

AP Physics 1 Practice Worksheet

Fifty questions across all 8 AP Physics 1 units: kinematics, forces, energy, momentum, rotation, oscillations, and fluids. Questions 45 to 50 ask for written explanations.

QUESTIONS	50	MULTIPLE CHOICE	12	WRITTEN	38
-----------	----	-----------------	----	---------	----

Instructions

Use $g = 9.8 \text{ m/s}^2$. State the principle you're using before calculating.

- 1** A car accelerates from 4 m/s to 16 m/s in 4 s. Find its acceleration.

- 2** An object starts at rest and accelerates at 3 m/s^2 for 4 s. Find its displacement.

- 3** A ball is thrown upward at 20 m/s. Find the time to reach its highest point ($v=0$). ($t = v_0/g$)

- 4** A ball is dropped from 45 m. Find the time to hit the ground. ($d=0.5 \times g \times t^2$, solve for t)

- 5** Newton's second law states that net force equals:

- A) mass times velocity
- B) mass times acceleration
- C) mass divided by acceleration
- D) mass plus acceleration

- 6** A 6 kg object experiences a net force of 18 N. Find its acceleration.

- 7** Find the weight of a 15 kg object. ($g=9.8$)

- 8** A 20 N force and a 12 N friction force act on a box in opposite directions. Find the net force.

- 9** A free-body diagram shows:

- A) Only the object's velocity
- B) All forces acting on one object
- C) The object's path over time
- D) Only gravitational force

- 10** A 10 N force moves an object 3 m in the same direction as the force. Find the work done.

- 11** Find the kinetic energy of a 5 kg object moving at 4 m/s.

- 12** Find the gravitational potential energy of a 3 kg object at height 10 m. ($g=9.8$)

- 13** A roller coaster has 200 J of PE at the top with no friction. Find its KE at the bottom.

- 14** Find the power of a machine that does 500 J of work in 10 s.

- 15** Which correctly describes conservation of mechanical energy?

- A) Total energy always increases
- B) PE + KE stays constant without friction
- C) KE always equals PE
- D) Energy conservation only applies to falling objects

- 16** A 4 kg object moves at 5 m/s. Find its momentum.

- 17** A force of 20 N acts on an object for 3 s. Find the impulse.

- 18** A 2 kg cart at 6 m/s collides and sticks with a stationary 4 kg cart. Find their combined velocity.

- 19** In any collision (elastic or inelastic), which quantity is always conserved?

- A) Kinetic energy
- B) Momentum
- C) Both KE and momentum
- D) Neither

- 20** A 10 N force is applied 0.5 m from a pivot, perpendicular to the lever arm. Find the torque.

- 21** An object in rotational equilibrium has:

- A) Zero net force only
- B) Zero net torque
- C) Maximum angular velocity
- D) Zero angular velocity always

- 22** Find the rotational kinetic energy of an object with $I=4 \text{ kg}\cdot\text{m}^2$ and angular velocity 3 rad/s.

- 23** Angular momentum is conserved when:

- A) A net external torque acts
- B) No net external torque acts
- C) The object speeds up
- D) Friction is present

- 24** Simple harmonic motion is characterized by a restoring force that is:

- A) Constant
- B) Proportional to displacement, directed opposite to it
- C) Proportional to velocity
- D) Zero at all times

- 25** A mass of 2 kg on a spring with $k=8$ N/m. Find the period. ($T=2\pi\sqrt{m/k}$, round to 2 decimals)

- 26** A pendulum has length 4 m. Find its period on Earth. ($T=2\pi\sqrt{L/g}$, round to 2 decimals)

- 27** Find the density of an object with mass 50 g and volume 10 cm^3 .

- 28** Find the pressure exerted by a 100 N force over an area of 5 m^2 .

- 29** Find the pressure 10 m underwater. ($P_0=101325\text{ Pa}$, $\rho=1000\text{ kg/m}^3$, $g=9.8$, $P=P_0+\rho\times g\times h$)

- 30** A block displaces 0.002 m^3 of water (density 1000 kg/m^3). Find the buoyant force. ($g=9.8$)

- 31** Water flows through a pipe narrowing from 6 cm^2 to 3 cm^2 . If initial speed is 2 m/s , find the speed in the narrow section.

- 32** An object floats when:
- A) Buoyant force is less than weight
 - B) Buoyant force equals weight
 - C) Buoyant force is zero
 - D) The object has no volume

- 33** Which quantity is a vector?
- A) Speed
 - B) Mass
 - C) Displacement
 - D) Time

- 34** Which quantity is a scalar?
- A) Velocity
 - B) Force
 - C) Mass
 - D) Acceleration

- 35** A projectile launched horizontally at 15 m/s falls for 3 s. Find the horizontal distance traveled.

- 36** Using the same projectile, find the vertical distance fallen in 3 s.

- 37** At the top of a projectile's path (launched at an angle), the vertical velocity is:
- A) Maximum
 - B) Zero
 - C) Equal to the horizontal velocity
 - D) Negative

- 38** A 1000 kg car decelerates from 25 m/s to rest in 5 s. Find its acceleration (include sign).

39 Static friction compared to kinetic friction (same surfaces) is generally:

- A) Smaller
- B) Larger or equal
- C) Always zero
- D) Unrelated to kinetic friction

40 Explain, using Newton's third law, why a swimmer moves forward when pushing water backward.

41 Explain why a satellite in circular orbit is accelerating even though its speed is constant.

42 A ball rolls down a ramp. Explain how its potential energy converts to both translational and rotational kinetic energy.

43 Explain why a spinning ice skater speeds up when pulling their arms in, using conservation of angular momentum.

44 Explain why a helium balloon rises in air, using buoyant force and weight.

45 Two objects of different mass are dropped from the same height (ignoring air resistance). Explain why they hit the ground at the same time.

46 Explain why work done by a force is zero when the force is perpendicular to the object's displacement.

47 A car goes around a circular curve at constant speed. Explain what force provides the centripetal acceleration and why it is necessary.

48 Explain why increasing the amplitude of a pendulum's swing (for small angles) does not change its period.

49 Explain why pressure increases with depth in a fluid, using the weight of the fluid above.

50 A 5 kg block sits on a frictionless 30-degree incline. Find the component of gravity along the incline. ($F = mg \sin(30)$, $g=9.8$)

Answer key

Direct answers only, in question order. Work the set first, then check.

1. 3.0	2. 24.0	3. 2.04	4. 3.03	5. B) mass times acceleration
6. 3.0	7. 147.0	8. 8	9. B) All forces acting on one object	10. 30
11. 40.0	12. 294.0	13. 200	14. 50.0	15. B) PE + KE stays constant without friction
16. 20	17. 60	18. 2.0	19. B) Momentum	20. 5.0
21. B) Zero net torque	22. 18.0	23. B) No net external torque acts	24. B) Proportional to displacement, directed opposite to it	25. 3.14
26. 4.01	27. 5.0	28. 20.0	29. 199325.0	30. 19.6
31. 4.0	32. B) Buoyant force equals weight	33. C) Displacement	34. C) Mass	35. 45
36. 44.1	37. B) Zero	38. -5.0	39. B) Larger or equal	40. As the swimmer pushes water backward (action force), the water pushes the swimmer forward with an equal and opposite force (reaction force), propelling the swimmer forward

41. Acceleration depends on the change in velocity, and velocity is a vector that includes direction; since the satellite's direction constantly changes as it moves in a circle, its velocity is changing, meaning it is accelerating toward the center (centripetal acceleration) even at constant speed
42. As the ball descends, gravitational potential energy decreases; by conservation of energy, this lost PE converts into kinetic energy, but because the ball also rotates as it rolls, the total KE splits between translational KE ($\frac{1}{2} m v^2$) and rotational KE ($\frac{1}{2} I \omega^2$)
43. Angular momentum $L = I\omega$ is conserved with no external torque; pulling the arms in decreases the moment of inertia I , so angular velocity ω must increase proportionally to keep L constant
44. The buoyant force from the displaced air is greater than the combined weight of the balloon and the helium inside it, since helium is less dense than air, producing a net upward force
45. Gravitational acceleration does not depend on mass; from $F=ma$ and $W=mg$, mass cancels ($a=g$), so both objects accelerate downward at the same rate regardless of mass, hitting the ground simultaneously
46. Work equals force times displacement times the cosine of the angle between them; when the force is perpendicular to displacement, the angle is 90 degrees and $\cos(90) = 0$, so no work is done
47. Friction between the tires and the road provides the centripetal force directed toward the center of the curve; this force is necessary to continuously change the car's direction, keeping it moving in a circle instead of a straight line
48. For small-angle oscillations, the period of a pendulum depends only on its length and gravitational acceleration ($T=2\pi\sqrt{L/g}$), not on amplitude, because the restoring force and the distance traveled both scale proportionally with amplitude, canceling out any effect on timing
49. At a greater depth, there is more fluid above a given point, and the weight of that additional fluid column adds to the pressure pushing down, so pressure increases linearly with depth
50. 24.5

Error log

Bring this page to your next session so the tutor can start from what actually blocked you.

Questions I answered incorrectly:

Was it the model choice, the formula, or the arithmetic?

The single topic I want to start the next session with:
