

Honors Physics Practice Worksheet

Fifty questions spanning kinematics, forces, energy and momentum, waves, and circuits. Questions 45 to 50 ask for written explanations.

QUESTIONS	50	MULTIPLE CHOICE	11	WRITTEN	39
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Instructions

Show units at every step. Use $g = 9.8 \text{ m/s}^2$ unless a question says otherwise.

1

A car travels 100 m in 5 s. Find its average velocity.

2

A runner accelerates from 0 to 8 m/s in 4 s. Find the acceleration.

3

A car starts at 5 m/s and accelerates at 2 m/s^2 for 3 s. Find its final velocity.

4

An object starts at rest and accelerates at 4 m/s^2 for 5 s. Find its displacement. ($d = v_0t + 0.5at^2$)

5

A ball is dropped and falls for 3 s. Find its velocity. ($g = 9.8$)

6

A ball is dropped from a height and falls for 2 s. Find the distance fallen. ($d = 0.5 \times g \times t^2$)

7

Newton's first law is also called the law of:

- A) Acceleration
- B) Inertia
- C) Action-reaction
- D) Gravitation

8

A 5 kg object experiences a net force of 20 N. Find its acceleration.

9

A 2 kg object accelerates at 6 m/s^2 . Find the net force acting on it.

10

Find the weight of a 10 kg object. ($W = mg$, $g = 9.8$)

11 Newton's third law states that forces come in:

- A) Random pairs
- B) Equal, opposite pairs
- C) Triples
- D) Unequal pairs

12 A box has an applied force of 40 N and friction of 15 N opposing it. Find the net force.

13 Using the net force above on a 5 kg box, find the acceleration.

14 An object moving at constant velocity has a net force of:

- A) A large positive value
- B) Zero
- C) Equal to its weight
- D) Cannot be determined

15 Find the kinetic energy of a 4 kg object moving at 3 m/s.

16 Find the gravitational potential energy of a 2 kg object at a height of 5 m. ($g=9.8$)

17 A 10 N force moves an object 4 m in the direction of the force. Find the work done.

18 A 3 kg object moves at 4 m/s. Find its momentum.

19 Two objects collide: a 2 kg cart at 3 m/s hits a stationary 2 kg cart and they stick together. Find their combined velocity after collision. (conservation of momentum)

20 In an elastic collision:

- A) Kinetic energy is lost
- B) Momentum and kinetic energy are both conserved
- C) Only kinetic energy is conserved
- D) Neither is conserved

21 A roller coaster has 500 J of potential energy at the top and no friction. Find its kinetic energy at the bottom.

22 As an object falls (ignoring air resistance), its total mechanical energy:

- A) Increases
- B) Decreases
- C) Stays constant
- D) Becomes zero

23 A wave has frequency 5 Hz and wavelength 2 m. Find its speed.

24 A wave has a period of 0.5 s. Find its frequency.

- 25** A wave travels at 340 m/s with wavelength 2 m. Find its frequency.

- 26** The law of reflection states the angle of incidence:

- A) Is always 90 degrees
- B) Equals the angle of reflection
- C) Is always 0 degrees
- D) Depends on the light's color

- 27** Sound travels at approximately 343 m/s. How long does it take to travel 686 m?

- 28** Find the current in a circuit with voltage 9 V and resistance 3 ohms. (Ohm's law)

- 29** Find the voltage across a resistor with current 2 A and resistance 5 ohms.

- 30** Find the resistance in a circuit with voltage 12 V and current 4 A.

- 31** Find the power used by a device with current 2 A and voltage 120 V. ($P=IV$)

- 32** In a series circuit, the current at every point is:

- A) Different at each point
- B) The same throughout
- C) Zero
- D) Equal to the voltage

- 33** In a parallel circuit, the voltage across each branch is:

- A) Different for each branch
- B) The same across each branch
- C) Zero
- D) Equal to the total resistance

- 34** Two resistors of 4 ohms and 6 ohms are connected in series. Find the total resistance.

- 35** Which quantity is a vector (has direction), not just a magnitude?

