

AP Physics 1 2025-Style Full Practice Exam

2025-style revised-course practice exam

Original practice paper. Every question in this PDF was written for Salar Cafe. It does not reproduce official AP exam wording. Models the revised 2025 structure: 40 MCQs in 80 minutes and 4 FRQs in 100 minutes.

Section I	40 multiple-choice questions - 80 minutes - 50%
Section II	4 free-response questions - 100 minutes - 50%
Calculator	Scientific or graphing calculator may be used for this practice paper.
Scoring	MCQ answer key and explanations plus FRQ scoring guidance are included after the exam.
Use	Complete the exam first. Do not consult the answer key until both sections are finished.

Topic emphasis

Momentum/energy; ramp-spring energy; torque experiment; buoyancy and Newton second law.

SECTION I - Multiple Choice

40 questions | 80 minutes | Choose the best answer for each question.

1. A 1.5 kg cart moving at 2.0 m/s collides with and sticks to a stationary 2.0 kg cart. What is their common speed immediately after the collision?
 - A. 1.71 m/s
 - B. 2.00 m/s
 - C. 0.86 m/s
 - D. 0.43 m/s
2. A spring of constant 100 N/m is compressed by 0.20 m. How much elastic potential energy is stored?
 - A. 4.00 J
 - B. 2.00 J
 - C. 20.00 J
 - D. 10.00 J
3. A 1.0 kg object starts from rest and drops through a vertical height of 1.5 m with negligible friction. What is its speed after the drop?
 - A. 29.4 m/s
 - B. 5.4 m/s
 - C. 3.8 m/s
 - D. 14.7 m/s
4. A force of 15 N is applied at radius 0.40 m from a pivot, making 90 degrees with the radius. What is the torque magnitude about the pivot?
 - A. 6.0 N m
 - B. 0.0 N m
 - C. 7.5 N m
 - D. 37.5 N m
5. An object displaces 0.0015 m^3 of a fluid with density 800 kg/m^3 . What buoyant force acts on it?
 - A. 5226666.7 N
 - B. 0.015 N
 - C. 1.2 N
 - D. 11.8 N
6. In a liquid of density 1200 kg/m^3 , what is the gauge-pressure increase 2.5 m below the surface?
 - A. 29.4 kPa
 - B. 3.0 kPa
 - C. 0.02 kPa
 - D. 4.7 kPa

7. A 1.0 kg block slides on a horizontal surface with coefficient of kinetic friction 0.15. What is the kinetic-friction force?
- A. 0.15 N
 - B. 9.8 N
 - C. 2.9 N
 - D. 1.5 N
8. A rigid body with rotational inertia 0.25 kg m^2 experiences a net torque of 2.5 N m . What is its angular acceleration?
- A. 0.10 rad/s^2
 - B. 0.6 rad/s^2
 - C. 10.0 rad/s^2
 - D. 5.0 rad/s^2
9. A cart starts from rest and reaches 15 m/s in 5 s with constant acceleration. What is the magnitude of its acceleration?
- A. 3.0 m/s^2
 - B. 1.5 m/s^2
 - C. 75.0 m/s^2
 - D. 20.0 m/s^2
10. A ball rolls horizontally from a table 0.8 m high with speed 2.0 m/s . Neglect air resistance. Approximately how far from the table does it land?
- A. 0.6 m
 - B. 1.6 m
 - C. 0.2 m
 - D. 0.8 m

11. A velocity-time graph is a straight line from 2 m/s at $t = 0$ to 2 m/s at $t = 6$ s. What is the displacement during the interval?
- A. -1.0 m
 - B. 15.0 m
 - C. 0.0 m
 - D. 12.0 m
12. A net horizontal force of 12 N acts on a 1.5 kg object. What is the object's acceleration?
- A. 18.0 m/s^2
 - B. 0.12 m/s^2
 - C. 8.0 m/s^2
 - D. -1.8 m/s^2
13. A 2.5 kg block slides on a horizontal surface with coefficient of kinetic friction 0.15. What is the kinetic-friction force?
- A. 7.4 N
 - B. 24.5 N
 - C. 0.38 N
 - D. 3.7 N
14. A 0.50 kg object moves in a horizontal circle of radius 1.0 m at speed 3.0 m/s. What is the required inward net force?
- A. 4.5 N
 - B. 1.9 N
 - C. 0.06 N
 - D. 1.5 N
15. A spring with $k = 40 \text{ N/m}$ is stretched 0.10 m from equilibrium. Which best describes the spring force on the attached object?
- A. 400.0 N opposite the displacement
 - B. 0.2 N opposite the displacement
 - C. 4.0 N in the direction of displacement
 - D. 4.0 N opposite the displacement
16. A 1.0 kg object starts from rest and drops through a vertical height of 0.8 m with negligible friction. What is its speed after the drop?
- A. 15.7 m/s
 - B. 2.8 m/s
 - C. 4.0 m/s
 - D. 7.8 m/s

17. A constant force of 12 N pulls an object 2.0 m. The force makes an angle of 30 degrees with the displacement. How much work does the force do?

- A. 6.0 J
- B. 20.8 J
- C. 12.0 J
- D. 24.0 J

18. A motor does 240 J of work in 4.0 s. What is its average power output?

- A. 30.0 W
- B. 60.0 W
- C. 960.0 W
- D. 0.017 W

19. A spring of constant 100 N/m is compressed by 0.15 m. How much elastic potential energy is stored?

- A. 1.12 J
- B. 2.25 J
- C. 15.00 J
- D. 7.50 J

20. A 0.5 kg cart moving at 2.0 m/s collides with and sticks to a stationary 0.5 kg cart. What is their common speed immediately after the collision?

- A. 2.00 m/s
- B. 2.50 m/s
- C. 0.50 m/s
- D. 1.00 m/s

- 21.** A 0.50 kg ball changes velocity from -2.0 m/s to -1.0 m/s along the x-axis. What is the x-component of the impulse on the ball?
- A. 0.5 N s
 - B. 2.0 N s
 - C. -1.5 N s
 - D. 0.5 J
- 22.** A constant force of 20 N acts for 0.20 s. What impulse is delivered?
- A. 20.2 N s
 - B. 100.0 N s
 - C. 4.0 N s
 - D. 2.0 N s
- 23.** A force of 12 N is applied at radius 0.20 m from a pivot, making 30 degrees with the radius. What is the torque magnitude about the pivot?
- A. 2.4 N m
 - B. 60.0 N m
 - C. 1.2 N m
 - D. 2.1 N m
- 24.** A rigid body with rotational inertia 0.30 kg m^2 experiences a net torque of 1.5 N m. What is its angular acceleration?
- A. 0.20 rad/s^2
 - B. 5.0 rad/s^2
 - C. 2.5 rad/s^2
 - D. 0.4 rad/s^2
- 25.** An object rolls without slipping down an incline at 30 degrees. Its rotational inertia is $I = 0.67MR^2$. What is its center-of-mass acceleration?
- A. 4.90 m/s^2
 - B. 2.93 m/s^2
 - C. 5.08 m/s^2
 - D. 8.18 m/s^2
- 26.** A wheel starts from rest with constant angular acceleration 2.0 rad/s^2 . What is its angular speed after 5.0 s?
- A. 10.0 rad/s
 - B. 25.0 rad/s
 - C. 50.0 rad/s
 - D. 0.4 rad/s

27. A 0.50 kg mass oscillates on an ideal spring with $k = 80 \text{ N/m}$. What is the period?
- A. 79.48 s
 - B. 0.50 s
 - C. 0.08 s
 - D. 0.04 s
28. An ideal spring-mass oscillator has spring constant 50 N/m and amplitude 0.12 m . What is the total mechanical energy?
- A. 0.36 J
 - B. 0.72 J
 - C. 6.00 J
 - D. 3.00 J
29. An ideal small-angle pendulum is moved to a planet where gravitational field strength is 1.44 times Earth's value. Its length is unchanged. What is the new period relative to its Earth period?
- A. 1.44 times the Earth period
 - B. 0.83 times the Earth period
 - C. 1.20 times the Earth period
 - D. 0.69 times the Earth period
30. In a liquid of density 1000 kg/m^3 , what is the gauge-pressure increase 1.0 m below the surface?
- A. 1.0 kPa
 - B. 12.2 kPa
 - C. 9.8 kPa
 - D. 0.01 kPa

