

AP Physics C: Mechanics Practice Test 7

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 projectile is launched at 20 m/s at 60° above the horizontal. What is its speed at $t = 3$ s? Take $g = 9.8 \text{ m/s}^2$.

- (A) 15.7 m/s
- (B) 18.8 m/s
- (C) 22.6 m/s
- (D) 20 m/s

Q2. A particle has velocity $v(t) = 6t - 2t^2$ m/s. What is its displacement from $t = 0$ until it first comes to rest again (apart from $t = 0$)?

- (A) 4.5 m
- (B) 18 m
- (C) 27 m
- (D) 9 m

Q3. A glider experiences acceleration $a = -0.5v$, where v is its velocity in m/s. It starts at 12 m/s. How far does it travel in the first 1 s?

- (A) 12 m
- (B) 13.2 m
- (C) 24 m
- (D) 9.44 m

Q4. Two runners start from opposite ends of a straight track. Runner A has position $x_A = 1t^2$ m and runner B has position $x_B = 60 - 10t$ m, measured from A's start. At what time do they meet?

- (A) 7.75 s
- (B) 6.33 s
- (C) 6 s
- (D) 4.22 s

Q5. A sled starts from rest with acceleration $a(t) = 4 + 3t \text{ m/s}^2$. How far does it travel in the first 3 s?

- (A) 18 m
- (B) 49.5 m
- (C) 15.8 m
- (D) 31.5 m

Q6. A particle moves along the x-axis with velocity $v(t) = 1 + 2t + 3t^2$ m/s, where t is in seconds. What is its displacement between $t = 2$ s and $t = 5$ s?

- (A) 70.5 m
- (B) 141 m
- (C) 212 m
- (D) 155 m

Q7. A cart starts with velocity 2 m/s and has acceleration $a(t) = 2 + 3t$ m/s². What is its velocity at $t = 4$ s?

- (A) 51 m/s
- (B) 10 m/s
- (C) 34 m/s
- (D) 58 m/s

Unit 2: Force and Translational Dynamics

Q8. A 4 kg object experiences a time-varying force $F(t) = 20 + 2t$ N. What is its acceleration at $t = 2$ s?

- (A) 6 m/s²
- (B) 3 m/s²
- (C) 5 m/s²
- (D) 7 m/s²

Q9. A 2 kg mass hangs at rest from a vertical spring of constant 200 N/m. By how much is the spring stretched from its natural length?

- (A) 0.196 m
- (B) 0.098 m
- (C) 0.01 m
- (D) 0.049 m

Q10. A car travels on a flat circular bend of radius 20 m. The coefficient of static friction is 0.6. What is the maximum speed without slipping?

- (A) 16.3 m/s
- (B) 14 m/s
- (C) 10.8 m/s
- (D) 7.67 m/s

Q11. A road is banked so that a car at 25 m/s can round a curve of radius 80 m with no sideways friction. What banking angle is required?

- (A) 57.8°
- (B) 51.4°
- (C) 38.6°
- (D) 19.3°

Q12. A planet has mass 4 times Earth's mass and radius 1 times Earth's radius. What is the gravitational field strength at its surface? (Earth's $g = 9.8$ m/s².)

- (A) 44.3 m/s²
- (B) 39.2 m/s²
- (C) 50.1 m/s²
- (D) 9.8 m/s²

Q13. A 60 kg person stands on a scale in a lift accelerating upwards at 2 m/s^2 . What is the scale reading (normal force)?

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

Q14. A 4 kg crate on a rough floor ($\mu_k = 0.2$) is pushed by a horizontal force of 40 N. What is its acceleration?

- (A) 8.04 m/s^2
- (B) 10 m/s^2
- (C) 12 m/s^2
- (D) 4.02 m/s^2

Q15. A 2 kg bob on a string of length 0.8 m swings in a horizontal circle with the string at 30° to the vertical. What is the tension in the string?

- (A) 22.6 N
- (B) 19.6 N
- (C) 33.9 N
- (D) 17 N

Q16. A 3 kg object falls through air with drag force $0.5v \text{ N}$, where v is in m/s . What is its acceleration when its speed is 5 m/s ?

- (A) 0.833 m/s^2
- (B) 13.4 m/s^2
- (C) 9.8 m/s^2
- (D) 8.97 m/s^2

Q17. Two blocks 4 kg and 3 kg connected by a light string rest on a frictionless table. A horizontal force of 40 N pulls the 4 kg block. What is the tension in the string?

- (A) 40 N
- (B) 22.9 N
- (C) 17.1 N
- (D) 34.3 N

Q18. A 0.5 kg mass moves in a horizontal circle of radius 0.5 m at speed 4 m/s , held by a string. What is the tension in the string?

- (A) 32 N
- (B) 16 N
- (C) 4 N
- (D) 8 N

Q19. A 5 kg block slides down a rough incline at 45° to the horizontal. The coefficient of kinetic friction is 0.1. What is its acceleration down the slope?

- (A) 6.24 m/s^2
- (B) 7.62 m/s^2
- (C) 3.12 m/s^2
- (D) 6.93 m/s^2

Unit 3: Work, Energy, and Power

- Q20. A net work of 100 J is done on a 4 kg object initially moving at 0 m/s. What is its final speed?**
- (A) 7.99 m/s
 - (B) 7.07 m/s
 - (C) 10.6 m/s
 - (D) 25 m/s
- Q21. A constant force of 20 N pushes an object in the direction of its motion at 4 m/s. What power is delivered?**
- (A) 160 W
 - (B) 24 W
 - (C) 80 W
 - (D) 40 W
- Q22. An object is dropped from rest from a height of 30 m. Ignoring air resistance, what is its speed just before hitting the ground?**
- (A) 12.1 m/s
 - (B) 294 m/s
 - (C) 17.1 m/s
 - (D) 24.2 m/s
- Q23. A small bead slides on a frictionless vertical loop of radius 2.5 m. What is the minimum speed it must have at the top of the loop to stay in contact?**
- (A) 7.83 m/s
 - (B) 7 m/s
 - (C) 9.9 m/s
 - (D) 4.95 m/s
- Q24. A 3 kg block attached to a spring ($k = 100 \text{ N/m}$) is released from rest when the spring is compressed 0.2 m. What is its maximum speed?**
- (A) 0.577 m/s
 - (B) 1.15 m/s
 - (C) 5.77 m/s
 - (D) 6.67 m/s
- Q25. A 4 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) 39.2 J
 - (B) 4 J
 - (C) 19.6 J
 - (D) 196 J
- Q26. A motor lifts a 80 kg load through a height of 10 m in 10 s at constant speed. What is the average power output?**
- (A) 392 W
 - (B) 784 W
 - (C) $7.84 \times 10^3 \text{ W}$
 - (D) 80 W

Q27. A force $F(x) = 25 \cos(\pi x/(2 \times 4))$ N, where x is in metres, acts from $x = 0$ to $x = 4$ m. How much work is done? Use $\pi = 3.14$.

- (A) 100 J
- (B) 127 J
- (C) 31.8 J
- (D) 63.7 J

Q28. A 2 kg block starts down a frictionless incline at 6 m/s and descends a vertical height of 5 m. What is its speed at the bottom?

- (A) 5.79 m/s
- (B) 9.9 m/s
- (C) 11.6 m/s
- (D) 15.9 m/s

Q29. A force $F(x) = 20 + 4x$ N acts on a particle as it moves from $x = 1$ m to $x = 3$ m along the x -axis. How much work is done?

- (A) 40 J
- (B) 56 J
- (C) 28 J
- (D) 72 J

Q30. A variable force $F(x) = 6x^2$ N moves an object from $x = 2$ m to $x = 4$ m. What work is done?

- (A) 36 J
- (B) 112 J
- (C) 56 J
- (D) 336 J

Unit 4: Linear Momentum

Q31. A 3 kg cart at 4 m/s catches up and sticks to a 4 kg cart moving at 3 m/s in the same direction. What is their common velocity?

- (A) 5.14 m/s
- (B) 3.43 m/s
- (C) 0 m/s
- (D) 1.71 m/s

Q32. A 0.01 kg bullet at 200 m/s embeds in a 2 kg wooden block hanging as a pendulum. How high does the block rise?

- (A) 0.0505 m
- (B) 0.114 m
- (C) 0.101 m
- (D) 10.2 m

Q33. An object at rest explodes into a 1 kg fragment moving at 4 m/s and a 3 kg fragment. What is the speed of the second fragment?

- (A) 1.33 m/s
- (B) 4 m/s
- (C) 2.67 m/s
- (D) 12 m/s

Q34. Two masses 2 kg at $x = 1$ m and 6 kg at $x = 4$ m lie on the x -axis. Where is their centre of mass?

- (A) 2 m
- (B) 13 m
- (C) 3.25 m
- (D) 4.88 m

Q35. A 1 kg ball hits a wall at 10 m/s and rebounds at 20 m/s in the opposite direction. What is the magnitude of the impulse from the wall?

- (A) 30 N·s
- (B) 10 N·s
- (C) 11.3 N·s
- (D) 15 N·s

Q36. A force $F(t) = 30 \sin(\pi t/2)$ N acts from $t = 0$ to $t = 2$ s. What impulse does it deliver? Use $\pi = 3.14$.

- (A) 21.6 N·s
- (B) 38.2 N·s
- (C) 60 N·s
- (D) 19.1 N·s

Q37. A constant force of 20 N acts for 2 s on a 3 kg object already moving at 5 m/s in the force direction. What is its final speed?

- (A) 11.7 m/s
- (B) 9.17 m/s
- (C) 18.3 m/s
- (D) 45 m/s

Q38. A force $F(t) = 20 + 5t$ N acts on an object from $t = 0$ to $t = 4$ s. What impulse does it deliver?

- (A) 80 N·s
- (B) 60 N·s
- (C) 120 N·s
- (D) 160 N·s

Unit 5: Torque and Rotational Dynamics

Q39. 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 0.5 m from the centre?

- (A) $0.753 \text{ kg}\cdot\text{m}^2$
- (B) $0.667 \text{ kg}\cdot\text{m}^2$
- (C) $1.33 \text{ kg}\cdot\text{m}^2$
- (D) $0.167 \text{ kg}\cdot\text{m}^2$

Q40. A net torque of $20 \text{ N}\cdot\text{m}$ acts on a body with moment of inertia $2 \text{ kg}\cdot\text{m}^2$. What is its angular acceleration?

- (A) 20 rad/s^2
- (B) 40 rad/s^2
- (C) 10 rad/s^2
- (D) 5 rad/s^2

Q41. A 1 kg particle moves at 3 m/s at a perpendicular distance 0.5 m from a point. What is its angular momentum about that point?

- (A) $3 \text{ kg}\cdot\text{m}^2/\text{s}$
- (B) $0.75 \text{ kg}\cdot\text{m}^2/\text{s}$
- (C) $1.5 \text{ kg}\cdot\text{m}^2/\text{s}$
- (D) $3.39 \text{ kg}\cdot\text{m}^2/\text{s}$

Q42. A flywheel with $I = 4 \text{ kg}\cdot\text{m}^2$ spins at 12 rad/s. A constant opposing torque of 2 N·m is applied. How long until it stops?

- (A) 24 s
- (B) 12 s
- (C) 48 s
- (D) 6 s

Q43. A uniform rod of mass 4 kg and length 1 m is pivoted at one end and held at 90° to the vertical. What torque does gravity exert about the pivot?

- (A) 39.2 N·m
- (B) 19.6 N·m
- (C) 22.1 N·m
- (D) 9.8 N·m

Q44. A tangential force of 30 N is applied at the rim of a wheel of radius 0.4 m and moment of inertia $4 \text{ kg}\cdot\text{m}^2$. What is the wheel's angular acceleration?

- (A) 7.5 rad/s^2
- (B) 12 rad/s^2
- (C) 1.5 rad/s^2
- (D) 3 rad/s^2

Q45. A disk starts with angular velocity 0 rad/s and constant angular acceleration 2 rad/s^2 . Through what angle does it rotate in 5 s?

- (A) 25 rad
- (B) 50 rad
- (C) 12.5 rad
- (D) 56.5 rad

Q46. A force of 20 N is applied at a distance 2 m from a pivot, at 60° to the lever arm. What is the torque about the pivot?

- (A) 69.3 N·m
- (B) 40 N·m
- (C) 20 N·m
- (D) 34.6 N·m

Unit 6: Energy and Momentum of Rotating Systems

Q47. What is the orbital period, in hours, of a satellite at radius 42000 km from Earth's centre? ($GM_{\text{Earth}} = 3.99 \times 10^{14} \text{ m}^3/\text{s}^2$.)

- (A) 47.6 hours
- (B) 11.9 hours
- (C) 23.8 hours
- (D) 35.7 hours

Q48. A planet has mass 3 times Earth's mass and radius 2 times Earth's radius. What is its escape velocity if Earth's is 11.2 km/s?

- (A) 19.4 km/s
- (B) 5.6 km/s
- (C) 6.86 km/s
- (D) 13.7 km/s

Q49. A 500 kg satellite orbits at radius 8000 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) 24.9 GJ
- (B) 12.5 GJ
- (C) 18.7 GJ
- (D) 6.23 GJ

Q50. A 150 kg satellite moves from radius 7000 km to radius 21000 km from Earth's centre. By how much does its gravitational potential energy change, in MJ?

- (A) 1.14e+04 MJ
- (B) 2.85e+03 MJ
- (C) 6.83e+03 MJ
- (D) 5.69e+03 MJ

Q51. A 2 kg mass falls 5 m while unwinding a string from a pulley ($I = 2 \text{ kg}\cdot\text{m}^2$, radius 0.5 m). What is its speed at the end, ignoring friction?

- (A) 9.9 m/s
- (B) 6.64 m/s
- (C) 4.43 m/s
- (D) 2.21 m/s

Q52. Planet A orbits a star with period 2 years. Planet B orbits the same star at 8 times A's orbital radius. What is B's period?

- (A) 45.3 years
- (B) 128 years
- (C) 22.6 years
- (D) 16 years

Q53. A body with moment of inertia $2 \text{ kg}\cdot\text{m}^2$ rotates at 8 rad/s. What is its rotational kinetic energy?

- (A) 64 J
- (B) 128 J
- (C) 145 J
- (D) 8 J

Unit 7: Oscillations

Q54. A 1 kg mass on a spring ($k = 200 \text{ N/m}$) oscillates with amplitude 0.2 m. What is its speed when its displacement is 0.1 m?

- (A) 2.83 m/s
- (B) 2.45 m/s
- (C) 1.41 m/s
- (D) 1.22 m/s

Q55. A particle in SHM obeys $d^2x/dt^2 = -5^2x$. What is the magnitude of its acceleration when its displacement is 0.2 m?

- (A) 2.5 m/s^2
- (B) 1 m/s^2
- (C) 10 m/s^2
- (D) 5 m/s^2

Q56. A 1 kg mass on a spring oscillates with period 2 s. What is the spring constant?

- (A) 9.87 N/m
- (B) 158 N/m
- (C) 4.93 N/m
- (D) 2.47 N/m

Q57. A particle in SHM has $x(t) = 0.3 \cos(3t)$ m. What is its position at $t = 1$ s?

- (A) 0.288 m
- (B) 0.297 m
- (C) 0.0423 m
- (D) -0.297 m

Q58. A pendulum of length 3 m has period 3.48 s. If its length is multiplied by 4, what is its new period?

- (A) 3.93 s
- (B) 13.9 s
- (C) 6.95 s
- (D) 3.48 s

Q59. Two springs of constants 200 N/m and 200 N/m act in parallel on a 1 kg mass. What is the period of oscillation?

- (A) 0.71 s
- (B) 0.444 s
- (C) 0.314 s
- (D) 0.628 s

Q60. A mass oscillates with $x(t) = 0.2 \cos(5t)$ m. What is its maximum speed?

- (A) 1 m/s
- (B) 0.04 m/s
- (C) 2 m/s
- (D) 5 m/s

Answer Key

Q1: A	Q11: C	Q21: C	Q31: B	Q41: C	Q51: C
Q2: D	Q12: B	Q22: D	Q32: A	Q42: A	Q52: A
Q3: D	Q13: D	Q23: D	Q33: A	Q43: B	Q53: A
Q4: D	Q14: A	Q24: B	Q34: C	Q44: D	Q54: B
Q5: D	Q15: A	Q25: A	Q35: A	Q45: A	Q55: D
Q6: B	Q16: D	Q26: B	Q36: B	Q46: D	Q56: A

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

Worked explanations for all 60 questions:

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