

Honors Physics Review Guide

Kinematics, forces, energy and momentum, and waves and circuits — the core Honors Physics scope. Work a section, then try the matching questions in the practice worksheet.

SECTIONS	5	WORKED EXAMPLES	4	FORMAT	Print friendly
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How to use this guide

A formula you cannot place is not knowledge yet. Work the recall drill below before the questions.

- Draw a diagram and label every known quantity before choosing a formula.
- Check units at the end of every calculation — they confirm whether the setup was right.
- State which model you're using (kinematics, forces, energy, momentum) before you start; each has its own toolkit.

1. Kinematics

NAME	FORMULA	WHEN TO USE
Average velocity	displacement / time	Finding overall speed and direction over a trip.
Acceleration	change in velocity / time	Describing how quickly velocity changes.
$v = v_0 + at$	final velocity from initial velocity, acceleration, time	Constant-acceleration motion, no displacement needed.
$d = v_0t + \frac{1}{2}at^2$	displacement from initial velocity, acceleration, time	Finding position under constant acceleration.
$v^2 = v_0^2 + 2ad$	final velocity squared without needing time	Time is unknown but displacement is known.
Free fall acceleration	$g = 9.8 \text{ m/s}^2$ downward	An object falls or is thrown near Earth's surface.

WORKED EXAMPLE

A ball is dropped from rest and falls for 2 seconds. Find its velocity (use $g = 9.8 \text{ m/s}^2$).

1. $v = v_0 + at$
2. $v = 0 + (9.8)(2)$
3. $v = 19.6 \text{ m/s}$

Check: Falling for longer produces a larger velocity, as expected.

2. Forces and Newton's laws

NAME	FORMULA	WHEN TO USE
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NAME	FORMULA	WHEN TO USE
Newton's first law	an object at rest/in motion stays that way unless a net force acts	Explaining why objects resist changes in motion (inertia).
Newton's second law	$F = ma$	Relating net force, mass, and acceleration.
Newton's third law	every action has an equal, opposite reaction	Explaining paired forces between two objects.
Weight	$W = mg$	The force of gravity on an object's mass.
Friction force	$f = \mu \times N$	Resistance to sliding between two surfaces.
Net force	vector sum of all forces acting on an object	Determining if and how an object accelerates.

WORKED EXAMPLE

A 10 kg box is pushed with 50 N of force. Friction opposes with 20 N. Find the acceleration.

1. Net force = $50 - 20 = 30 \text{ N}$
2. $a = F/m = 30/10$
3. $a = 3 \text{ m/s}^2$

Check: The applied force exceeds friction, so the box accelerates forward.

3. Energy and momentum

NAME	FORMULA	WHEN TO USE
Kinetic energy	$KE = \frac{1}{2} m v^2$	Energy of motion.
Gravitational potential energy	$PE = m g h$	Stored energy due to height.
Conservation of energy	total mechanical energy stays constant (no friction)	Relating energy at two points in a system.
Work	$W = F \times d$ (force in direction of motion)	Energy transferred by a force over a distance.
Momentum	$p = m v$	A moving object's 'quantity of motion'.
Conservation of momentum	total momentum before = total momentum after	Analyzing collisions.

WORKED EXAMPLE

A 2 kg cart moves at 5 m/s. Find its kinetic energy.

1. $KE = \frac{1}{2} m v^2$
2. $KE = 0.5 \times 2 \times 5^2$
3. $KE = 0.5 \times 2 \times 25 = 25 \text{ J}$

Check: Energy in joules is expected for this formula.

4. Waves, sound, and light

NAME	FORMULA	WHEN TO USE
Wave speed	$v = f \times \text{wavelength}$	Relating frequency, wavelength, and speed of any wave.
Period	$T = 1/f$	The time for one complete wave cycle.
Law of reflection	angle of incidence = angle of reflection	Predicting how light bounces off a surface.
Speed of sound in air	approximately 343 m/s at room temperature	Estimating sound travel time.

5. Electricity and circuits

NAME	FORMULA	WHEN TO USE
Ohm's law	$V = IR$	Relating voltage, current, and resistance.
Power	$P = IV$	The rate electrical energy is used.
Series circuit	same current throughout, resistances add	Components connected in a single loop.
Parallel circuit	same voltage across each branch, current splits	Components connected across shared nodes.

WORKED EXAMPLE

A circuit has voltage 12 V and resistance 4 ohms. Find the current.

1. $I = V/R$
2. $I = 12/4$
3. $I = 3 \text{ A}$

Check: Higher resistance would give lower current for the same voltage.

Notes and tutor hand-off

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

Which formula did you need to look up more than once?

One diagram (free-body, energy bar chart, circuit) you want to redraw from memory:

Worksheet question numbers to review with a tutor:
