

وحارس البكالوريا BACCALAUREATE SCHOOLS

Grade 9th

26th Nov, 2025

Refer to Your Physics Book for the following material

Topic	Details
Displacement and Velocity (p. 5 – 20)	 Position definition Displacement definition Displacement vs. Distance Vector and Scalar Quantities
	 Representing Vector Quantities Adding and Subtracting Vectors Graphical Method Analytical Method
	- Position-Time Graphs
	Velocity and SpeedVelocity-Time GraphsModeling Unifor Motion
Acceleration (p. 21 – 34)	 Acceleration definition Instantaneous Velocity vs. Average Velocity Position-Time and Velocity-Time graphs in case of changing velocity (acceleration) Constant acceleration Calculations and formulas Solving Non-Uniform Problems using motion equations of constant acceleration Free falling objects
Projectile Motion (p. 35 – 43)	 Representing velocity in 2D-Motion Adding Velocities in 2D Graphing Projectile Motion Modeling Projectile Motion Solving Projectile Motion by splitting into two dimensions.
Force, Mass and Acceleration (p. 52 – 64)	Newton's first lawMass and Inertia



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	 Force cause acceleration Newton's second law Apply Newton's 2nd law Newton's 3rd law Actions and Reactions Freebody Diagrams Modeling Forces Solving Force Problems
Types of Forces (p. 65 – 75)	 Contact and Non-Contact Forces Weight Tension Force Friction Force Normal Force 2D Force Problems

- Priority is to refer to Your NOTES and Worksheets and Quizzes.
- Please bring your own Calculator to the exam.
- Physics classes between 7th and 11th of December will be dedicated to review and any questions or explanations regarding the material.



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№ 1. MODELING MOTION

1.1 Displacement & Velocity

Displacement

- **Definition:** How far you are from your starting point *and in what direction*.
- It is a vector (has magnitude + direction).
- Formula:

$$\underline{\mathsf{Displacement}} = x_{\mathsf{final}} - x_{\mathsf{initial}}$$

Example:

You walk +5 m (forward), then -2 m (backward). Total displacement = 5 - 2 = +3 m forward.

Velocity

- Velocity = speed + direction
- Average Velocity Formula:

$$\underline{v = \frac{\text{displacement}}{\text{time}}}$$

Example:

A car moves 20 m east in 5 seconds.

$$v = \frac{20}{5} = 4 \text{ m/s east}$$

1.2 Acceleration

- Acceleration tells you how velocity changes over time.
- Formula:

$$\underline{a} = \frac{v_f - v_i}{t}$$



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Units: m/s²

Examples:

If a bike speeds up from 2 m/s to 10 m/s in 4 s:

$$a = \frac{10 - 2}{4} = 2 \text{ m/s}^2$$

If an object slows down (decelerates), acceleration will be negative.

1.3 Free-Falling Objects

- Free-fall happens when gravity is the only force acting.
- On Earth:

$$g = 9.8 \,\mathrm{m/s}^2 (\mathrm{downward})$$

Objects in free fall speed up as they fall.

Key Free-Fall Equations (no air resistance):

$$\frac{v = gt}{d = \frac{1}{2}gt^2}$$

Example:

How far does a rock fall in 2 seconds?

$$d = \frac{1}{2}(9.8)(2^2) = 19.6 \,\mathrm{m}$$

1.4 Projectile Motion

Projectiles have two motions happening at the same time:

- 1. Horizontal motion:
 - Constant velocity
 - No horizontal acceleration



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2. Vertical motion:

o Accelerated by gravity (9.8 m/s² downward)

Example:

A ball is thrown horizontally at 8 m/s off a 10 m cliff.

Horizontal distance:

Use: d = vt

Vertical drop:

Use:
$$d = \frac{1}{2}gt^2$$

The motions don't affect each other.

Ջ 2. FORCES & NEWTON'S LAWS

2.1 Force, Mass, and Acceleration (Newton's 2nd Law)

Newton's Second Law:

F = ma

- F: Net force (N)
- m: Mass (kg)
- a: Acceleration (m/s²)

Example:

A 3 kg box accelerates at 4 m/s².

$$F = (3)(4) = 12 \text{ N}$$

2.2 Newton's Three Laws (Quick Review)

1 Newton's First Law: Inertia

• An object stays at rest or moves at constant velocity unless a net force acts on it.

2 Newton's Second Law: F = ma

- More force → more acceleration.
- More mass \rightarrow harder to accelerate.



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3 Newton's Third Law: Action–Reaction

- For every action, there is an equal and opposite reaction.
- Example: You push on a wall \rightarrow the wall pushes back with equal force.

2.3 Types of Forces

<u>Understanding common forces is crucial for drawing free-body diagrams.</u>

Weight (Gravity)

- Force pulling objects downward due to gravity.
- Formula:

$$W = mg$$

Always acts straight down.

Example:

Mass = 5 kg

W = (5)(9.8) = 49 N downward

Normal Force

- Support force from a surface.
- Acts perpendicular to the surface.
- Balances weight on flat ground.

Tension Force

- Force in a rope, string, or cable.
- Pulls along the direction of the rope.



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Friction Force

- Opposes the motion between surfaces.
- Two types:
 - o **Static friction:** resists motion before movement starts.
 - o Kinetic friction: resists motion while sliding.

Example:

A box is pushed right.

• Friction acts **left**.

A Quick Practice Questions

- 1. A car changes velocity from 10 m/s to 22 m/s in 6 seconds.
 - o What is its acceleration?
- 2. A ball is dropped from rest.
 - o How fast is it going after 3 seconds?
- 3. Calculate the weight of a 12 kg dog.
- 4. A rope pulls a sled with **30 N** of tension, causing a **3 m/s²** acceleration.
 - o What is the sled's mass?
- 5. Identify the forces acting on a book resting on a table.

Tips for Studying for the Final

- Focus on graphs: position vs time, velocity vs time.
- Practice drawing motion diagrams.
- Always identify forces before solving.
- Break projectile motion into horizontal vs vertical parts.
- Keep units consistent!