- A) Speed
- B) Distance
- C) Velocity
- D) Time

- 36** Which quantity is a scalar (magnitude only)?

- A) Velocity
- B) Displacement
- C) Force
- D) Speed

- 37** A projectile is launched horizontally at 10 m/s and falls for 2 s before landing. Find the horizontal distance traveled.

- 38** Using the same projectile, find how far it fell vertically in 2 s. ($d=0.5 \times g \times t^2$)

39 Static friction compared to kinetic friction, for the same surfaces, is generally:

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

40 A 1000 kg car moving at 20 m/s brakes and stops in 5 s. Find its acceleration (include the sign).

41 Explain, using Newton's second law, why a heavier object requires more force to achieve the same acceleration as a lighter object.

42 Explain why an astronaut floats in orbit despite gravity still acting on them.

43 Explain why momentum is conserved in a collision but kinetic energy is only conserved in an elastic collision.

44 A skier goes down a frictionless hill. Explain how potential energy converts to kinetic energy using conservation of energy.

45 Explain why increasing resistance in a series circuit decreases the current, using Ohm's law.

46 Explain the difference between speed and velocity using an example of a car driving in a circle.

47 Explain why a heavier and a lighter object dropped from the same height (ignoring air resistance) hit the ground at the same time.

48 Explain why work done is zero when a force is applied perpendicular to an object's displacement.

49 A ball is thrown straight up. Explain what happens to its velocity and acceleration at the highest point.

50 Two 4-ohm resistors are connected in parallel. Find the total resistance. ($1/R_{\text{total}} = 1/R_1 + 1/R_2$)

Answer key

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

1. 20.0	2. 2.0	3. 11	4. 50.0	5. 29.4
6. 19.6	7. B) Inertia	8. 4.0	9. 12	10. 98.0
11. B) Equal, opposite pairs	12. 25	13. 5.0	14. B) Zero	15. 18.0
16. 98.0	17. 40	18. 12	19. 1.5	20. B) Momentum and kinetic energy are both conserved
21. 500	22. C) Stays constant	23. 10	24. 2.0	25. 170.0
26. B) Equals the angle of reflection	27. 2.0	28. 3.0	29. 10	30. 3.0
31. 240	32. B) The same throughout	33. B) The same across each branch	34. 10	35. C) Velocity
36. D) Speed	37. 20	38. 19.6	39. B) Larger or equal	40. -4.0
41. Since $F = ma$, for a fixed acceleration, force is directly proportional to mass, so a larger mass requires a proportionally larger force to produce the same acceleration	42. The astronaut and spacecraft are both in continuous free fall around Earth, moving fast enough that they fall around the curve of the planet; gravity provides the centripetal force for orbit, so there is no supporting force to create the sensation of weight	43. Momentum conservation follows from Newton's third law, which applies to any collision regardless of what happens to the objects; kinetic energy can convert into other forms (heat, sound, deformation) in inelastic collisions, so only elastic collisions conserve it	44. As the skier descends, height decreases so gravitational potential energy (mgh) decreases, and since total mechanical energy is conserved with no friction, that lost potential energy converts directly into kinetic energy, increasing speed	45. Ohm's law states $I = V/R$; if voltage stays constant and resistance increases, the current must decrease proportionally, since current and resistance are inversely related for fixed voltage

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46. Speed is the magnitude of how fast an object moves regardless of direction, while velocity includes direction; a car driving in a circle at constant speed has a constantly changing velocity because its direction keeps changing, even though its speed stays the same
47. Acceleration due to gravity does not depend on mass; from $F=ma$ and $W=mg$, the mass cancels out ($a = mg/m = g$), so all objects accelerate downward at the same rate regardless of their mass
48. Work depends on the component of force in the direction of motion; a force perpendicular to displacement has no component along the direction of motion, so it does zero work on the object
49. At the highest point, the ball's velocity is momentarily zero, but its acceleration remains g (9.8 m/s^2) downward throughout the entire flight, since gravity continues to act on it even when it is not moving
50. 2
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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:
