m/s²

Q14. A person of mass 62.0 kg stands on a scale in a lift accelerating upward at 2.5 m/s². What is the scale reading in newtons? Take $g = 9.8$ m/s².

- (A) 607.6 N
- (B) 452.6 N
- (C) 155.0 N
- (D) 762.6 N

Q15. Two masses 5 kg and 12 kg are connected by a light string over a frictionless pulley. What is the magnitude of their acceleration? Take $g = 9.8$ m/s².

- (A) 4.04 m/s²
- (B) 5.72 m/s²
- (C) 23.80 m/s²
- (D) 9.80 m/s²

Q16. A car travels around a banked curve of radius 5.2 m banked at 30 degrees with no reliance on friction. What speed is required?

- (A) 7.14 m/s
- (B) 5.42 m/s
- (C) 29.42 m/s
- (D) 9.39 m/s

Q17. A 5 kg block on a horizontal table (coefficient of kinetic friction 0.24) is connected by a string over a pulley to a hanging 5 kg block. What is the acceleration of the system? Take $g = 9.8$ m/s².

- (A) 4.90 m/s²
- (B) 6.08 m/s²
- (C) 2.35 m/s²
- (D) 3.72 m/s²

Q18. A skydiver of mass 84.8 kg experiences air resistance $F = bv$ with $b = 12.8$ kg/s. What is the terminal velocity? Take $g = 9.8$ m/s².

- (A) 10637 m/s
- (B) 0.015 m/s
- (C) 8.06 m/s
- (D) 64.92 m/s

Q19. A planet has mass 7.5×10^{23} kg and radius 3.1 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) 10.41 m/s^2
- (B) 2.60 m/s^2
- (C) 5.21 m/s^2
- (D) 16137097 m/s^2

Unit 3: Work, Energy, and Power

Q20. A variable force $F(x) = 13 + 12x$, with F in newtons and x in metres, acts on an object as it moves from $x = 0$ to $x = 2.0$ m. How much work is done?

- (A) 50.00 J
- (B) 26.00 J
- (C) 74.00 J
- (D) 56.87 J

Q21. A force $F(x) = 2.6x^2$, with F in newtons and x in metres, pushes an object from $x = 0$ to $x = 2.2$ m. How much work is done?

- (A) 27.68 J
- (B) 6.29 J
- (C) 9.23 J
- (D) 13.84 J

Q22. A spring of constant 110 N/m is stretched from 0.11 m to 0.33 m. How much work is done by the spring force during this stretch? Give the signed work.

- (A) 5.32 J
- (B) -5.32 J
- (C) 5.99 J
- (D) -5.99 J

Q23. A 3.9 kg block moving at 6.2 m/s slides 2.1 m while a constant friction force of 16 N opposes it. What is its final speed?

- (A) 4.61 m/s
- (B) 7.46 m/s
- (C) -2.42 m/s
- (D) 6.20 m/s

Q24. A constant force of 35 N acts in the direction of motion on an object moving at 4.5 m/s. What is the instantaneous power delivered?

- (A) 7.78 W
- (B) 39.50 W
- (C) 157.5 W
- (D) 78.75 W

Q25. A motor delivers power $P(t) = 60 + 30t$, with P in watts and t in seconds. How much work does it do from $t = 0$ to $t = 2.6$ s?

- (A) 156.0 J
- (B) 358.8 J
- (C) 257.4 J
- (D) 234.0 J

Q26. A particle has potential energy $U(x) = 2.4 x^2 + 1.4 x^3$, with U in joules and x in metres. What is the force on the particle at $x = 1.5$ m?

- (A) 16.65 N
- (B) -7.20 N
- (C) -9.45 N
- (D) -16.65 N

Q27. A 1.8 kg block attached to a spring of constant 137 N/m is released from rest with the spring compressed by 0.23 m on a frictionless surface. What is its speed as it passes equilibrium?

- (A) 0.026 m/s
- (B) 17.51 m/s
- (C) 8.72 m/s
- (D) 2.01 m/s

Q28. A 5.1 kg crate is lifted vertically at constant speed through a height of 4.2 m. How much work is done by the lifting force? Take $g = 9.8 \text{ m/s}^2$.

- (A) 209.9 J
- (B) 49.98 J
- (C) 21.42 J
- (D) 105.0 J

Q29. A motor lifts a 32.0 kg load through 6.9 m in 7.4 s at constant speed. What is its average power output? Take $g = 9.8 \text{ m/s}^2$.

