

AP Physics C: Mechanics Practice Test 11

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 $v(t) = 8.00 + 2.00t + 2.00t^2$, where v is in m/s and t is in s. What is the velocity of the particle at $t = 3$ s?

- (A) 25.6 m/s
- (B) 38.4 m/s
- (C) 28.0 m/s
- (D) 32.0 m/s

Q2. A particle starts with velocity 9.00 m/s and has acceleration $a(t) = 5.00 + 3.00t$, in m/s^2 . What is its velocity at $t = 4$ s?

- (A) 45.0 m/s
- (B) 60.9 m/s
- (C) 29.0 m/s
- (D) 53.0 m/s

Q3. A particle has position $x(t) = 0 + 4.00t + 0.500t^3$, in metres. What is its displacement between $t = 0$ and $t = 2$ s?

- (A) 9.00 m
- (B) 12.0 m
- (C) 15.0 m
- (D) 17.0 m

Q4. A particle moves with velocity $v(t) = 20.0 - 5.00t^2$, in m/s. At what time does it momentarily come to rest?

- (A) 1.60 s
- (B) 2.00 s
- (C) 2.50 s
- (D) 4.00 s

Q5. A particle has position $x(t) = 5.00t^3 + 2.00t$, in metres. What is its acceleration at $t = 2$ s?

- (A) 42.0 m/s^2
- (B) 78.0 m/s^2
- (C) 60.0 m/s^2
- (D) 30.0 m/s^2

Q6. A particle starts at $x = 1.00$ m with velocity 2.00 m/s and acceleration $a(t) = 2.00t$, in m/s^2 . What is its position at $t = 3$ s?

- (A) 16.0 m
- (B) 13.6 m
- (C) 18.4 m
- (D) 20.0 m

Q7. A projectile is launched with speed 30.0 m/s at 60 degrees above the horizontal. What is its maximum height? Take $g = 9.8$ m/s^2 .

- (A) 34.4 m
- (B) 27.6 m
- (C) 41.3 m
- (D) 45.9 m

Unit 2: Force and Translational Dynamics

Q8. A 12.0 kg block slides down a plane inclined at 30 degrees. The coefficient of kinetic friction is 0.100 . What is the acceleration of the block down the plane?

- (A) 3.24 m/s^2
- (B) 4.05 m/s^2
- (C) 4.86 m/s^2
- (D) 4.90 m/s^2

Q9. Two masses 3.00 kg and 6.00 kg are connected by a light string over a frictionless pulley. What is the magnitude of their acceleration?

- (A) 2.45 m/s^2
- (B) 4.25 m/s^2
- (C) 3.27 m/s^2
- (D) 4.90 m/s^2

Q10. A 2.00 kg block is pushed against a spring of constant 100 N/m, compressing it by 0.200 m, and released from rest. What is the initial acceleration of the block?

- (A) 8.00 m/s^2
- (B) 12.5 m/s^2
- (C) 20.0 m/s^2
- (D) 10.0 m/s^2

Q11. A 5.00 kg object on a frictionless surface experiences a horizontal force $F(t) = 10.0 + 5.00t$, in newtons. What is its acceleration at $t = 2$ s?

- (A) 3.40 m/s^2
- (B) 4.80 m/s^2
- (C) 4.00 m/s^2
- (D) 2.00 m/s^2

Q12. A 2.00 kg mass moves in a horizontal circle of radius 0.500 m at speed 4.00 m/s, held by a string. What is the tension in the string?

- (A) 51.2 N
- (B) 64.0 N
- (C) 80.0 N
- (D) 8.00 N

Q13. An astronaut of mass 60.0 kg is at a height of half an Earth radius above the Earth surface. What is approximately the astronaut weight there? Take $g = 9.8 \text{ m/s}^2$ at the surface.

- (A) 209 N
- (B) 261 N
- (C) 327 N
- (D) 588 N

Q14. A 10.0 kg block on a horizontal surface is pulled by a force of 100 N at 37 degrees above the horizontal. The coefficient of kinetic friction is 0.100. What is the acceleration of the block?

- (A) 7.61 m/s^2
- (B) 6.09 m/s^2
- (C) 9.51 m/s^2
- (D) 7.99 m/s^2

Q15. Two blocks of masses 4.00 kg and 10.0 kg are connected by a string on a horizontal table. The 4.00 kg block has coefficient of kinetic friction 0.100 with the table, the other block is frictionless. A horizontal force of 60.0 N pulls the system. What is the acceleration?

- (A) 3.20 m/s^2
- (B) 4.81 m/s^2
- (C) 4.29 m/s^2
- (D) 4.01 m/s^2

Q16. A 3.00 kg object is driven by a constant force of 30.0 N while experiencing a drag force bv with $b = 2.00 \text{ N}\cdot\text{s/m}$. What is its acceleration when its speed is 5.00 m/s?