31. An object displaces 0.0015 m^3 of a fluid with density 800 kg/m^3 . What buoyant force acts on it?
- A. 5226666.7 N
 - B. 1.2 N
 - C. 0.015 N
 - D. 11.8 N
32. Water flows steadily through a pipe. The radius decreases from 5.0 cm to 1.0 cm. If the speed in the wider section is 2.0 m/s, what is the speed in the narrower section?
- A. 2.0 m/s
 - B. 10.0 m/s
 - C. 0.1 m/s
 - D. 50.0 m/s
33. A sample has mass 0.25 kg and volume 300 cm^3 . What is its density in SI units?
- A. 833 kg/m^3
 - B. 0.83 kg/m^3
 - C. 8333 kg/m^3
 - D. 0.001 kg/m^3
34. The distance from a planet's center to a satellite is increased from r to $2r$ while the planet mass stays fixed. How does the gravitational force magnitude change?
- A. four times as large
 - B. one-fourth as large
 - C. one-half as large
 - D. twice as large
35. A 2.0 kg cart moving at 2.0 m/s collides with and sticks to a stationary 2.0 kg cart. What is their common speed immediately after the collision?
- A. 2.00 m/s
 - B. 1.00 m/s
 - C. 0.50 m/s
 - D. 2.50 m/s
36. A spring of constant 40 N/m is compressed by 0.10 m. How much elastic potential energy is stored?
- A. 0.40 J
 - B. 4.00 J
 - C. 2.00 J
 - D. 0.20 J

- 37.** A 2.0 kg object starts from rest and drops through a vertical height of 1.0 m with negligible friction. What is its speed after the drop?
- A. 4.4 m/s
 - B. 3.1 m/s
 - C. 9.8 m/s
 - D. 19.6 m/s
- 38.** A force of 15 N is applied at radius 0.20 m from a pivot, making 60 degrees with the radius. What is the torque magnitude about the pivot?
- A. 1.5 N m
 - B. 3.0 N m
 - C. 2.6 N m
 - D. 75.0 N m
- 39.** An object displaces 0.0010 m^3 of a fluid with density 1200 kg/m^3 . What buoyant force acts on it?
- A. 11.8 N
 - B. 1.2 N
 - C. 0.010 N
 - D. 11760000.0 N
- 40.** In a liquid of density 1200 kg/m^3 , what is the gauge-pressure increase 0.5 m below the surface?
- A. 0.6 kPa
 - B. 0.00 kPa
 - C. 5.9 kPa
 - D. 23.5 kPa

SECTION II - Free Response

4 questions | 100 minutes | Show reasoning, equations, units, graphs, and experimental logic when requested.

Question types: Mathematical Routines; Translation Between Representations; Experimental Design and Analysis; Qualitative/Quantitative Translation.

Question 1 - Mathematical Routines: Momentum and energy in a cart collision (10 points)

A. A cart of mass M moving at speed v receives a block of mass $M/4$ dropped vertically onto it. The block sticks. Determine the cart-block horizontal speed immediately after the collision.

B. Sketch the horizontal momentum of the cart-block system as a function of time before, during and after the collision, neglecting external horizontal impulse.

C. Determine the fraction of the initial horizontal kinetic energy remaining after the collision.

D. Explain why horizontal momentum can be conserved while mechanical energy decreases.

Question 2 - Translation Between Representations: Ramp and spring energy (12 points)

A. A block of mass m starts from rest a distance $8D$ up a frictionless incline and first contacts an uncompressed spring at position $6D$. It momentarily stops after compressing the spring by $4D$. Draw qualitative kinetic, gravitational and spring-energy bar charts at release, first contact, and maximum compression.

B. Starting from conservation of energy, derive an expression relating k to m , g , the incline angle θ and D .

C. Sketch the kinetic energy versus position from release to maximum compression.

D. Explain why the block speed reaches a maximum after the spring first begins to compress rather than exactly at first contact.

Question 3 - Experimental Design and Analysis: Torque and unknown mass (10 points)

A. A meterstick pivots at its center. A block of unknown mass can hang from holes at different distances on one side. A spring scale pulls at the other end. Design measurements that produce a linear graph whose slope can determine the block mass.

B. State the torque-equilibrium equation for one trial.

C. Describe a valid linearization and identify the slope in terms of the unknown mass and known constants.

D. Describe one procedural step that reduces uncertainty in the mass determination.

Question 4 - Qualitative/Quantitative Translation: Buoyancy and acceleration (8 points)

A. A fully submerged block of mass m and volume V is released in a fluid of density ρ . Neglect drag. Draw and label the forces on the block.

B. Derive the block acceleration immediately after release, taking upward as positive.

C. The same block is released in a denser fluid. Compare the initial acceleration and justify physically.

ANSWER KEY - Section I

1. C - Momentum Momentum conservation gives $m_1 v_1 = (m_1 + m_2) v_f$, so $v_f = 0.86 \text{ m/s}$.	2. B - Energy $U_s = 1/2 kx^2 = 2.00 \text{ J}$.
3. B - Energy Conservation of energy: $mgh = 1/2 mv^2$, so $v = \sqrt{2gh} = 5.4 \text{ m/s}$. Mass cancels.	4. A - Rotation Torque magnitude is $\tau = rF \sin(\theta) = 6.0 \text{ N m}$.
5. D - Fluids Archimedes principle: $F_B = \rho g V = 11.8 \text{ N}$.	6. A - Fluids $\Delta P = \rho g h = 29.4 \text{ kPa}$.
7. D - Forces $F_k = \mu_k N = \mu_k mg = 0.15(1.0)(9.8) = 1.5 \text{ N}$.	8. C - Rotation Rotational Newton second law: $\tau_{\text{net}} = I \alpha$, so $\alpha = \tau/I = 10.0 \text{ rad/s}^2$.
9. A - Kinematics For constant acceleration, $a = \Delta v / \Delta t = 15/5 = 3.0 \text{ m/s}^2$.	10. D - Kinematics Fall time is $\sqrt{2h/g} = 0.40 \text{ s}$, so horizontal range is $v_x t = 0.8 \text{ m}$.
11. D - Kinematics Displacement equals area under v-t graph: average velocity times time = $(2+2)/2 \times 6 = 12.0 \text{ m}$.	12. C - Forces Newton second law gives $a = F_{\text{net}}/m = 12/1.5 = 8.0 \text{ m/s}^2$.
13. D - Forces $F_k = \mu_k N = \mu_k mg = 0.15(2.5)(9.8) = 3.7 \text{ N}$.	14. A - Forces $F_c = mv^2/r = 4.5 \text{ N}$.
15. D - Forces Hooke law gives $F_s = -kx$. Magnitude is $40(0.10) = 4.0 \text{ N}$ and direction is toward equilibrium.	16. C - Energy Conservation of energy: $mgh = 1/2 mv^2$, so $v = \sqrt{2gh} = 4.0 \text{ m/s}$. Mass cancels.
17. B - Energy $W = Fd \cos(\theta) = 12(2.0)\cos(30) = 20.8 \text{ J}$.	18. B - Energy Average power is work divided by time: $P = W/t = 60.0 \text{ W}$.
19. A - Energy $U_s = 1/2 kx^2 = 1.12 \text{ J}$.	20. D - Momentum Momentum conservation gives $m_1 v_1 = (m_1 + m_2) v_f$, so $v_f = 1.00 \text{ m/s}$.
21. A - Momentum Impulse equals change in momentum: $J_x = m(v_f - v_i) = 0.5 \text{ N s}$.	22. C - Momentum The area under a force-time graph is impulse. For constant force, $J = F \Delta t = 4.0 \text{ N s}$.
23. C - Rotation Torque magnitude is $\tau = rF \sin(\theta) = 1.2 \text{ N m}$.	24. B - Rotation Rotational Newton second law: $\tau_{\text{net}} = I \alpha$, so $\alpha = \tau/I = 5.0 \text{ rad/s}^2$.
25. B - Rotation For rolling without slipping, $a = g \sin(\theta)/(1+\beta) = 2.93 \text{ m/s}^2$.	26. A - Rotation $\omega = \omega_0 + \alpha t = 10.0 \text{ rad/s}$.
27. B - Oscillations $T = 2\pi \sqrt{m/k} = 0.50 \text{ s}$.	28. A - Oscillations At maximum displacement all energy is spring potential: $E = 1/2 kA^2 = 0.36 \text{ J}$.
29. B - Oscillations T is proportional to $1/\sqrt{g}$, so $T_{\text{new}}/T_E = 1/\sqrt{1.44} = 0.83$.	30. C - Fluids $\Delta P = \rho g h = 9.8 \text{ kPa}$.

31. D - Fluids Archimedes principle: $F_B = \rho g V = 11.8 \text{ N}$.	32. D - Fluids Continuity gives $A_1 v_1 = A_2 v_2$. Because area is proportional to r^2 , $v_2 = v_1 (r_1/r_2)^2 = 50.0 \text{ m/s}$.
33. A - Fluids Convert volume: $300 \text{ cm}^3 = 0.000300 \text{ m}^3$. Then $\rho = m/V = 833 \text{ kg/m}^3$.	34. B - Forces Gravitational force varies as $1/r^2$, so doubling r makes the force $1/4$ as large.
35. B - Momentum Momentum conservation gives $m_1 v_1 = (m_1 + m_2) v_f$, so $v_f = 1.00 \text{ m/s}$.	36. D - Energy $U_s = 1/2 kx^2 = 0.20 \text{ J}$.
37. A - Energy Conservation of energy: $mgh = 1/2 mv^2$, so $v = \sqrt{2gh} = 4.4 \text{ m/s}$. Mass cancels.	38. C - Rotation Torque magnitude is $\tau = rF \sin(\theta) = 2.6 \text{ N m}$.
39. A - Fluids Archimedes principle: $F_B = \rho g V = 11.8 \text{ N}$.	40. C - Fluids $\Delta P = \rho g h = 5.9 \text{ kPa}$.

SCORING GUIDE - Section II

This compact rubric emphasizes the evidence a strong AP-style response should contain. Equivalent correct reasoning should receive credit.

Question 1 - Mathematical Routines: Momentum and energy in a cart collision - 10 points

3 points: Horizontal momentum conservation gives $Mv = (5M/4)v_f$, so $v_f = 4v/5$.

3 points: Constant nonzero horizontal momentum line.

2 points: $K_f/K_i = 4/5$.

2 points: The sticking collision converts mechanical energy to internal energy while external horizontal impulse remains negligible.

Question 2 - Translation Between Representations: Ramp and spring energy - 12 points

3 points: Energy shifts from gravitational to kinetic, then from gravitational/kinetic into spring energy; total stays constant.

3 points: Uses initial and final gravitational height change and $1/2 k(4D)^2$ at stop; equivalent consistent expression earns credit.

3 points: K rises on the frictionless descent, then eventually falls to zero as spring energy dominates.

3 points: Immediately after contact, downhill gravity can still exceed spring force, so net force remains downhill until the spring force grows enough.

Question 3 - Experimental Design and Analysis: Torque and unknown mass - 10 points

3 points: Measures geometry and spring-scale force for multiple balanced configurations.

3 points: Sum of clockwise torques equals sum of counterclockwise torques about pivot.

2 points: Any algebraically valid linear relation whose slope contains mg and known geometric factors is acceptable.

2 points: Use widely spaced configurations, repeat force readings, keep beam horizontal, and measure lever arms from pivot.

Question 4 - Qualitative/Quantitative Translation: Buoyancy and acceleration - 8 points

3 points: Upward buoyant force $\rho V g$; downward weight mg .

3 points: $\rho V g - mg = ma$, so $a = g(\rho V - m)/m$.

2 points: The denser fluid produces greater buoyant force and therefore a more upward (or less downward) acceleration.

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