- (A) 2164 W
- (B) 292.4 W
- (C) 16012 W
- (D) 42.38 W

Q30. A force $F(x) = 11 + 5 x + 1.2 x^2$, with F in newtons and x in metres, acts from $x = 0$ to $x = 3.4$ m. How much work is done?

- (A) 66.30 J
- (B) 82.02 J
- (C) 53.12 J
- (D) 37.40 J

Unit 4: Linear Momentum

Q31. A time-varying force $F(t) = 22 + 9 t$, with F in newtons and t in seconds, acts from $t = 0$ to $t = 2.5$ s. What is the impulse delivered?

- (A) 55.00 N s
- (B) 83.12 N s
- (C) 111.2 N s
- (D) 77.50 N s

Q32. A force-time graph shows a triangular pulse rising to 88 N and returning to zero over 0.2 s. What is the impulse delivered?

- (A) 8.80 N s
- (B) 17.60 N s
- (C) 4.40 N s
- (D) 5.87 N s

Q33. A 1.5 kg object moving at 4.6 m/s receives an impulse of 22 N s in the direction of motion. What is its final velocity?

- (A) 26.60 m/s
- (B) 19.27 m/s
- (C) 37.60 m/s
- (D) 14.67 m/s

Q34. A 3 kg cart moving at 5.2 m/s collides with and sticks to a stationary 6 kg cart. What is their common velocity after the collision?

- (A) 5.20 m/s
- (B) 2.60 m/s
- (C) 1.73 m/s
- (D) 15.60 m/s

Q35. An object of mass 8 kg at rest explodes into two fragments of masses 4 kg and 4 kg. The 4 kg fragment moves at 3.4 m/s. What is the velocity of the 4 kg fragment?

- (A) 3.40 m/s
- (B) -3.47 m/s
- (C) 4.21 m/s
- (D) -3.40 m/s

Q36. Two carts of masses 4 kg and 3 kg collide and stick together. Their x-velocities before the collision are 5.6 m/s and 0.3 m/s. What is the x-velocity of the combined carts after the collision?

- (A) 3.33 m/s
- (B) 5.82 m/s
- (C) 5.90 m/s
- (D) 3.07 m/s

Q37. Masses 2 kg at $x = 0.9$ m and 2 kg at $x = 3.5$ m lie on the x-axis. What is the x-coordinate of their centre of mass?

- (A) 2.20 m
- (B) 4.40 m
- (C) 2.86 m
- (D) 3.50 m

Q38. A 0.7 kg ball hits a wall at 4.4 m/s and rebounds at 5.5 m/s in the opposite direction. What is the magnitude of the impulse delivered by the wall?

- (A) 6.93 N s
- (B) 0.770 N s
- (C) 3.85 N s
- (D) 3.08 N s

Unit 5: Torque and Rotational Dynamics

Q39. A force of 48 N is applied at a distance 1.1 m from a pivot, at an angle of 60 degrees to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 52.80 N m
- (B) 26.40 N m
- (C) 45.73 N m
- (D) 60.97 N m

Q40. What is the moment of inertia of a uniform rod of mass 5.9 kg and length 1.0 m about an axis through one end perpendicular to the rod?

- (A) 0.492 kg m^2
- (B) 5.90 kg m^2
- (C) 1.97 kg m^2
- (D) 2.95 kg m^2

Q41. What is the moment of inertia of a thin hoop of mass 3.6 kg and radius 0.5 m about its central axis?

- (A) 1.39 kg m^2
- (B) 0.450 kg m^2
- (C) 1.80 kg m^2
- (D) 0.900 kg m^2

Q42. A net torque of 27 N m acts on an object with moment of inertia 5.4 kg m^2 . What is its angular acceleration?

- (A) 145.8 rad/s^2
- (B) 5.00 rad/s^2
- (C) 32.40 rad/s^2
- (D) 0.200 rad/s^2

Q43. A wheel has angular acceleration $\alpha(t) = 1.5 + 0.4 t$, with α in rad/s^2 and t in seconds, and initial angular velocity 1.1 rad/s . What is its angular velocity at $t = 3.6 \text{ s}$?

- (A) 11.68 rad/s
- (B) 6.50 rad/s
- (C) 9.09 rad/s
- (D) 7.99 rad/s

Q44. An object has moment of inertia 2.8 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 3.3 kg?

- (A) 4.78 kg m^2
- (B) 2.80 kg m^2
- (C) 1.19 kg m^2
- (D) 3.99 kg m^2

Q45. A horizontal beam is pivoted at its left end. A weight of 114 N hangs 0.9 m from the pivot, and an upward force is applied at the right end 2.7 m from the pivot. What upward force balances the beam?

- (A) 38.00 N
- (B) 342.0 N
- (C) 114.0 N
- (D) 102.6 N

Q46. A disc with moment of inertia 5.2 kg m^2 undergoes angular acceleration 3.7 rad/s^2 . What net torque acts on it?

- (A) 1.41 N m
- (B) 8.90 N m
- (C) 38.48 N m
- (D) 19.24 N m

Unit 6: Energy and Momentum of Rotating Systems

Q47. A rotating object has moment of inertia 1.6 kg m^2 and angular velocity 4.1 rad/s . What is its rotational kinetic energy?

- (A) 26.90 J
- (B) 3.28 J
- (C) 6.56 J
- (D) 13.45 J

Q48. A spinning skater with moment of inertia 5.0 kg m^2 rotates at 3.2 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) 1.60 rad/s
- (B) 3.20 rad/s
- (C) 6.40 rad/s
- (D) 16.00 rad/s

Q49. A solid cylinder of mass 4.7 kg rolls without slipping at speed 5.4 m/s . What is its total kinetic energy? For a solid cylinder $I = 0.5MR^2$.

- (A) 68.53 J
- (B) 137.1 J
- (C) 102.8 J
- (D) 19.04 J

Q50. What is the orbital speed of a satellite in a circular orbit 10.6 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) 9217 m/s
- (B) 37754717 m/s
- (C) 6144 m/s
- (D) 3072 m/s

Q51. What is the orbital period of a satellite in a circular orbit 10.0 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) 4966 s
- (B) 19864 s
- (C) 0.001 s
- (D) 9932 s

Q52. What is the escape velocity from a distance of 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) 6358 m/s
- (B) 8992 m/s
- (C) 4496 m/s
- (D) 12716 m/s

Q53. A 4.0 kg particle moves at 4.8 m/s on a line whose perpendicular distance from a fixed point is 1.1 m. What is its angular momentum about that point?

- (A) 19.20 kg m²/s
- (B) 4.40 kg m²/s
- (C) 5.28 kg m²/s
- (D) 21.12 kg m²/s

Unit 7: Oscillations

Q54. A 1.5 kg mass on a spring of constant 51 N/m oscillates on a frictionless surface. What is its period?

- (A) 36.64 s
- (B) 1.08 s
- (C) 0.171 s
- (D) 0.185 s

Q55. A simple pendulum of length 1.4 m undergoes small oscillations. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 16.62 s
- (B) 0.378 s
- (C) 2.37 s
- (D) 0.898 s

Q56. A mass of 1.6 kg on a spring of constant 55 N/m oscillates with amplitude 0.27 m. What is its maximum speed?

- (A) 1.58 m/s
- (B) 0.792 m/s
- (C) 3.17 m/s
- (D) 0.046 m/s

Q57. An oscillator with amplitude 0.32 m and angular frequency 7.16 rad/s is at displacement 0.16 m from equilibrium. What is its speed there?

- (A) 1.98 m/s
- (B) 2.29 m/s
- (C) 1.15 m/s
- (D) 2.56 m/s

Q58. A mass of 0.7 kg on a spring of constant 55 N/m oscillates with amplitude 0.3 m. What is its maximum acceleration?

- (A) 2.66 m/s²
- (B) 23.57 m/s²
- (C) 78.57 m/s²
- (D) 1.33 m/s²

Q59. A physical pendulum has moment of inertia 1.7 kg m² about its pivot, mass 3.9 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) 23.08 s
- (B) 1.71 s
- (C) 0.272 s
- (D) 0.466 s

Q60. A mass of 1.9 kg on a spring of constant 72 N/m oscillates as $x = A \sin(\omega t)$, starting from equilibrium. How long does it first take to reach $x = A/2$?

- (A) 0.255 s
- (B) 0.085 s
- (C) 0.170 s
- (D) 0.510 s

Answer Key

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

Worked explanations for all 60 questions:

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