- (A) 6.67 m/s^2
- (B) 5.33 m/s^2
- (C) 8.33 m/s^2
- (D) 10.0 m/s^2

Q17. A mass on a string moves in a horizontal circle of radius 25.0 m at speed 10.0 m/s, forming a conical pendulum. What angle does the string make with the vertical?

- (A) 17.8 degrees
- (B) 26.6 degrees
- (C) 22.2 degrees
- (D) 67.8 degrees

Q18. A 60.0 kg person stands on a scale in a lift accelerating upward at 2.00 m/s^2 . What is the scale reading in newtons?

- (A) 588 N
- (B) 468 N
- (C) 850 N
- (D) 708 N

- Q19. A 2.00 kg block on a frictionless surface experiences a position-dependent force $F(x) = 10.0 + 5.00x$, in newtons. What is its acceleration when $x = 4.00$ m?**
- (A) 12.0 m/s^2
 - (B) 18.8 m/s^2
 - (C) 5.00 m/s^2
 - (D) 15.0 m/s^2

Unit 3: Work, Energy, and Power

- Q20. A variable force $F(x) = 10.0 + 4.00x$, in newtons, acts on a particle as it moves from $x = 1.00$ m to $x = 4.00$ m. How much work is done by this force?**
- (A) 51.0 J
 - (B) 69.0 J
 - (C) 60.0 J
 - (D) 30.0 J

- Q21. A spring of constant 200 N/m is stretched from 0.200 m to 0.400 m beyond its natural length. How much work is done by the spring force during this stretch? Give the magnitude.**
- (A) 9.60 J
 - (B) 15.0 J
 - (C) 4.00 J
 - (D) 12.0 J

- Q22. A constant force of 50.0 N acts on an object moving at 3.00 m/s, at 0 degrees to the velocity. What is the instantaneous power delivered by the force?**
- (A) 150 W
 - (B) 120 W
 - (C) 170 W
 - (D) 188 W

- Q23. A 4.00 kg object moving at 3.00 m/s receives 40.0 J of net work. What is its final speed?**
- (A) 4.58 m/s
 - (B) 6.19 m/s
 - (C) 5.39 m/s
 - (D) 4.47 m/s

- Q24. A force $F(x) = 6.00x^2$, in newtons, acts from $x = 2.00$ m to $x = 3.00$ m. How much work does it do?**
- (A) 30.4 J
 - (B) 45.6 J
 - (C) 38.0 J
 - (D) 15.0 J

- Q25. A motor does 200 J of work in 10.0 s at a steady rate. What is its average power output?**
- (A) 16.0 W
 - (B) 20.0 W
 - (C) 25.0 W
 - (D) 2000 W

Q26. A 2.00 kg block is dropped from a height of 1.00 m above a vertical spring of constant 200 N/m. What is the maximum compression of the spring?

- (A) 0.441 m
- (B) 0.689 m
- (C) 0.443 m
- (D) 0.551 m

Q27. A 5.00 kg block slides at 10.0 m/s on a horizontal surface with coefficient of kinetic friction 0.200. What is its speed after sliding 5.00 m?

- (A) 8.97 m/s
- (B) 7.62 m/s
- (C) 10.3 m/s
- (D) 9.02 m/s

Q28. A lift of total mass 50.0 kg rises at a constant speed of 2.00 m/s. What power must the motor supply against gravity?

- (A) 784 W
- (B) 980 W
- (C) 1225 W
- (D) 100 W

Q29. An object moves at a constant speed of 2.00 m/s while a force $F(t) = 10.0 + 4.00t$, in newtons, acts in the direction of motion from $t = 0$ to $t = 3$ s. How much work is done?

- (A) 81.6 J
- (B) 96.0 J
- (C) 110 J
- (D) 60.0 J

Q30. A ball is released from rest from a height of 5.00 m (initial speed 1.00 m/s). What is its speed just before hitting the ground? Neglect air resistance.

- (A) 9.95 m/s
- (B) 8.46 m/s
- (C) 11.4 m/s
- (D) 7.00 m/s

Unit 4: Linear Momentum

Q31. A 4.00 kg object experiences a force $F(t) = 20.0 + 3.00t$, in newtons, from $t = 0$ to $t = 2$ s. If it starts from rest, what is its change in velocity?

- (A) 11.5 m/s
- (B) 9.20 m/s
- (C) 14.4 m/s
- (D) 46.0 m/s

Q32. A 4.00 kg object moving at 2.00 m/s is acted on by a constant net force of 40.0 N for 5.00 s in the direction of motion. What is its final velocity?

- (A) 44.2 m/s
- (B) 59.8 m/s
- (C) 52.0 m/s
- (D) 202 m/s

- Q33. A 2.00 kg object moving at 8.00 m/s collides elastically head-on with a 3.00 kg object moving at -2.00 m/s. What is the final velocity of the 2.00 kg object?**
- (A) -2.00 m/s
 - (B) -4.00 m/s
 - (C) -6.00 m/s
 - (D) 4.00 m/s
- Q34. A 3.00 kg object moving at 6.00 m/s collides with a 5.00 kg object moving at -3.00 m/s and they stick together. What is their common velocity?**
- (A) 1.88 m/s
 - (B) 0.375 m/s
 - (C) -1.12 m/s
 - (D) 2.25 m/s
- Q35. A stationary object of mass 10.0 kg explodes into two parts of masses 3.00 kg and 7.00 kg. The 3.00 kg part moves at 6.00 m/s. What is the velocity of the other part?**
- (A) -2.06 m/s
 - (B) -2.57 m/s
 - (C) 2.57 m/s
 - (D) 1.80 m/s
- Q36. A force pulse on a 5.00 kg object has impulse equal to the area of a triangle with peak force 80.0 N and base 4.00 s. What is the change in velocity of the object?**
- (A) 25.6 m/s
 - (B) 40.0 m/s
 - (C) 64.0 m/s
 - (D) 32.0 m/s
- Q37. A 2.00 kg object experiences a force $F(t) = 4.00t^2$, in newtons, from $t = 0$ to $t = 3$ s. What is its change in velocity if it starts from rest?**
- (A) 18.0 m/s
 - (B) 15.3 m/s
 - (C) 21.6 m/s
 - (D) 21.0 m/s
- Q38. A 1.00 kg ball hits a wall at 12.0 m/s and rebounds at -10.0 m/s. The contact time is 0.0500 s. What is the magnitude of the average force on the ball?**
- (A) 352 N
 - (B) 550 N
 - (C) 440 N
 - (D) 22.0 N

Unit 5: Torque and Rotational Dynamics

Q39. A force of 40.0 N is applied at a distance of 0.500 m from a pivot, at 60 degrees to the lever arm. What is the magnitude of the torque about the pivot?

- (A) 13.9 N·m
- (B) 17.3 N·m
- (C) 21.7 N·m
- (D) 20.0 N·m

Q40. A uniform rod of mass 4.00 kg and length 2.00 m is pivoted at one end. A torque of 18.0 N·m is applied about the pivot. What is the angular acceleration?

- (A) 3.38 rad/s²
- (B) 2.70 rad/s²
- (C) 4.22 rad/s²
- (D) 1.12 rad/s²

Q41. A hanging mass of 4.00 kg is attached to a string wound around a solid disk pulley of mass 2.00 kg and radius 0.200 m. What is the acceleration of the hanging mass?

- (A) 6.66 m/s²
- (B) 9.02 m/s²
- (C) 7.84 m/s²
- (D) 9.80 m/s²

Q42. A wheel has angular acceleration $\alpha(t) = 2.00 + 2.00t$, in rad/s², and initial angular velocity 1.00 rad/s. What is its angular velocity at $t = 3$ s?

- (A) 13.6 rad/s
- (B) 18.4 rad/s
- (C) 7.00 rad/s
- (D) 16.0 rad/s

Q43. A uniform rod of mass 8.00 kg and length 1.00 m has moment of inertia $(1/12)ML^2$ about its centre. What is its moment of inertia about a parallel axis 0.500 m from the centre?

- (A) 2.67 kg·m²
- (B) 2.13 kg·m²
- (C) 3.33 kg·m²
- (D) 0.667 kg·m²

Q44. A uniform rod of mass 6.00 kg and length 2.00 m is pivoted at one end and held at 60 degrees above the horizontal, then released. What is its initial angular acceleration?

- (A) 2.94 rad/s²
- (B) 4.59 rad/s²
- (C) 4.90 rad/s²
- (D) 3.68 rad/s²

Q45. Two torques of 10.0 N·m and 6.00 N·m act in opposite directions on a wheel of moment of inertia 4.00 kg·m². What is the angular acceleration of the wheel?

- (A) 0.800 rad/s²
- (B) 1.25 rad/s²
- (C) 1.00 rad/s²
- (D) 2.50 rad/s²

- Q46. A thin rod of length 2.00 m has uniform linear mass density 4.00 kg/m. What is its moment of inertia about an axis through one end, perpendicular to the rod?**
- (A) $10.7 \text{ kg}\cdot\text{m}^2$
 - (B) $8.53 \text{ kg}\cdot\text{m}^2$
 - (C) $13.3 \text{ kg}\cdot\text{m}^2$
 - (D) $32.0 \text{ kg}\cdot\text{m}^2$

Unit 6: Energy and Momentum of Rotating Systems

- Q47. A flywheel with moment of inertia $4.00 \text{ kg}\cdot\text{m}^2$ rotates at 5.00 rad/s. What is its rotational kinetic energy?**

- (A) 40.0 J
- (B) 62.5 J
- (C) 100 J
- (D) 50.0 J

- Q48. A rotating disk of moment of inertia $2.00 \text{ kg}\cdot\text{m}^2$ spinning at 8.00 rad/s drops a second disk of moment of inertia $2.00 \text{ kg}\cdot\text{m}^2$ onto it, and they rotate together. What is their final angular speed?**

- (A) 3.20 rad/s
- (B) 5.00 rad/s
- (C) 4.00 rad/s
- (D) 8.00 rad/s

- Q49. A satellite orbits Earth at a distance of 6.50 million metres from Earth centre. What is its orbital speed in km/s? Use $GM \text{ for Earth} = 3.986 \times 10^{14} \text{ m}^3/\text{s}^2$.**

- (A) 6.66 km/s
- (B) 9.01 km/s
- (C) 7.83 km/s
- (D) 11.1 km/s

- Q50. A satellite orbits Earth at radius 7.50 million metres from Earth centre. What is its orbital period in minutes? Use $GM = 3.986 \times 10^{14} \text{ m}^3/\text{s}^2$.**

- (A) 91.6 minutes
- (B) 124 minutes
- (C) 108 minutes
- (D) 215 minutes

- Q51. What is the escape speed from Earth at a distance of 12.0 million metres from Earth centre, in km/s? Use $GM = 3.986 \times 10^{14} \text{ m}^3/\text{s}^2$.**

- (A) 8.15 km/s
- (B) 6.93 km/s
- (C) 5.76 km/s
- (D) 9.78 km/s

Q52. A 4.00 kg mass falls 2.00 m, unwinding a string from a solid disk pulley of mass 4.00 kg and radius 0.200 m. What is the angular speed of the pulley just as the mass has fallen 2.00 m, starting from rest?

- (A) 21.7 rad/s
- (B) 29.4 rad/s
- (C) 31.3 rad/s
- (D) 25.6 rad/s

Q53. A 5.00 kg particle moves at 6.00 m/s in a circle of radius 3.00 m. What is the magnitude of its angular momentum about the centre?

- (A) 72.0 kg·m²/s
- (B) 112 kg·m²/s
- (C) 90.0 kg·m²/s
- (D) 30.0 kg·m²/s

Unit 7: Oscillations

Q54. A 1.00 kg mass on a spring of constant 50.0 N/m oscillates in simple harmonic motion. What is its period?

- (A) 0.889 s
- (B) 0.755 s
- (C) 1.02 s
- (D) 44.4 s

Q55. A simple pendulum of length 1.00 m oscillates with small amplitude. What is its period? Take $g = 9.8 \text{ m/s}^2$.

- (A) 2.01 s
- (B) 1.71 s
- (C) 2.31 s
- (D) 19.7 s

Q56. A mass-spring system with mass 2.00 kg and spring constant 100 N/m oscillates with amplitude 0.200 m. What is its maximum speed?

- (A) 1.13 m/s
- (B) 1.41 m/s
- (C) 1.77 m/s
- (D) 0.200 m/s

Q57. A mass-spring oscillator has amplitude 0.300 m, mass 2.00 kg and spring constant 50.0 N/m. What is its speed when its displacement is 0.100 m?

- (A) 1.20 m/s
- (B) 1.63 m/s
- (C) 1.50 m/s
- (D) 1.41 m/s

Q58. A 2.00 kg mass on a spring of constant 40.0 N/m is displaced 0.100 m from equilibrium. What is the magnitude of its acceleration at that instant?

- (A) 1.60 m/s²
- (B) 2.50 m/s²
- (C) 4.00 m/s²
- (D) 2.00 m/s²

Q59. A pendulum of length 1.00 m has period 2.01 s. If its length is increased to 2.00 m, what is its new period?

- (A) 2.41 s
- (B) 2.84 s
- (C) 3.26 s
- (D) 4.01 s

Q60. A 3.00 kg mass is attached to two springs in parallel with constants 40.0 N/m and 70.0 N/m. What is the frequency of oscillation?

- (A) 0.819 Hz
- (B) 0.964 Hz
- (C) 1.11 Hz
- (D) 0.581 Hz

Answer Key

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

Worked explanations for all 60 questions:

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