



Physics

A VRC Curriculum Syllabus



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Bismillahirrahmanirraheem

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Course Introduction

Welcome to the exciting journey of Physics! In this course, students will explore the fundamental principles that govern the natural world, from the motion of objects and the forces acting on them to the behavior of energy, waves, electricity, and light. Topics include 1-D and 2-D kinematics, Newton's laws, momentum, work and energy, circular motion, thermal physics, electricity and magnetism, sound, and optics. Through real-world applications, mathematical reasoning, and Islamic reflections, students will develop a deep understanding of how Allah's perfectly ordered creation operates. This course aims to nurture scientific thinking, curiosity, and a sense of awe for the Creator's precision and wisdom in every aspect of the universe.

Term-wise Physics Syllabus with Learning Outcomes and Spiritual Reflections

All CK-12 references in the table refer to the CK-12 Physics FlexBook available here:

<https://flexbooks.ck12.org/cbook/ck-12-physics-flexbook-2.0/>

Term I: Foundations of Mechanics and Basic Physics Concepts

1. One Dimensional Motion 2. Newton's Laws of Motion 3. Motion and Forces in Two Dimensions 4. Momentum and its conservation 5. Work, Energy and Power 6. Rotational Motion

Topic	Learning Outcomes	Islamic Integration	Resources/References
1. One Dimensional Motion 1.1 <u>Describing motion with words</u> : Exploring the science of kinematics,	✍ Differentiate between scalar and vector quantities	🕌 Reflect on Allah's order and precision in the universe, where every	1.1 Describing Motion with Words: ❖ CK-12 Physics, Ch. 2 (Secs. 2.1–2.6) ❖ The Physics Classroom, Lesson 1

<p>distinguishing between scalars and vectors, understanding position and displacement, analyzing speed and velocity both average and instantaneous, examining acceleration including average and uniform, calculating displacement during uniform acceleration.</p> <p>1.2 <u>Describing motion with diagrams</u>: Ticker Tape diagrams, Vector diagrams</p> <p>1.3 <u>Understanding Position vs. Time Graphs</u>: Interpreting graph shapes and determining motion from the slope of a p-t graph</p> <p>1.4 <u>Understanding Velocity vs. Time Graphs</u>: Interpreting graph shapes, calculating slope and area under a v-t graph, and analyzing motion</p> <p>1.5 <u>Free Fall and the Acceleration of Gravity</u>: Understanding acceleration due to gravity, representing</p>	<ul style="list-style-type: none"> ✍ Define and use terms such as distance, displacement, speed, velocity, and acceleration ✍ Interpret motion using ticker tape and vector diagrams ✍ Analyze motion using position-time (p-t) graphs ✍ Determine an object's velocity from the slope of a p-t graph ✍ Interpret velocity-time (v-t) graphs to describe changing motion ✍ Calculate acceleration from the slope of a v-t graph ✍ Determine displacement by 	<p>motion follows exact laws created by Him.</p> <ul style="list-style-type: none"> 🕋 Appreciate the perfect design and measurement in nature as a sign of Allah's wisdom and power. 🕋 Consider how studying motion helps us understand the continuous activity Allah sustains in the universe. 🕋 Think about how time itself is a gift from Allah and how He controls its flow precisely. 🕋 Reflect on the concept that all movement is under Allah's command, and nothing moves without His will. 🕋 Contemplate the continuous change 	<p>(https://www.physicsclassroom.com/class/1DKin)</p> <p>1.2 Describing motion with diagrams:</p> <p>The Physics Classroom, Lesson 2 (https://www.physicsclassroom.com/class/1DKin)</p> <p>1.3 Understanding Position vs. Time Graphs:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 2 (Sec. 2.8) ❖ The Physics Classroom, Lesson 3 (https://www.physicsclassroom.com/class/1DKin) <p>1.4 Understanding Velocity vs. Time Graphs:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 2 (Sec. 2.9) ❖ The Physics Classroom, Lesson 4 (https://www.physicsclassroom.com/class/1DKin) <p>1.5 Free Fall and the Acceleration of Gravity:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 2 (Sec. 2.7) ❖ The Physics Classroom, Lesson 5 (https://www.physicsclassroom.com/class/1DKin)
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<p>free fall using graphs, analyzing how time affects velocity, and exploring whether the mass of a free-falling object influences its velocity.</p> <p>1.6 <u>Describing Motion with Equations</u>: Introduction to kinematic equations, solving problems using kinematic formulas, applying equations to free-fall situations, and connecting kinematic equations with motion graphs.</p>	<p>finding the area under a v-t graph</p> <ul style="list-style-type: none"> ✍ Describe free fall and explain acceleration due to gravity ✍ Represent free-fall motion on graphs ✍ Analyze how time affects the velocity of a free-falling object ✍ Evaluate whether mass affects the velocity of objects in free fall ✍ Apply kinematic equations to solve motion problems ✍ Use equations to describe and calculate motion during free fall ✍ Connect motion graphs with the 	<p>and renewal in the universe as signs of Allah’s creative power.</p> <ul style="list-style-type: none"> 🕋 Consider the forces and accelerations as manifestations of the natural laws Allah set for the universe. 🕋 Reflect on the journey and purpose in life, just as objects follow a path directed by Allah’s design. 🕋 Appreciate the balance and order in gravity as a perfect law set by Allah to maintain harmony on Earth. 🕋 Think about the predictability of Allah’s laws and how they allow humans to learn and benefit from His creation. 	<p>1.5 Describing Motion with Equations:</p> <p>The Physics Classroom, Lesson 6 https://www.physicsclassroom.com/class/1DKin)</p>
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	<p>appropriate kinematic equations</p>	<ul style="list-style-type: none"> ⌘ Reflect on the control Allah has over time and motion, and the wisdom behind these laws. ⌘ Consider equality and fairness in natural laws, which do not discriminate between masses in free fall. ⌘ Recognize that discovering and understanding these laws is a way to appreciate Allah's knowledge and encourage gratitude. ⌘ Reflect on the precision of the universe as evidence of divine order and planning. ⌘ Think about how human intellect, a gift from Allah, 	
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		allows us to uncover the patterns in His creation.	
<p>2. Newton's Laws of Motion</p> <p>2.1 <u>Newton's First Law of Motion</u>: Exploring the concept of inertia, the relationship between mass and motion, and the effects of balanced and unbalanced forces on an object's state of motion</p> <p>2.2 <u>Force and its Representation</u>: Understanding the concept of force, identifying various types of forces, constructing free-body diagrams, and calculating net force</p> <p>2.3 <u>Newton's Second Law of Motion</u>: Examining the relationship between force, mass, and acceleration; understanding the need (or lack thereof) for continuous force to sustain motion; calculating acceleration; analyzing individual forces, the effects of air resistance in</p>	<ul style="list-style-type: none"> ✍ Define and explain the concept of inertia and how it relates to mass ✍ Distinguish between balanced and unbalanced forces and describe their effects on an object's motion ✍ Describe the relationship between force and motion as outlined in Newton's First Law ✍ Define force and identify various types of forces (gravitational, normal, frictional, applied, etc.) ✍ Construct and interpret free-body diagrams to 	<ul style="list-style-type: none"> 🕋 Reflect on the order, consistency, and balance (mīzān) Allah has placed in the universe, mirrored in the laws governing motion. 🕋 Understand that just as physical laws govern objects, divine laws govern human actions and their consequences. 🕋 Consider inertia and stability (Newton's First Law) as reminders that change requires cause, intention, and Allah's permission. 	<p>2.1 Newton's First Law of Motion:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 3 (Sec. 3.3) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws <p>2.2 Force and its Representation:</p> <p>The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws</p> <p>2.3 Newton's Second Law of Motion:</p> <p>The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws</p> <p>2.4 Newton's Third Law of Motion:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 3 (Sec. 3.4) ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/Physics-Tutorial/Newton-s-Laws

<p>free fall, and solving two-body force problems</p> <p>2.4 <u>Newton's third law of motion</u>: Identifying interaction force-pairs and understanding action-reaction relationships between objects</p>	<p>represent forces acting on objects</p> <ul style="list-style-type: none"> ✍ Calculate the net force acting on an object using vector addition ✍ Apply Newton's Second Law ($F = ma$) to solve problems involving acceleration, force, and mass ✍ Explain why a continuous force is not needed to sustain constant motion when no net force is present ✍ Analyze motion affected by air resistance and distinguish it from ideal free fall ✍ Solve two-body problems involving tension, gravity, and contact forces 	<ul style="list-style-type: none"> 🕋 Appreciate how balanced and unbalanced forces reflect the divine balance in creation and how disruption leads to movement or turmoil. 🕋 Contemplate the invisible forces at work in the universe as signs of Allah's unseen but perfect power. 🕋 Recognize that free-body diagrams encourage thoughtful analysis of complex systems, a skill emphasized in the Qur'an. 🕋 Realize that Newton's Second Law, where every force produces an outcome, parallels the Islamic principle that every 	
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	<p>✍ State Newton’s Third Law and identify action-reaction force pairs in various real-life and experimental scenarios</p> <p>✍ Explain how forces always occur in equal and opposite pairs, and describe how these interactions influence motion</p>	<p>deed has a consequence.</p> <p>🕋 Reflect on Newton’s Third Law (action-reaction) as a metaphor for divine justice and accountability.</p> <p>🕋 Feel inspired by these laws as evidence of Tawheed, the oneness of Allah, demonstrated by the perfect order He maintains.</p> <p>🕋 Recognize that studying these physical laws deepens humility, awe, and gratitude toward Allah’s wisdom and power.</p> <p>🕋 Appreciate the subtle and detailed design of the universe, which</p>	
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		<p>points to Allah’s name Al-Ḥakīm (The All-Wise).</p> <p>🕋 Understand that human intellect is a divine gift that allows us to uncover these signs and grow in faith.</p>	
<p>3. Motion and Forces in Two Dimensions</p> <p>3.1 Vector Operations: Understanding vectors and their directions; performing vector addition and finding resultants; resolving vectors into components; adding components; analyzing relative velocity with riverboat problems; and exploring the independence of perpendicular components of motion.</p> <p>3.2 Projectile Motion: Defining a projectile and examining the characteristics of its trajectory; analyzing horizontal and vertical components of velocity and</p>	<p>✍ Define vectors and explain their properties, including direction and magnitude</p> <p>✍ Perform vector addition and subtraction to find resultant vectors</p> <p>✍ Resolve vectors into perpendicular components and add components accurately</p> <p>✍ Analyze relative velocity problems,</p>	<p>🕋 Reflect on the concept of vectors as a representation of direction and magnitude, illustrating Allah’s precise order in creation where every element has a defined path and magnitude, symbolizing His control over all directions and forces.</p> <p>🕋 Consider the independence of perpendicular components in</p>	<p>3.1 Vector Operations:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 5 (Secs. 1.5, 1.6) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/vectors <p>3.2 Projectile Motion:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 4 (Secs. 4.2, 4.3) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/vectors <p>3.3 Forces in Two Dimensions:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 4 (Sec. 4.1) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/vectors

<p>displacement; breaking down initial velocity into components; and solving problems involving both horizontal and non-horizontal projectile launches.</p> <p><u>3.3 Forces in Two Dimensions:</u> Adding and resolving forces acting in two dimensions; understanding equilibrium and statics; revisiting net force problems; analyzing forces on inclined planes; and solving two-body problems in two-dimensional contexts.</p>	<p>including riverboat scenarios</p> <ul style="list-style-type: none"> ✍ Understand the independence of perpendicular components in two-dimensional motion ✍ Define projectile motion and describe the characteristics of projectile trajectories ✍ Analyze horizontal and vertical components of velocity and displacement in projectile motion ✍ Break down initial velocity into components for projectile problems ✍ Solve projectile motion problems involving both horizontal and angled launches 	<p>motion as a sign of Allah’s intricate design, where multiple systems operate simultaneously yet independently in perfect harmony.</p> <ul style="list-style-type: none"> 🕋 Contemplate projectile motion as a manifestation of Allah’s lawfulness in nature, showing how objects follow predictable paths according to His wisdom and decree. 🕋 Appreciate the balance and coordination in two-dimensional forces, symbolizing the divine balance (mīzān) Allah established to maintain order and justice in the universe. 	
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	<ul style="list-style-type: none"> ✍ Add and resolve forces acting in two dimensions ✍ Explain the concepts of equilibrium and statics in two-dimensional force systems ✍ Solve net force problems involving inclined planes and two-body systems in two dimensions 	<ul style="list-style-type: none"> 🕋 Reflect on equilibrium and statics as metaphors for spiritual and social balance, encouraging believers to seek harmony in life as Allah commands. 🕋 Recognize that complex problems, like those involving forces on inclined planes or interacting bodies, reflect the interdependence Allah created in His universe, reminding us of the importance of interconnectedness and accountability. 🕋 Understand that the laws governing motion and forces are consistent and universal, pointing to the One who governs all without 	
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		<p>exception by Al-Qayyum (The Self-Subsisting).</p> <p>🕋 Use the study of motion in two dimensions to appreciate the comprehensive knowledge bestowed by Allah and to foster gratitude and humility for His perfect creation.</p>	
<p>4. Momentum and Its Conservation</p> <p>4.1 <u>The Impulse-Momentum Change Theorem</u>: Exploring the relationship between force, time, and momentum; understanding how impulse causes changes in momentum; examining real-world applications such as car crash safety features, sports techniques, and collision events to illustrate the concept of impulse and momentum change.</p>	<p>✍ Define momentum and explain how it depends on mass and velocity.</p> <p>✍ Understand the impulse-momentum theorem and apply it to real-life scenarios.</p> <p>✍ Analyze how impulse changes an object's momentum.</p> <p>✍ Apply the law of conservation of</p>	<p>🕋 Reflect on how momentum and impulse represent the balance of action and reaction, symbolizing the divine justice of Allah</p> <p>🕋 Recognize that every force and change in the physical world is subject to divine will and occurs by</p>	<p>4.1. The Impulse-Momentum Change Theorem:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 6 (Sec. 6.1) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/momentum <p>4.2 The Law of Momentum Conservation:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 6 (Sec. 6.2) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/momentum

<p>4.2 <u>The Law of Momentum Conservation</u>: Reviewing Newton’s Third Law in the context of momentum; understanding the momentum conservation principle in isolated systems; using equations both algebraically and conceptually to solve problems; applying these principles to analyze real-life examples such as collisions and explosions; and exploring how total system momentum remains unchanged when no external force acts.</p> <p>4.3 <u>Collisions in Two Dimensions</u>: Applying the impulse–momentum change theorem and the law of momentum conservation to various types of collisions; analyzing hit-and-stick collisions at right angles and glancing collisions using vector components and graphical methods.</p>	<p>momentum to isolated systems.</p> <ul style="list-style-type: none"> ✍ Use vector and algebraic methods to solve momentum conservation problems. ✍ Understand and explain the principle of action-reaction in terms of momentum. ✍ Solve problems involving explosions and collisions, including both linear and two-dimensional cases. ✍ Apply the impulse-momentum theorem and conservation principles to right-angle and glancing collisions. ✍ Use Pythagoras’ Theorem to find resultant velocities in two-dimensional collisions. 	<p>Allah’s precise decree:</p> <p><i>“Indeed, all things We created with predestination.”</i> (Qur’an 54:49)</p> <ul style="list-style-type: none"> 🕋 Understand the impacts and collisions in life, just like in physics, leave traces and changes reminding us that our actions also have lasting consequences in this world and the Hereafter. 🕋 See the conservation of momentum as a metaphor for how nothing is lost or wasted in Allah’s creation as everything is accounted for: <p><i>“And your Lord is not ever unjust to</i></p> 	<p>4.3 Collisions in Two Dimensions:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 6 (Secs. 6.3, 6.4) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/momentum
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	<p>✍ Interpret momentum changes through graphs, vectors, and real-world events.</p>	<p><i>the servants.”</i> <i>(Qur’an 41:46)</i></p> <p>🕋 Realize that interactions between bodies, as seen in collisions, reflect the interconnectedness and balance Allah established among His creations.</p> <p>🕋 View problem-solving through the lens of clarity, logic, and fairness, which Islam promotes in both physical reasoning and ethical conduct.</p> <p>🕋 Appreciate the use of math and logic in analyzing collisions as a gift from Allah to understand His creation.</p>	
5. Work, Energy and Power	<p>✍ Define work and explain how forces</p>	<p>🕋 Reflect on the concept of work as</p>	5.1 Basic Terminology and Concepts:

<p>5.1 <u>Basic Terminology and Concepts</u>: Defining work and understanding how forces work on objects; calculating work done in various scenarios; exploring the concepts of potential energy, kinetic energy, and mechanical energy; understanding power as the rate of doing work and its practical significance.</p> <p>5.2 <u>The Work-Energy Relationship</u>: Examining the work-energy relationship; distinguishing between internal and external forces; analyzing situations where mechanical energy is conserved; applying concepts through practice problems; using bar chart illustrations to visualize energy changes.</p>	<p>cause work on objects in different contexts.</p> <ul style="list-style-type: none"> ✍ Calculate the amount of work done by constant and variable forces. ✍ Understand and differentiate between potential energy, kinetic energy, and mechanical energy. ✍ Describe the concept of power as the rate at which work is done and calculate power in practical situations. ✍ Analyze the work-energy theorem and explain the relationship between work and changes in kinetic energy. ✍ Distinguish between internal and external forces and their impact on 	<p>a transfer of energy through force and motion, symbolizing that every effort in life when aligned with intention results in meaningful outcomes by Allah’s will.</p> <ul style="list-style-type: none"> 🕋 Recognize that potential and kinetic energy illustrate how Allah has placed stored and active power within creation, enabling change and movement at His command. 🕋 Consider mechanical energy as a representation of balance in systems, echoing the divine harmony that sustains both physical and spiritual realms. 	<ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 6 (Secs. 6.5, 6.6, 6.7) Ch.7 (7.1, 7.2, 7.3) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/energy <p>5.2 The Work-Energy Relationship:</p> <ul style="list-style-type: none"> ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/energy
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	<p>mechanical energy conservation.</p> <p>✍ Apply the principles of energy conservation to solve problems involving work and energy transformations.</p> <p>✍ Use bar charts to represent changes in energy in physical systems clearly.</p>	<p>🕋 Contemplate power as a measure of how quickly work is done, drawing a parallel to how Allah rewards sincere consistent effort regardless of scale</p> <p><i>“So whoever does an atom’s weight of good will see it...”</i> (Qur’an 99:7)</p> <p>🕋 Understand the work energy theorem as a reminder that no energy is lost without purpose. Every input leads to a corresponding effect, reinforcing the divine principle of cause and consequence.</p> <p>🕋 Reflect on internal and external forces as metaphors for inner and outer</p>	
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		<p>influences in life. Both affect our spiritual energy and outcomes, and Allah's guidance helps us remain balanced.</p> <p>ﷻ Appreciate bar charts and visual tools as aids to understanding Allah's precision, reminding us that clarity and order are part of divine mercy and knowledge.</p> <p>ﷻ View the conservation of energy as a sign of Allah's perfection. In His creation, nothing is wasted or random. All is sustained with wisdom</p> <p><i>“Indeed, it is Allah who is the continual Provider, the firm possessor</i></p>	
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		<p><i>of strength”</i> <i>(Qur’an 51:58)</i></p> <p>ﷻ Let the study of energy deepen awe for Allah’s creative power and encourage gratitude for the intellect He has given to uncover His signs in the universe.</p>	
<p>6. Rotational Motion</p> <p><u>6.1 Torque:</u> Exploring the concept of torque as the rotational effect of a force; understanding the role of lever arms in producing rotational motion; examining everyday examples like seesaws and wrenches; analyzing the direction of torque using the right-hand rule; defining torque mathematically as the product of force and perpendicular distance from the axis of rotation; distinguishing between clockwise and counterclockwise torques;</p>	<p>✍ Define torque as the rotational effect of a force and explain how lever arms produce rotational motion in real-life examples such as seesaws and wrenches.</p> <p>✍ Use the right-hand rule to determine the direction of torque and distinguish between clockwise and</p>	<p>ﷻ Recognize that a small force applied at the right position can produce a large rotational effect, reminding us that even small good deeds, if placed with sincerity, have great value in Allah’s sight.</p> <p>ﷻ Contemplate angular momentum’s resistance to change as a</p>	<p>6.1 Torque: CK-12 Physics, Ch. 8 (Sec. 8.1)</p> <p>6.2 Angular Momentum: CK-12 Physics, Ch. 8 (Sec. 8.2)</p>

<p>solving problems involving equilibrium and net torque.</p> <p><u>6.2: Angular momentum: What makes an object difficult to turn?</u></p> <p>Exploring angular momentum as the rotational counterpart to linear momentum; defining angular momentum in terms of rotational velocity, radius, and moment of inertia; examining how mass distribution influences the ease of turning an object; analyzing practical examples such as spinning wheels, figure skaters, and rotating machinery; applying the conservation of angular momentum in real-life scenarios; and connecting angular momentum to torque through mathematical relationships.</p>	<p>counterclockwise torques.</p> <ul style="list-style-type: none"> ✍ Calculate torque mathematically as the product of force and perpendicular distance, and apply this to solve equilibrium and net torque problems. ✍ Define angular momentum as the rotational counterpart of linear momentum, and relate it to angular velocity, radius, and moment of inertia. ✍ Explain how mass distribution influences the ease or difficulty of turning objects, using examples such as spinning wheels, figure skaters, and rotating machinery. ✍ Apply the conservation of 	<p>metaphor for human nature. Deeply rooted habits are not easily changed without external guidance, just as life requires divine guidance for true transformation.</p> <ul style="list-style-type: none"> 🕋 Reflect on the conservation of angular momentum as a reminder of accountability: just as rotational motion is preserved unless acted upon, every deed continues to exist until it is weighed on the Day of Judgment. 🕋 Appreciate the mathematical precision of torque and angular momentum as signs of Allah's perfect order in creation, where 	
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	<p>angular momentum to analyze physical systems, recognizing how rotational motion is sustained unless acted upon by external torque.</p> <p>✍ Use mathematical relationships to connect torque with changes in angular momentum and solve real-world problems involving rotational dynamics.</p>	<p>balance, cause, and consequence operate with wisdom and purpose.</p>	
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Term II: Advanced Mechanics, Thermal Physics, and Electricity

7. Circular Motion and Satellite Motion 8. Thermal Physics 9. Fluids 10. Static Electricity 11. Electric Circuits 12. Magnetic Fields and Electromagnetism

Topic	Learning Outcomes	Islamic Integration	Resources/References
<p>7. Circular Motion and Satellite Motion</p> <p><u>7.1 Motion Characteristics for Circular Motion:</u> Exploring the unique characteristics of objects moving in a circle; understanding how speed remains constant while velocity changes due to</p>	<p>✍ Describe the characteristics of objects in circular motion, including constant speed with changing direction.</p> <p>✍ Differentiate between speed and</p>	<p>🕋 Reflect on the consistent, circular paths of celestial bodies as signs of Allah’s order and precision in the universe.</p>	<p>7.1 Motion Characteristics for Circular Motion:</p> <p>The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/circles</p> <p>7.2 Applications of Circular Motion:</p>

<p>continuous direction change; analyzing the role of acceleration in circular motion and why it always points toward the center; identifying the requirement of centripetal force for circular paths; recognizing common misconceptions such as the misuse of the "centrifugal force" term; and applying mathematical formulas to quantify circular motion scenarios involving radius, mass, and speed.</p> <p><u>7.2 Applications of Circular Motion:</u> Applying Newton's Second Law to circular motion scenarios to understand how net force and acceleration function in curved paths; exploring real-life contexts such as amusement park rides, where circular loops and spins involve varying centripetal forces; and examining athletic activities including ice skating turns, downhill skiing on curved slopes, and cyclists navigating bends to see how circular motion principles are used to maintain balance,</p>	<p>velocity in the context of circular motion.</p> <ul style="list-style-type: none"> ✍ Explain centripetal acceleration and the requirement for a centripetal force. ✍ Identify misconceptions such as the "centrifugal force" and clarify the correct physics. ✍ Use mathematical equations to calculate variables related to circular motion (e.g., radius, mass, speed, acceleration). ✍ Apply Newton's Second Law to analyze forces in circular motion. ✍ Examine real-world circular motion applications such as amusement park rides and athletic 	<ul style="list-style-type: none"> 🕒 Consider the unseen yet powerful nature of centripetal force as a reminder of Allah's unseen control over all creation. 🕒 Contemplate how the constant direction change in circular motion parallels life's spiritual journey, which requires constant redirection toward Allah. 🕒 Observe how the predictability of gravitational forces reflects the unchanging will and laws of Allah who sustains the universe. 🕒 Recognize that gravity governs both the fall of an apple and the orbit 	<p>The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/circles</p> <p>7.3 Universal Gravitation:</p> <p>The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/circles</p> <p>7.4 Planetary and Satellite Motion:</p> <p>The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/circles</p>
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<p>optimize performance, and ensure safety through calculated force and motion.</p> <p><u>7.3 Universal Gravitation:</u> Understanding gravity as a fundamental force that governs attraction between all objects with mass; exploring the historical link between the falling apple and the orbiting moon to grasp Newton’s realization of a universal force; learning the inverse square law that describes how gravitational force weakens with distance; applying Newton’s Law of Universal Gravitation to calculate gravitational interactions; examining Cavendish’s experiment in determining the gravitational constant (G); and distinguishing between the universal gravitational constant (G) and the local gravitational acceleration (g) experienced near Earth’s surface.</p> <p><u>7.4 Planetary and Satellite Motion:</u> Exploring the motion of planets and satellites through Kepler’s Three Laws,</p>	<p>movements (ice skating, skiing, cycling).</p> <ul style="list-style-type: none"> ✍ Understand Newton’s Law of Universal Gravitation and apply the inverse square law to gravitational interactions. ✍ Compare the gravitational constant (G) with gravitational acceleration (g), and understand their roles in physics. ✍ Explain Kepler’s Three Laws and their significance in planetary motion. ✍ Apply concepts of circular motion to satellite motion, including calculations of speed, period, and altitude. 	<p>of the moon, revealing the unity in Allah’s creation.</p> <ul style="list-style-type: none"> 🕋 Use the study of satellite motion to appreciate how Allah keeps planets and stars in their orbits without collision or deviation: <p><i>“It is not allowable for the sun to reach the moon, nor does the night overtake the day, but each, in an orbit, is swimming.”</i> (Surah Ya-Sin 36:40)</p> <ul style="list-style-type: none"> 🕋 Appreciate Kepler’s Laws as reflections of divine symmetry and harmony in the cosmos, signs (ayat) meant to inspire reflection and awe. 	
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<p>which describe elliptical orbits, equal areas in equal times, and the relationship between orbital period and distance; applying circular motion principles to satellites in stable orbits; using mathematical formulas to determine orbital speed, period, and altitude; understanding the concept of weightlessness as the result of continuous free fall during orbit; and analyzing energy transformations in satellite motion, including the relationship between kinetic, potential, and total mechanical energy.</p>	<ul style="list-style-type: none"> ✍ Understand weightlessness as a result of orbital free fall. ✍ Analyze the energy relationships in satellite motion, including changes in kinetic and potential energy. 	<ul style="list-style-type: none"> 🕌 Understand that weightlessness and orbital balance represent Allah’s ability to uphold His creation in perfect equilibrium without error. 🕌 Reflect on the verse: <i>“He created the heavens without pillars that you see and has cast into the earth firmly set mountains, lest it should shift with you...” (Surah Luqman 31:10)</i> 🕌 Let the study of planetary motion nurture a sense of humility and submission to the One who governs all motion and rest by His will alone. 	
<p>8. Thermal Physics</p> <p>8.1 <u>Heat and Temperature:</u> Introducing the fundamental</p>	<ul style="list-style-type: none"> ✍ Understand the difference between heat and temperature 	<ul style="list-style-type: none"> 🕌 Reflect on the precise balance Allah created in 	<p>8.1 Heat and Temperature:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 9 (Secs. 9.1, 9.2)

<p>concepts of heat and temperature; understanding how thermometers measure temperature as indicators of the average speed of particles; exploring the nature of heat as energy transfer; examining the three methods of heat transfer—conduction, convection, and radiation and analyzing the rates at which heat is transferred in different materials and situations.</p> <p>8.2 <u>Calorimetry</u>: Learning how to measure the quantity of heat involved in thermal processes; understanding the use of calorimeters in determining heat transfer; applying calorimetry techniques to solve practical problems involving heat exchange and temperature changes.</p>	<p>and explain how they relate to the motion of particles in matter</p> <ul style="list-style-type: none"> ✍ Describe how thermometers work and explain how they act as indicators of particle speed ✍ Identify and compare the three methods of heat transfer: conduction, convection, and radiation ✍ Analyze factors that affect the rate of heat transfer in different materials and environments ✍ Use the principles of calorimetry to calculate the amount of heat transferred in various processes ✍ Understand how calorimeters function and how they are 	<p>thermal systems, where the movement of particles and transfer of heat follow exact laws that demonstrate His wisdom</p> <ul style="list-style-type: none"> ⌚ Consider how heat is a form of energy that Allah created to serve human needs, from warmth to cooking to life-supporting climate systems ⌚ Contemplate the concept of temperature as a hidden reality revealed through scientific tools, similar to how spiritual truths are made clear through revelation ⌚ Recognize that the different methods of heat transfer are part of Allah’s 	<ul style="list-style-type: none"> ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/thermalP <p>8.2 Calorimetry:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 9 (Secs. 9.3, 9.4, 9.5) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/thermalP
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	<p>used in measuring energy changes in physical systems</p> <p>✍ Apply specific heat capacity formulas to solve problems related to heat and temperature changes</p>	<p>design, allowing ecosystems to function and energy to circulate across the earth</p> <p>🕋 Think about the orderliness of energy transfer and how it reflects the name of Allah Al Muqaddim, the One who brings forth what is hidden in a measured way</p> <p>🕋 Appreciate that no heat transfer occurs without purpose or design, just as no event in life is without meaning in Allah’s plan</p> <p>🕋 Reflect on the Quranic verse:</p> <p><i>“And We made from water every living thing”</i></p>	
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		<p><i>(Surah Al Anbiya 21:30)</i> and consider how temperature and heat play a role in sustaining that life through Allah's mercy</p>	
<p>9. Fluids</p> <p>Exploring the properties and behavior of fluids in various contexts; understanding how pressure is distributed in liquids and gases; analyzing the principles of buoyancy and Archimedes' Law; applying Pascal's Law in hydraulic systems; studying gas behavior through Boyle's Law, Gay-Lussac's Law, and the Combined Gas Law; and extending this understanding to the Universal Gas Law to relate pressure, volume, temperature, and number of moles. Practical examples include oceanic and atmospheric pressure, floating and sinking objects, hydraulic systems, and gas-filled containers.</p>	<ul style="list-style-type: none"> ✍ Define fluid pressure and explain how it varies with depth in liquids and with atmospheric conditions. ✍ Calculate pressure in fluids and apply it to oceanic and atmospheric contexts. ✍ Explain Archimedes' principle and analyze buoyancy to determine whether objects float or sink. ✍ Apply Pascal's Law to understand pressure transmission in 	<p>🕋 Reflect on fluid pressure and equilibrium as signs of Allah's precision in creation, where even unseen forces maintain balance and order. <i>"And We have made the night and the day two signs, and We erased the sign of the night and made the sign of the day visible, that you may seek bounty from your Lord..." (Qur'an 17:12)</i> → reminding students of the divine order in natural cycles,</p>	<p>Fluids</p> <p>CK-12 Physics, Ch. 10 (Secs. 10.1-10.5)</p>

	<p>confined fluids and solve related hydraulic problems. Understand and apply Boyle's Law, Gay-Lussac's Law, and the Combined Gas Law to describe gas behavior under varying conditions.</p> <p>✍ Use the Universal Gas Law to connect pressure, volume, temperature, and the number of moles in ideal gases. Solve practical problems involving fluid pressure, buoyancy, hydraulics, and gas laws using mathematical relationships.</p> <p>✍ Develop the ability to connect microscopic behavior of particles with macroscopic fluid phenomena.</p>	<p>including fluid systems.</p> <p>🕋 Consider Archimedes' principle as a metaphor for support and uplift: just as a fluid supports a body, Allah uplifts and sustains His creation.</p> <p>🕋 Recognize Pascal's Law as an example of equality in transmission: pressure applied at one point is felt everywhere, reflecting the universality of Allah's justice and mercy.</p> <p>🕋 Study gas laws to appreciate how Allah governs the universe with consistent rules, where changes in one property affect</p>	
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		others in a predictable, balanced manner. <i>"Indeed, Allah is the Sustainer of all things."</i> (Qur'an 51:58)	
<p>10. Static Electricity</p> <p>10.1 <u>Core ideas in Static Electricity</u>: Exploring the structure of matter as it relates to electric charge; distinguishing between neutral and charged objects; understanding charge interactions such as attraction and repulsion; identifying the differences between conductors and insulators; examining the concept of polarization and how charge separation occurs in neutral objects.</p> <p>10.2 <u>Methods of Charging</u>: Investigating the different ways objects acquire electric charge; exploring triboelectric charging through friction; understanding charging by conduction through direct</p>	<ul style="list-style-type: none"> ✍ Describe the basic structure of matter and how it relates to electric charge ✍ Differentiate between neutral, positively charged, and negatively charged objects ✍ Explain charge interactions and the forces of attraction and repulsion ✍ Identify the characteristics of conductors, insulators, and polarized materials ✍ Investigate the methods of charging 	<ul style="list-style-type: none"> ⚠ Reflect on the unseen nature of electric charges and forces as a powerful reminder of Allah's invisible power that governs all creation. ⚠ Consider how opposite charges attracting and like-charges repelling reflect the perfect balance and wisdom Allah has placed in the universe. ⚠ Contemplate how electric fields, though invisible, produce measurable effects, 	<p>10.1 Core ideas in Static Electricity:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 9 (Secs. 9.3, 9.4, 9.5) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/estatics <p>10.2 Methods of Charging:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 15 (Sec. 15.1) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/estatics <p>10.3 Electric Force:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 15 (Sec. 15.1, 15.3) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/estatics <p>10.4 Electric Fields:</p>

<p>contact; learning about charging by induction using electric fields without contact; and examining grounding as a method for removing excess charge and achieving electrical neutrality.</p> <p>10.3 <u>Electric Force</u>: Revisiting the interactions between electric charges and how they attract or repel each other; understanding Coulomb's Law as a quantitative expression of electric force; exploring the inverse square relationship between force and distance; and connecting the behavior of electric forces with Newton's Laws of Motion to analyze the effects of charge interactions.</p> <p>10.4 <u>Electric Fields</u>: Exploring the concept of action at a distance through the presence of electric fields; understanding electric field intensity as the strength of a field at a point; interpreting electric field lines as visual representations of force direction; examining how electric fields behave around</p>	<p>by friction, conduction, induction, and grounding</p> <ul style="list-style-type: none"> ✍ Apply the principles of Coulomb's Law to calculate electric force ✍ Analyze the relationship between distance and force using the inverse square law ✍ Relate electric force behavior to Newton's Laws of Motion ✍ Define and describe electric field intensity and how it acts on charges ✍ Interpret electric field lines and explain their significance in predicting force direction 	<p>illustrating how Allah's command operates beyond human sight but with absolute precision and justice.</p> <ul style="list-style-type: none"> 🕋 Appreciate that the predictability and order of electric forces mirror the divine laws governing both nature and human life, emphasizing that nothing happens without Allah's will. 🕋 Think about grounding as a metaphor for spiritual purification, where removing excess charge parallels the believer's journey to discharge negative traits and maintain purity before Allah. 	<ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 15 (Sec.15.2) ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/estatics
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<p>conductors; and analyzing natural phenomena such as lightning to illustrate the real-world effects of electric fields.</p>	<ul style="list-style-type: none"> ✍ Explore how electric fields behave in and around conductors ✍ Examine real-world examples such as lightning to illustrate electric field concepts 	<ul style="list-style-type: none"> 🕋 Recognize the awe-inspiring power of lightning as a vivid sign of Allah’s might and control over all forces, encouraging humility and submission. 🕋 Understand that electric fields act at a distance, reflecting Allah’s intimate involvement in creation while remaining unseen, illustrating His role as the Planner and Orchestrator whose order sustains the universe. 	
<p>11. Electric Circuits</p> <p>11.1 Electric Potential Difference: Exploring how electric fields influence the movement of charge within a circuit. Understanding the concept of electric potential as the stored energy per unit</p>	<ul style="list-style-type: none"> ✍ Understand how electric fields influence the movement of charge within a circuit and explain the concepts of electric potential 	<ul style="list-style-type: none"> 🕋 Contemplate electrical resistance as a metaphor for life’s challenges that limit and shape our actions, reminding us that obstacles 	<p>11.1 Electric Potential Difference</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 16 (Sec. 16.1) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/circuits <p>11.2 Electric Current</p>

<p>charge at a point. Examining electric potential difference as the driving force that causes charge to move through a circuit and how this difference relates to the energy transformation in electrical devices</p> <p>11.2 <u>Electric Current:</u> Understanding what constitutes an electric circuit and the essential components needed for a complete path for charge flow. Exploring the concept of electric current as the rate of charge movement through a conductor. Examining how electrical power represents the ability of moving charges to perform work in a device. Identifying and addressing common misconceptions about how charges move in circuits and how current behaves in various parts of the circuit.</p> <p>11.3 <u>Electrical Resistance:</u> Exploring the journey of a typical electron through a conductor and understanding how collisions and obstacles</p>	<p>and electric potential difference as the driving force for current.</p> <ul style="list-style-type: none"> ✍ Describe the essential components required for a functioning electric circuit and define electric current as the rate of charge flow through a conductor. ✍ Explain how electrical power represents the ability of moving charges to perform work in devices and address common misconceptions about electric circuits. ✍ Define electrical resistance and identify the factors that affect it including material type, length, and 	<p>are part of Allah’s wisdom to help us grow and transform.</p> <ul style="list-style-type: none"> 🕋 Appreciate how Ohm’s Law demonstrates the balance Allah has placed in creation where cause and effect are connected in precise measure, showing that nothing happens without purpose. 🕋 Think about series circuits as a symbol of the unity of the believers who share a single path and purpose, and parallel circuits as a reflection of diversity in the ummah where multiple paths contribute to a common good. 	<ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 16 (Sec. 16.2) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/circuits <p>11.3 Electrical Resistance:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 16 (Sec. 16.5) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/circuits <p>11.4 Circuit Connections:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 17 (Sec. 17.1-17.6) ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/circuits
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<p>create resistance to its motion. Defining electrical resistance and the factors that affect it such as material, length and cross-sectional area of the conductor. Applying Ohm's Law to relate voltage, current and resistance in a circuit. Revisiting the concept of electric power to see how resistance influences the rate at which electrical energy is converted into other forms of energy in circuits.</p> <p><u>11.4 Circuit Connections:</u> Learning to interpret and use standard circuit symbols and diagrams to represent electric circuits. Exploring the two main types of circuit connections and their characteristics. Understanding how series circuits function where components are connected end to end so that the current is the same through each. Analyzing parallel circuits where components are connected across common points providing multiple paths for current. Investigating combination circuits that</p>	<p>cross-sectional area of the conductor.</p> <ul style="list-style-type: none"> ✍ Apply Ohm’s Law to relate voltage, current, and resistance in an electric circuit and calculate electrical power in resistive components. ✍ Interpret circuit diagrams using standard symbols and distinguish between series, parallel, and combination circuits. ✍ Analyze the behavior of series circuits where current remains the same through each component and parallel circuits where multiple paths allow different currents through different branches. 	<ul style="list-style-type: none"> 🕌 Recognize that the consistent behavior of circuits and the precise flow of energy reflect the divine laws that govern the universe, reminding us of Allah’s names Al-Qadir the All Powerful and Al-Hakim the All Wise. 🕌 Understand that just as energy flows through circuits to power devices, all strength and benefit ultimately come from Allah who sustains and governs all creation with perfect wisdom. 	
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<p>contain both series and parallel elements and applying strategies to analyze their behavior.</p>	<p>✍ Apply strategies to solve problems involving combination circuits that contain both series and parallel elements.</p>		
<p>12. Magnetic Fields and Electromagnetism</p> <p>12.1 <u>Magnetism</u>: Introducing the fundamental properties of magnets including magnetic poles; understanding the nature and representation of magnetic fields; exploring the relationships and interactions between magnets and electric charges.</p> <p>12.2 <u>Electromagnetism</u>: Understanding the magnetic field generated by a current-carrying wire; exploring the creation and applications of electromagnets; studying Ampere’s Law and its role in describing the relationship between electric current and magnetic fields.</p>	<p>✍ Describe the fundamental properties of magnets including magnetic poles and explain the nature of magnetic fields.</p> <p>✍ Understand and illustrate the relationships between magnets and electric charges.</p> <p>✍ Explain how a current-carrying wire generates a magnetic field and describe the workings and applications of electromagnets.</p>	<p>â Reflect on the unseen nature of magnetic fields as a profound sign of Allah’s invisible but powerful influence governing the universe.</p> <p>â Consider the polarity of magnets as a reflection of the divine balance and duality in creation, illustrating harmony and order designed by Allah.</p> <p>â Contemplate how electric currents</p>	<p>12.1 Magnetism:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 18 (Sec. 18.1-18.3) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/Magnetic-Fields-and-Electromagnetism <p>12.2 Electromagnetism:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 19 (Sec. 19.1, 19.2) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/Magnetic-Fields-and-Electromagnetism <p>12.3 Magnetism and Moving Charges:</p> <p>The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/Magnetic-Fields-and-Electromagnetism</p> <p>12.4 Magnetism and Current Carrying Wires:</p>

<p>12.3 <u>Magnetism and Moving Charges</u>: Exploring the force experienced by a moving electric charge in a magnetic field; understanding the principles behind devices like the mass spectrometer that use magnetic forces to analyze particles.</p> <p>12.4 <u>Magnetism and Current Carrying Wires</u>: Examining the forces exerted on wires carrying electric current within magnetic fields; understanding how these forces are applied in devices such as speakers and electric motors to produce sound and motion.</p> <p>12.5 <u>Electromagnetic Induction and Lenz's Law</u>: Introducing Faraday's Law of electromagnetic induction, explaining how a changing magnetic flux induces an electromotive force (emf). Understanding Lenz's Law as the principle that the direction of the induced current opposes the change causing it, demonstrating energy conservation. Exploring real-</p>	<ul style="list-style-type: none"> ✍ Apply Ampere's Law to relate electric current and magnetic fields. ✍ Analyze the force exerted on moving electric charges in magnetic fields and describe applications such as the mass spectrometer. ✍ Examine the forces on current-carrying wires within magnetic fields and understand their use in practical devices like speakers and electric motors. ✍ State and apply Faraday's Law to calculate induced emf. ✍ Use Lenz's Law to predict the direction of induced currents. 	<p>create magnetic fields, symbolizing the interconnectedness and cause-effect relationships embedded in Allah's design.</p> <p>♣ Appreciate that magnetic forces acting at a distance reflect Allah's intimate control and governance of the universe beyond human perception.</p> <p>♣ Think about electromagnets as examples of human ingenuity inspired by Allah's creation, reminding us to be grateful for the knowledge and skills bestowed upon us.</p> <p>♣ Recognize the precision in</p>	<ul style="list-style-type: none"> ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/Magnetic-Fields-and-Electromagnetism <p>12.5 Electromagnetic Induction and Lenz's Law:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 19 (Sec. 19.3-19.6)
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<p>world applications such as electric generators, transformers, induction cooktops, and braking systems.</p>	<ul style="list-style-type: none"> ✍ Explain how electromagnetic induction is applied in generators and transformers. ✍ Analyze practical applications such as electromagnetic braking and induction heating. 	<p>devices like mass spectrometers that use magnetic forces to uncover the secrets of the microcosm, illustrating the depth of Allah’s wisdom.</p> <ul style="list-style-type: none"> 🕋 Reflect on electric motors and speakers as practical applications of magnetic forces, showcasing how Allah’s laws of nature enable technology that benefits humanity. 🕋 Understand that the complex interactions of magnetism and electricity affirm the unity and perfect order of the universe, pointing to Allah as Al-Musawwir (The Fashioner) and Al- 	
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‘Alīm (The All-Knowing).

Term III: Waves, Optics, and Light

13. Vibrations and Waves 14. Sound Waves 15. Light and Color 16. Reflection and Mirrors 17. Refraction and Lenses 18. Modern Physics

Topic	Learning Outcomes	Islamic Integration	Resources/References
<p>13. Vibrations and Waves</p> <p>13.1 <u>Vibrations</u>: Exploring vibrational motion as repetitive back-and-forth movement; understanding the key properties of periodic motion including amplitude, frequency, and period; examining pendulum motion as a classic example of vibration; and analyzing the motion of a mass attached to a spring to illustrate simple harmonic motion.</p> <p>13.2 <u>The Nature of a Wave</u>: Understanding waves as disturbances that transfer energy without the transfer of matter; exploring different types of wavelike motion;</p>	<p>✍ Understand and describe vibrational motion as repetitive back and forth movement and identify examples such as pendulums and mass spring systems.</p> <p>✍ Explain the key properties of periodic motion including amplitude, frequency, and period and relate them to observable vibrations.</p>	<p>🕋 Reflect on the repetitive nature of vibrational motion as a reminder of the cycles Allah has placed in creation such as the alternation of day and night and the phases of the moon.</p> <p>🕋 Contemplate how waves transfer energy invisibly across distances just as Allah’s command and mercy reach His</p>	<p>13.1 Vibrations</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 11 (Sec. 11.1) ❖ The Physics Classroom, Lesson 0 https://www.physicsclassroom.com/class/waves <p>13.2 The Nature of a Wave:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 11 (Sec. 11.2, 11.3) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/waves <p>13.3 Properties of a Wave:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 11 (Sec. 11.4) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/waves

<p>defining what constitutes a wave; and classifying waves into categories such as mechanical and electromagnetic, transverse and longitudinal.</p> <p>13.3 Properties of a Wave: Exploring the fundamental characteristics of waves, including the structure or anatomy of a wave; understanding the concepts of frequency and period; examining how waves transport energy and the role of amplitude in energy transfer; studying the speed of waves and applying the wave equation to relate speed, frequency, and wavelength.</p> <p>13.4 Behavior of Waves: Examining how waves interact with boundaries and how their behavior changes at interfaces. Understanding reflection and how waves bounce back from surfaces. Exploring refraction and how waves change direction when passing into a different medium. Analyzing diffraction and how waves</p>	<ul style="list-style-type: none"> ✍ Define waves and describe how they transfer energy without transferring matter distinguishing between types such as mechanical electromagnetic transverse and longitudinal. ✍ Identify and analyze the fundamental properties of waves including frequency period amplitude wavelength speed and apply the wave equation to solve problems. ✍ Explain and predict how waves behave at boundaries including reflection refraction diffraction and interference. ✍ Understand and describe the Doppler Effect and how motion affects the 	<p>creation even when unseen.</p> <ul style="list-style-type: none"> 🕋 Consider the harmony and precision in the properties of waves as signs of Allah’s perfect design and order in the universe. 🕋 Think about the behavior of waves at boundaries as a metaphor for how believers must adapt and respond when faced with life’s tests and challenges. 🕋 Appreciate the intricate patterns of standing waves and harmonics as reflections of the beauty and complexity in Allah’s creation inviting us to ponder His greatness. 	<p>13.4 Behavior of Waves:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 11 (Sec. 11.5) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/waves <p>13.5 Standing Waves:</p> <p>The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/waves</p>
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<p>bend around obstacles or through openings. Studying wave interference and how overlapping waves combine to produce patterns. Investigating the Doppler Effect and how the motion of a source or observer affects the perceived frequency of a wave.</p> <p><u>13.5 Standing Waves:</u> Understanding the difference between traveling waves and standing waves and how standing waves are formed through the interference of two waves traveling in opposite directions. Exploring the concepts of nodes and antinodes as points of no displacement and maximum displacement in a standing wave. Analyzing harmonics and the distinct patterns formed on strings and in air columns. Applying mathematical relationships to predict and describe the behavior of standing waves in various systems.</p>	<p>observed frequency of a wave.</p> <ul style="list-style-type: none"> ✍ Differentiate between traveling waves and standing waves and explain how standing waves form in various systems. ✍ Analyze the formation of nodes antinodes and harmonics in standing wave patterns on strings and in air columns and apply mathematical relationships to describe them. 	<ul style="list-style-type: none"> 🕋 Recognize that just as waves combine to produce interference patterns our actions combine in life to produce consequences recorded with precision by Allah. 🕋 Reflect on how the Doppler Effect illustrates changes in perception due to motion reminding us that human understanding is limited and always dependent on Allah’s guidance. 	
<p>14. Sound Waves</p>			<p>14.1 The Nature of a Sound Wave:</p>

<p>14.1 <u>The Nature of a Sound Wave:</u> Understanding that sound is a mechanical wave requiring a medium for its transmission and cannot travel through a vacuum. Exploring how sound propagates as a longitudinal wave where particles of the medium vibrate parallel to the direction of wave motion. Examining sound as a pressure wave characterized by regions of compression and rarefaction that create detectable variations in air pressure.</p> <p>14.2 <u>Sound Properties and Their Perception:</u> Exploring the relationship between pitch and frequency and how frequency determines whether a sound is perceived as high or low. Understanding intensity as a measure of the energy carried by a sound wave and learning how the decibel scale is used to express sound levels. Investigating the factors that affect the speed of sound in different media. Examining the structure and function of the</p>	<ul style="list-style-type: none"> ✍ Understand that sound is a mechanical wave requiring a medium for transmission and describe its longitudinal nature with compressions and rarefactions. ✍ Explain how pitch relates to frequency and how intensity and decibel scale measure sound energy levels. ✍ Investigate how the speed of sound varies across different media and describe the structure and function of the human ear in detecting sound. ✍ Analyze constructive and destructive interference in sound waves including beats and describe the Doppler Effect and shock waves. 	<ul style="list-style-type: none"> 🕋 Reflect on the unseen nature of sound waves as a reminder of how Allah’s commands operate invisibly yet powerfully in the universe, just as His mercy and will reach us even though unseen. 🕋 Consider how the precision in pitch, frequency, and intensity mirrors the perfection and balance Allah has placed in His creation. 🕋 Contemplate how resonance and natural frequencies symbolize the fitrah (natural disposition) Allah has instilled in all creation, where everything inclines toward its designed path and purpose. 	<ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 12 (Sec. 12.1) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/sound <p>14.2 Sound Properties and Their Perception:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 12 (Sec. 12.2-12.4) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/sound <p>14.3 Behavior of Sound Waves:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 12 (Sec. 12.5, 12.6) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/sound <p>14.4 Resonance and Standing Waves:</p> <ul style="list-style-type: none"> ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/sound
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<p>human ear and how it detects and interprets sound waves.</p> <p><u>14.3 Behavior of Sound Waves:</u> Understanding how sound waves interfere with one another to produce constructive and destructive patterns including the formation of beats. Exploring the Doppler Effect and how motion between a source and observer changes perceived frequency as well as the formation of shock waves. Examining how sound waves behave at boundaries including reflection, refraction and diffraction and how these behaviors influence what we hear and how sound travels in various environments.</p> <p><u>14.4 Resonance and Standing Waves:</u> Exploring the concept of natural frequency and how objects tend to vibrate at specific frequencies. Understanding forced vibration and how external forces can cause objects to oscillate. Examining how standing wave patterns form in different</p>	<ul style="list-style-type: none"> ✍ Explore boundary behaviors such as reflection, refraction, and diffraction and how these affect sound propagation. ✍ Understand the concept of resonance, natural frequency, forced vibration, and formation of standing wave patterns including harmonics. 	<ul style="list-style-type: none"> 🕋 Think about how the human ear's ability to detect subtle variations in sound reflects Allah's blessing of hearing, urging us to use this gift in gratitude and obedience. 🕋 Recognize that the Doppler Effect and changes in perceived sound with motion illustrate the relativity of our perceptions and how only Allah sees and knows all realities perfectly. 🕋 Appreciate how the predictable behavior of sound at boundaries and its patterns of interference show the laws set by Allah and encourage reflection on the harmony He has 	
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<p>systems and how these patterns relate to the fundamental frequency and its harmonics.</p>		<p>established in the universe.</p> <p>🕋 Reflect on the Qur’anic descriptions of sound, voice, and hearing as reminders of accountability for how we use our senses and what we choose to listen to in life.</p>	
<p>15. Light Waves and Color</p> <p>15.1 <u>The Wave Properties of Light</u>: Exploring the evidence that demonstrates the wave nature of light through its wavelike behaviors. Understanding how light produces interference patterns using two-point source interference and thin film interference. Examining polarization as a property unique to transverse waves and as further proof of light’s wave characteristics.</p> <p>15.2 <u>Color and Vision</u>: Exploring the electromagnetic</p>	<p>🔍 Understand and explain the wave properties of light, including interference and polarization.</p> <p>🔍 Analyze and describe two point source interference and thin film interference phenomena.</p> <p>🔍 Identify and explain how the human eye perceives color</p>	<p>🕋 Reflect on the nature of light as a sign of Allah’s creative power, illuminating the darkness both literally and metaphorically in our lives.</p> <p>🕋 Consider how the wave properties of light demonstrate Allah’s order and precision in creation, where even invisible</p>	<p>15.1 The Wave Properties of Light:</p> <p>The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/light</p> <p>15.2 Color and Vision</p> <p>The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/light</p> <p>15.3 Mathematical Analysis of Two-Source Light Interference:</p> <p>The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/light</p>

<p>spectrum with a focus on the visible range that human eyes can detect. Understanding how the eye responds to different wavelengths of light to perceive color. Examining how light interacts with materials through absorption, reflection, and transmission to produce various colors. Learning about the principles of color addition and color subtraction and how these explain everyday phenomena such as the blue color of the sky and the red hues of sunsets.</p> <p><u>15.3 Mathematical Analysis of Two-Source Light Interference:</u> Analyzing the structure and features of interference patterns created by two coherent light sources. Understanding how path difference between waves affects the positions of constructive and destructive interference. Studying Young's equation as a mathematical model to predict fringe spacing in interference patterns. Reviewing Young's famous double-slit experiment and its</p>	<p>through interaction with the visible spectrum.</p> <ul style="list-style-type: none"> ✍ Explore how light absorption, reflection, and transmission influence the colors we see. ✍ Understand the principles of color addition and subtraction and apply these to explain natural phenomena like the sky's color and sunsets. ✍ Use mathematical models such as Young's equation to analyze interference patterns and predict fringe spacing. ✍ Appreciate the significance of Young's double-slit experiment as 	<p>phenomena follow predictable patterns.</p> <ul style="list-style-type: none"> 🕋 Contemplate the colors in nature as manifestations of Allah's artistry and wisdom, each hue carefully designed to bring beauty and balance to the world. 🕋 Appreciate the human eye as a complex gift from Allah, enabling us to perceive and appreciate the diversity of colors and light around us. 🕋 Reflect on the principle of interference and harmony in light waves as a metaphor for the unity and balance Allah commands 	
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<p>significance in demonstrating the wave nature of light. Exploring additional applications of two-point source interference in optics and modern technology.</p>	<p>evidence of the wave nature of light.</p>	<p>in the universe and human society.</p> <ul style="list-style-type: none"> 🕌 Think about the interplay of light and color as a reminder of the balance between light and darkness in life, and the ultimate guidance Allah provides. 🕌 Recognize that scientific discoveries like Young’s experiment unveil deeper layers of the universe’s design, inspiring gratitude for Allah’s boundless knowledge and creative power. 	
<p>16. Reflection and Mirrors</p> <p>16.1 <u>Reflection and its Importance</u>: Exploring how light enables sight by traveling in straight lines and reflecting off surfaces. Understanding the concept of the line of sight as</p>	<p>🔗 Understand how light enables sight by traveling in straight lines and reflecting from surfaces</p>	<p>🕌 Reflect on how light traveling in straight lines and reflecting from surfaces symbolizes Allah’s</p>	<p>16.1 Reflection and its Importance:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Sec.14.1) ❖ The Physics Classroom, Lesson 1 https://www.physicsclassroom.com/class/refln

<p>the path light follows from an object to the eye. Learning the law of reflection which states that the angle of incidence equals the angle of reflection. Distinguishing between specular reflection, where light reflects in a single direction from smooth surfaces, and diffuse reflection, where light scatters in many directions from rough surfaces, affecting how we perceive objects.</p> <p>16.2 Image Formation in Plane Mirrors: Understanding why images are formed when light reflects off plane mirrors. Examining the characteristics of images in plane mirrors such as their size, orientation, and distance from the mirror. Learning how to construct ray diagrams to accurately locate images formed by plane mirrors. Exploring how much of a mirror is necessary to see a full image of an object. Investigating the use of right-angle mirrors and other systems with multiple mirrors to create complex reflections.</p>	<ul style="list-style-type: none"> ✍ Explain the concept of the line of sight and how it relates to the path of light ✍ Apply the law of reflection, stating the angle of incidence equals the angle of reflection ✍ Differentiate between specular reflection from smooth surfaces and diffuse reflection from rough surfaces ✍ Describe why and how images form in plane mirrors, including their size, orientation, and location ✍ Construct ray diagrams to locate images formed by plane mirrors accurately ✍ Analyze how much of a plane mirror is 	<p>perfect guidance illuminating the path for believers</p> <ul style="list-style-type: none"> ⌘ Consider the law of reflection as a sign of Allah’s precise and unchanging laws governing both the physical universe and spiritual truths ⌘ Contemplate how specular and diffuse reflections reveal Allah’s wisdom in creating diverse ways for light to reveal beauty and truth ⌘ Appreciate that the formation of images through reflection teaches us about self-reflection and the importance of seeing ourselves clearly before Allah 	<p>16.2 Image Formation in Plane Mirrors:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Sec.14.4) ❖ The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/refln <p>16.3 Concave Mirrors:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Sec.14.5) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/refln <p>16.4 Convex Mirrors:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Sec.14.6) ❖ The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/refln
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<p><u>16.3 Concave Mirrors:</u> Exploring the structure and properties of concave curved mirrors. Understanding how light reflects off concave mirrors and how images are formed through this reflection. Learning the two fundamental rules of reflection specific to concave mirrors. Constructing ray diagrams to predict the position and nature of images formed by concave mirrors. Examining the characteristics of these images, including size, orientation, and type (real or virtual). Applying the mirror equation to relate object distance, image distance, and focal length. Investigating spherical aberration and how it affects image quality in curved mirrors.</p> <p><u>16.4 Convex Mirrors:</u> Understanding how light reflects from convex curved mirrors and how images are formed through this reflection. Learning to construct ray diagrams to determine the position and properties of images created by convex</p>	<p>needed to view a full image</p> <ul style="list-style-type: none"> ✍ Investigate reflections from right-angle and multiple mirror systems ✍ Explore the structure and properties of concave mirrors, including reflection behavior and image formation ✍ Use ray diagrams to predict the position and nature of images formed by concave mirrors ✍ Describe the characteristics of images formed by concave mirrors, such as real or virtual, magnified or reduced ✍ Apply the mirror equation to concave mirrors and 	<ul style="list-style-type: none"> 🕋 Think about mirrors as metaphors for the heart that reflects the light of faith or the darkness of doubt depending on its purity 🕋 Recognize that concave mirrors, which can magnify and clarify images, remind us of the need for deep reflection and focus in our spiritual lives 🕋 Understand that imperfections like spherical aberration show human limitations, encouraging humility before the perfection of Allah’s creation 🕋 See convex mirrors, which provide wider views but smaller 	
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<p>mirrors. Exploring the characteristics of these images, such as being virtual, diminished, and upright. Applying the mirror equation specifically to convex mirrors to relate object distance, image distance, and focal length.</p>	<p>understand spherical aberration effects</p> <ul style="list-style-type: none"> ✍ Understand how convex mirrors reflect light and form images ✍ Construct ray diagrams for convex mirrors and describe the properties of their images ✍ Apply the mirror equation for convex mirrors to relate object distance, image distance, and focal length 	<p>images, as a reminder of Allah’s encompassing knowledge and vision, seeing all things from every angle</p> <ul style="list-style-type: none"> 🕋 Reflect on the mirror equation as a demonstration of divine order, balance, and the interconnectedness of cause and effect in both the seen and unseen realms 🕋 Acknowledge that light and reflection are physical manifestations of Allah’s attribute An-Nur (The Light), guiding all creation towards truth and understanding 	
<p>17. Refraction and Lenses</p> <p>17.1 <u>Refraction at a Boundary:</u> Understanding how light behaves when it passes from</p>	<ul style="list-style-type: none"> ✍ Describe how light bends when it passes from one medium to another due to 	<ul style="list-style-type: none"> 🕋 Reflect on how light bends at boundaries as a sign of Allah’s 	<p>17.1 Refraction at a Boundary:</p> <p>The Physics Classroom, Lesson 1</p>

<p>one medium to another and changes speed causing it to bend at the boundary. Exploring how refraction enables sight by directing light into the eye correctly so that clear images are formed. Investigating the cause of refraction based on differences in optical density and the speed of light in various materials. Examining how the direction of light bending depends on whether light speeds up or slows down as it crosses the boundary. Learning from examples like the archer fish to appreciate how creatures use refraction in their interaction with the environment.</p> <p>17.2 The Mathematics of Refraction: Exploring how the angle of refraction describes the bending of light as it passes between materials of different optical densities. Understanding Snell's Law as the mathematical relationship that governs refraction and how it predicts the bending of light. Learning how to apply ray tracing techniques and</p>	<p>changes in speed and optical density</p> <ul style="list-style-type: none"> ✍ Apply Snell's law to calculate angles of refraction and analyze refraction scenarios ✍ Explain the conditions that lead to total internal reflection and identify applications where it occurs ✍ Analyze and explain refraction phenomena such as dispersion through prisms, rainbow formation, and mirages ✍ Construct accurate ray diagrams for both converging and diverging lenses to determine image characteristics ✍ Apply the lens formula to solve numerical problems 	<p>design in creating precise laws that govern the behavior of His creation</p> <ul style="list-style-type: none"> ♻ Consider the ability of lenses and the eye to focus light as a reminder of Allah's mercy in providing human beings with sight and perception ♻ Contemplate the dispersion of light into beautiful colors as a manifestation of Allah's artistry and the diversity of His creation ♻ Recognize that the consistency of refraction and total internal reflection laws reflect Allah's unchanging will and perfect 	<p>https://www.physicsclassroom.com/class/refrn</p> <p>17.2 The Mathematics of Refraction:</p> <p>The Physics Classroom, Lesson 2 https://www.physicsclassroom.com/class/refrn</p> <p>17.3 Total Internal Reflection:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Sec.14.3) ❖ The Physics Classroom, Lesson 3 https://www.physicsclassroom.com/class/refrn <p>17.4 Interesting Refraction Phenomena:</p> <p>The Physics Classroom, Lesson 4 https://www.physicsclassroom.com/class/refrn</p> <p>17.5 Image Formation by Lenses:</p> <ul style="list-style-type: none"> ❖ CK-12 Physics, Ch. 14 (Secs.14.7, 14.8) ❖ The Physics Classroom, Lesson 5 https://www.physicsclassroom.com/class/refrn <p>17.6 The Eye:</p>
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<p>Snell's Law to solve practical refraction problems. Investigating how to determine the index of refraction for various materials through experimental and mathematical methods.</p> <p>17.3 <u>Total Internal Reflection</u>: Revisiting boundary behavior to understand how light behaves when moving from a more optically dense medium to a less optically dense medium. Exploring the concept of total internal reflection, where all light is reflected back into the denser medium instead of refracting. Learning about the critical angle and how it determines the conditions under which total internal reflection occurs.</p> <p>17.4 <u>Interesting Refraction Phenomena</u>: Exploring how refraction causes the dispersion of light into its component colors as it passes through a prism, creating a spectrum. Understanding the formation of rainbows as a result of dispersion, reflection, and</p>	<p>involving focal length, object distance, and image distance</p> <ul style="list-style-type: none"> ✍ Explain the anatomy of the eye and how it focuses light to form images ✍ Describe common vision defects such as nearsightedness and farsightedness and how corrective lenses address them 	<p>command over natural processes</p> <ul style="list-style-type: none"> 🕋 Appreciate the structure of the eye and its ability to accommodate as a miraculous sign of Allah's wisdom and power in designing living beings 🕋 Understand that the ability to correct vision with lenses is part of Allah's provision of knowledge and resources to humanity for ease and benefit 🕋 See the rainbow and mirage as reminders of Allah's signs in nature that inspire reflection and gratitude 	<p>The Physics Classroom, Lesson 6 https://www.physicsclassroom.com/class/refrn</p>
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<p>refraction of sunlight in water droplets. Examining mirages as optical illusions created by the refraction of light in layers of air with varying temperatures and densities.</p> <p><u>17.5 Image Formation by Lenses:</u> Exploring the structure and anatomy of lenses and how their shape influences the bending of light. Understanding how lenses refract light to form images and revisiting concepts of image formation through refraction. Learning to construct ray diagrams for converging lenses to predict image position, size, and nature. Analyzing object and image relationships for converging lenses and understanding how they depend on object distance. Constructing ray diagrams for diverging lenses and studying how they produce virtual, diminished, and upright images. Exploring object and image relationships for diverging lenses. Applying mathematical equations related</p>			
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<p>to lenses to calculate focal lengths, object distances, and image distances.</p> <p>17.6 <u>The Eye</u>: Exploring the anatomy of the human eye and understanding the function of each part in focusing light. Learning how the eye forms images on the retina and how these images are detected and processed. Examining the wonder of accommodation as the eye adjusts its focal length to see objects at varying distances. Understanding the causes of farsightedness and how it is corrected using converging lenses. Exploring the causes of nearsightedness and how it is corrected using diverging lenses.</p>			
<p>18. Modern Physics</p> <p>Exploring the fundamental principles and discoveries that shape contemporary physics; studying the basic constituents of matter including leptons, quarks, and bosons; examining the fundamental forces: electromagnetic, strong</p>	<p>✍ Identify fundamental particles (leptons, quarks, bosons) and describe their roles in the universe. Explain the four fundamental forces and their effects at</p>	<p>🕒 Contemplate the evolution of atomic models as an example of human curiosity and intellect granted by Allah, emphasizing that</p>	<p>Modern Physics</p> <p>CK-12 Physics, Ch. 20 (Sec. 20.1- 20.11)</p>

<p>nuclear, and weak nuclear; tracing the historical development of atomic models from Dalton to Bohr; understanding the quantum mechanical model of the atom; analyzing isotopes, nuclear stability, radioactivity, nuclear reactions, and nuclear reactors; and introducing the revolutionary concepts of the Special and General Theories of Relativity. Practical examples include particle interactions, nuclear decay, energy production in reactors, and the behavior of matter and energy at relativistic speeds.</p>	<p>atomic and subatomic scales. Trace the historical development of atomic theory from Dalton to Bohr, highlighting key experiments and discoveries.</p> <ul style="list-style-type: none"> ✍ Compare and contrast the planetary model of the atom with Bohr's model and the quantum mechanical model. ✍ Understand the concept of quarks and their contribution to particle physics. ✍ Define isotopes and explain factors contributing to nuclear stability. ✍ Describe radioactive decay processes, calculate half-life, 	<p>knowledge is a gift and responsibility.</p> <ul style="list-style-type: none"> 🕋 Recognize nuclear stability, isotopes, and radioactive decay as illustrations of balance and order in creation, echoing the Qur'anic concept of <i>mīzān</i> (balance). <i>"And We have made the heaven and the earth two signs, and We erased the sign of the night and made the sign of the day visible, that you may seek bounty from your Lord..." (Qur'an 17:12)</i> 🕋 Consider nuclear energy and reactors as a demonstration of human stewardship (<i>khalīfah</i>) over Allah's resources, requiring ethical 	
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	<p>and understand their applications.</p> <ul style="list-style-type: none"> ✍ Analyze nuclear reactions including fission and fusion, and describe the working principles of nuclear reactors. ✍ Apply the concepts of the Special Theory of Relativity to understand time dilation, length contraction, and mass-energy equivalence ($E=mc^2$). ✍ Appreciate the significance of the General Theory of Relativity in explaining gravity, spacetime curvature, and cosmic phenomena. ✍ Solve problems involving atomic and subatomic systems, radioactive decay, 	<p>responsibility and safety.</p> <ul style="list-style-type: none"> 🕋 Reflect on relativistic physics, time dilation, and the interconnectedness of space and time as signs of Allah's infinite knowledge and power beyond human perception. <i>"...Indeed, Allah is over all things competent."</i> (Qur'an 2:20) 🕋 Understand that modern physics reveals both the limits and the potential of human inquiry, reinforcing humility, awe, and gratitude toward Allah while pursuing scientific knowledge. 	
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	nuclear reactions, and relativistic scenarios.		
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Physics Interactives

Term I	Term II	Term III
<u>1-Dimensional Kinematics</u>	<u>Circular Motion and Gravitation</u>	<u>Vibrations, Waves, and Sound</u>
<u>Newton's Laws of Motion</u>	<u>Balance and Rotation</u>	<u>Light and Color</u>
<u>Vectors, Projectiles and Two-Dimensional Motion</u>	<u>Static Electricity</u>	<u>Reflection and Mirrors</u>
<u>Forces in Two Dimensions</u>	<u>Electric Circuits</u>	<u>Refraction and Lenses</u>
<u>Momentum and Collisions</u>	<u>Magnetism and Electromagnetism</u>	
<u>Work and Energy</u>		

Free Online Resources for Physics Learning

<https://www.physicsclassroom.com/>

<https://www.khanacademy.org/>

<https://phet.colorado.edu/>

<https://flexbooks.ck12.org/cbook/ck-12-physics-flexbook-2.0/>

<https://openstax.org/subjects/science>

<https://www.fizzics.org/>

Physics Course Evaluation

Homework and Problem Sets (assigned regularly) - 20%

Focus on reinforcing concepts, calculations, diagrams, and application of physics laws, including reflection tasks where appropriate.

Quizzes (weekly or biweekly short assessments) -20%

Target key concepts, formulas, and problem-solving skills from recent lessons.

Tests (end of term, midterm, and final exams) -20%

Comprehensive tests that assess understanding of concepts, problem-solving, graphing, and interpretation of real-world physics phenomena.

Laboratory Work and Practical Activities - 15%

Assessment of hands-on experiments, simulations, data collection, analysis, and written lab reports.

Class Participation and Engagement -10%

Includes involvement in class discussions, asking thoughtful questions, contributing to group work, and demonstrating curiosity about physics in relation to Islamic integration themes.

Project or Research Assignment (can include Science Fair or Physics Investigation Project)- 15%

Encourage independent or small group investigations, model building, or presentation of physics concepts linked to real-world applications or Islamic reflections (e.g., exploring physics in nature, Islamic contributions to physics).

Islamic Reflections

Unit 1-One Dimensional Motion

The study of one-dimensional motion invites students to reflect on the perfect order, balance, and consistency that Allah ﷻ has established in the universe. Concepts such as displacement, velocity, acceleration, and free fall are not random occurrences, but manifestations of the precise laws Allah created to govern all movements. Whether an object is accelerating downward under gravity or traveling at constant velocity, its behavior is predictable, measurable, and rooted in divine wisdom.

“[It is He] who created seven heavens in layers. You do not see in the creation of the Most Merciful any inconsistency. So return your vision to the sky, do you see any breaks?” (Surah Al-Mulk 67:3)

“Then return your vision twice again, your vision will return to you humbled while it is fatigued.” (Surah Al-Mulk 67:4)

These verses remind us that the uniformity in motion and the flawless working of natural laws are signs (*ayat*) of the Creator’s majesty. Every free-fall or uniform acceleration is governed by laws that never change, laws that testify to Allah’s supreme control over time, space, and matter.

“To Allah belongs the dominion of the heavens and the earth; and Allah is over all things competent.” (Surah Āl-‘Imrān 3:189)

Motion graphs, whether position-time or velocity-time, give us insight into patterns and predictability, revealing how events unfold precisely as Allah wills. The slope of a graph, the area under a curve, each has meaning, and each is part of the larger tapestry Allah has woven into His creation. As we analyze these patterns, we are reminded to seek meaning and truth through contemplation.

“Indeed, in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding, those who remember Allah while standing or sitting or [lying] on their sides and give thought to the creation of the heavens and the earth, [saying], ‘Our Lord, You did not create this aimlessly; exalted are You...’” (Surah Āl-‘Imrān 3:190–191)

Studying one-dimensional motion also brings attention to the gift of human intellect (*‘aql*), which Allah has bestowed upon us to understand His creation. The ability to measure, model, and predict motion with mathematical precision is a reminder of Allah’s name Al-‘Alīm (The All-Knowing), He who gave knowledge and understanding to humankind.

The concept of time, central to motion, is also deeply spiritual. Time is a creation of Allah, and every moment that passes brings with it accountability and opportunity:

“By time. Indeed, mankind is in loss except for those who have believed and done righteous deeds and advised each other to truth and advised each other to patience.” (Surah Al-‘Asr 103:1–3)

In this unit, students are encouraged to see science not merely as the study of objects and numbers but as a journey into understanding Allah’s power and mercy through the laws He created. Physics becomes a tool for reflection, gratitude, and submission. The constant acceleration of a falling object, the smooth line of a velocity graph, or the stillness of an object at rest, all point to a higher reality.

This integration of science and spirituality nurtures a worldview in which faith and reason are not opposites but companions. As students engage with these principles, they cultivate both academic excellence and a deepened sense of *tawheed* (oneness of Allah), recognizing Him as the ultimate cause and sustainer of all that moves and rests.

Unit 2-Newton’s Law of Motion

The study of forces opens a profound window into the unseen mechanisms that govern motion and stability throughout the universe. Although forces themselves are invisible to the eye, their effects are evident and measurable serving as powerful reminders of Allah’s unseen power that sustains all creation. Just as no object moves without the influence of a force, nothing in existence occurs without the will and command of Allah:

“You did not throw when you threw, but it was Allah who threw...”
(Qur’an 8:17)

Each type of force whether gravitational, frictional, or applied, plays an essential role in maintaining the delicate balance of the cosmos. This balance mirrors the divine order that Allah has established:

“And the heaven He raised and imposed the balance, that you do not transgress within the balance.” (Qur’an 55:7–8)

When students analyze free-body diagrams, they are encouraged to break down complex systems into understandable components, reflecting the way Allah invites believers to deeply contemplate the signs within creation:

“Indeed, in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding.” (Qur’an 3:190)

Newton's First Law teaches that an object will remain at rest or continue moving at a constant velocity unless acted upon by an external force. This principle resonates with a profound truth in creation: change does not occur without cause, and all things follow the laws decreed by the Creator. The concept of inertia, the resistance of an object to changes in its state of motion points to the stability and consistency Allah has embedded in the universe. The Qur'an often reminds us that everything is in its proper place, moving or still by His will:

"To Allah belongs the dominion of the heavens and the earth; and Allah is over all things competent." (Qur'an 3:189)

The distinction between balanced and unbalanced forces teaches students about equilibrium and disruption. Balanced forces bring peace and stability; unbalanced forces cause movement and change. This physical principle mirrors the divine *mīzān* (balance) that Allah commands in all aspects of life and creation:

"And the heaven He raised and imposed the balance, that you do not transgress within the balance." (Qur'an 55:7–8)

Studying these laws helps students appreciate that the universe is not chaotic but governed by consistent rules that invite reflection on the One who created and sustains them. Just as physical motion requires an external force to change, our spiritual and moral states require intention and effort, guided by divine revelation.

Newton's Second Law, expressed as $F = ma$, reveals the direct relationship between an object's acceleration and the net force applied. This law highlights the precision and order Allah has woven into the universe, where every action produces a measurable and predictable outcome. It reflects the divine reality that nothing happens without a cause, and every cause unfolds according to Allah's predetermined laws:

"Indeed, all things We created with predestination." (Qur'an 54:49)

The insight that continuous force is not always required to sustain motion (provided no opposing force acts) challenges common intuition and deepens one's appreciation for Allah's subtle, flawless systems. These laws hold true from the vast movements of celestial bodies to the gentle fall of a leaf inviting reflection, awe, and humility:

"Do they not look at the camels, how they are created? And at the sky, how it is raised?"
(Qur'an 88:17–18)

Including air resistance in free-fall studies reminds students that even the smallest influences in motion are accounted for in Allah's design. Problems involving interactions between two bodies further illustrate how systems work in harmony, teaching us about interdependence and cause-effect relationships governed by divine wisdom.

Through this study, students learn that science and spirituality are inseparable. The consistent, measurable behavior of physical objects reflects Allah's name *Al-Hakīm* (The All-Wise), whose wisdom and governance permeate every aspect of the universe.

Unit 3 – Motion and Forces in Two Dimensions

The study of motion in two dimensions reveals an even deeper level of precision and balance in Allah's creation. The way objects move through space guided by vector components, projectiles, and multiple forces reflects the complexity and harmony Allah has woven into the universe. Though these concepts often appear abstract or invisible, they have concrete, observable outcomes, reminding us that Allah's signs are not always seen with the eye but felt through their effects just like the unseen forces acting on creation.

When students study **vectors**, they learn that direction and magnitude both matter just as human intention (niyyah) and effort ('amal) are both considered in Islam. Every vector, when broken into components, reflects how Allah invites believers to reflect deeply, analyze thoughtfully, and seek clarity in complexity. The Qur'an says:

“Indeed, in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding.”
(Qur'an 3:190)

In **projectile motion**, we observe that a single object's path depends on its initial velocity and the constant acceleration due to gravity. The curved trajectory it follows which is both predictable and measurable, reminds us that all movement is under divine control. The horizontal and vertical components, though independent, work together to define the final destination, echoing how different aspects of human effort and divine decree lead to a precise outcome. Allah says:

“To Allah belongs the dominion of the heavens and the earth; and Allah is over all things competent.” (Qur'an 3:189)

The **relative velocity** of objects, especially in problems like the riverboat model, demonstrates that perspective and frame of reference matter just as in life, what seems fast or slow, fair or unfair, can differ based on our position and understanding. Yet, the laws governing them remain consistent, a sign of Allah’s unchanging wisdom.

In **forces acting in two dimensions**, we study how multiple vectors combine, how equilibrium is maintained, and how disruption leads to motion. This reflects the *mīzān* (balance) that Allah has established in the physical world and commands in moral and spiritual life. When balance is preserved, there is stability. When it is broken, there is motion or turmoil, just as imbalance in society causes injustice and unrest:

“And the heaven He raised and imposed the balance, that you do not transgress within the balance.” (Qur’an 55:7–8)

Inclined planes and two-body problems teach how direction, friction, and applied forces interact in intricate systems. These systems mirror human relationships and struggles, each component even when small or unseen, affects the outcome. Just as a rope’s tension or a slope’s angle influences motion, every thought, word, and action in life has weight and consequence.

By engaging with these concepts, students not only enhance their problem-solving skills but also deepen their awareness of Allah’s mastery over creation. They are reminded that the laws of motion, balance, and direction reflect the laws of divine justice, purpose, and wisdom. Nothing is random; everything is decreed with intent and perfection:

“Indeed, all things We created with predestination.” (Qur’an 54:49)

This integration of science with spirituality fosters not only academic growth but also faith and humility. Students are encouraged to view the universe not as a set of disconnected phenomena but as a unified system governed by Allah, the All-Wise (Al-Ḥakīm) and the All-Knowing (Al-‘Alīm).

Unit 4 – Momentum and Collisions

The study of momentum and collisions offers deep insight into the invisible yet powerful laws Allah has established in the universe. Momentum, which is based on mass and velocity, teaches us that motion is not random but follows a deliberate and predictable pattern designed by the Creator. Just as objects change their motion through impulse, our own lives and circumstances shift based on the forces—both internal and external—that Allah allows to affect us.

The **impulse-momentum theorem** demonstrates how change comes through force overtime mirroring how lasting transformation in our lives requires consistent effort and time under Allah’s guidance. These physical laws reflect the precision and mercy of Allah’s creation. As He says:

“Indeed, all things We created with predestination.” (Qur’an 54:49)

The **law of conservation of momentum** reinforces the idea that nothing is lost in Allah’s system as everything is preserved, recorded, and returned in balance. In Islam, every deed, no matter how small carries weight and will be returned in the Hereafter:

“So whoever does an atom’s weight of good will see it, and whoever does an atom’s weight of evil will see it.” (Qur’an 99:7–8)

Two-dimensional collisions, where objects move in complex patterns yet still obey consistent laws, reflect the **balance and harmony** Allah placed in nature. These interactions reveal how seemingly chaotic events are under divine control and follow exact principles, a reminder that our own lives, no matter how complex, are within Allah’s perfect knowledge and plan.

Furthermore, these topics develop analytical skills and logical reasoning, encouraging students to reflect deeply on cause and effect. Such reflection is praised in the Qur’an, where believers are called to ponder the signs of creation:

“Indeed, in the creation of the heavens and the earth... are signs for those of understanding.”
(Qur’an 3:190)

Through this unit, students are reminded that science is not just a tool for physical understanding but a **path to spiritual awakening**. By studying how motion, impact, and energy work under Allah’s laws, we strengthen both our knowledge and our faith.

Unit 5 – Work, Energy and Power

The study of work, energy, and power allows students to witness the deep interconnection between effort, motion, and transformation in Allah’s creation. Whether it is the lifting of an object against gravity, the motion of a vehicle powered by fuel, or the sunlight energizing life on Earth, each event reflects a consistent system of cause and effect designed by the Creator. These physical concepts remind us that in both the material and spiritual worlds, effort leads to result, and energy is never wasted in Allah’s perfect accounting.

“That is because Allah is the Truth, and it is He who gives life to the dead, and it is He who is over all things competent.” (Surah Al Hajj 22:6)

Work, in physics, involves applying a force to move an object over a distance. This simple idea carries profound meaning. Just as physical work transforms energy from one form to another, our spiritual efforts also lead to change. When we strive for good with sincerity, Allah promises reward and elevation. The connection between force, movement, and energy mirrors this spiritual law of reward for effort.

“And that there is not for man except that [good] for which he strives. And that his effort is going to be seen.” (Surah An Najm 53:39–40)

The concept of kinetic energy and potential energy teaches us that everything has the capacity to move and change, and that this potential is placed by Allah. A stationary object high above the ground holds energy because of its position, just as the human soul carries potential energy waiting to be used in acts of worship, service, and reflection. When it is put to use, it becomes kinetic, active, and beneficial, fulfilling the purpose for which it was created.

“Indeed, We created man from a drop of fluid, to test him; and We made him hearing and seeing.” (Surah Al Insan 76:2)

Mechanical energy, as the sum of kinetic and potential energy, emphasizes that even when things appear still or inactive, there is hidden potential and stored capacity. Allah has created the universe with such balance and consistency that energy is conserved and transformed rather than lost. This serves as a sign of His perfection and wisdom.

Power, which is the rate of doing work, helps us reflect on the intensity and efficiency of energy use. Some processes release energy slowly, others rapidly. In life, too, people vary in how quickly they act or respond to challenges. The idea of power teaches us to value both effort and time, and to strive for excellence in our actions, no matter how small they may seem.

“And whatever good you put forward for yourselves, you will find it with Allah. It is better and greater in reward.” (Surah Al Muzzammil 73:20)

Understanding the relationship between work and energy leads us to recognize the balance and order that Allah has established. Whether mechanical energy is conserved in a closed system or transformed through friction, the underlying message is one of accountability and precision. Nothing happens without purpose, and no action is without result.

This unit also highlights the importance of distinguishing between internal and external forces. Just as internal forces do not change the total energy of a system, our internal thoughts only lead to change when acted upon by intention and outward effort. Islam teaches us to align inner beliefs with outward actions, making every step of our journey meaningful.

Through bar charts and energy analysis, students learn to visualize and track how energy moves and transforms. These tools allow us to reflect on how Allah has given humans the ability to understand, calculate, and benefit from the laws of nature. Every joule of energy, every second of power, every bit of work performed, all follow divine laws set in motion by the One who is All Powerful and All Wise.

As students explore work, energy, and power, they are encouraged to view science as more than just numbers and equations. It is a reflection of Allah's names, such as Al Qadir (The All Powerful) and Al Hakim (The All Wise), and it nurtures humility, gratitude, and a deeper awareness of our place in the universe. True understanding comes not only through calculation but through reflection and remembrance.

“Say, Travel through the land and observe how He began creation.” (Surah Al Ankabut 29:20)

Unit 6 – Rotational Motion

The study of rotational motion offers students a unique opportunity to reflect on balance, effort, and the hidden forces that govern both the physical and spiritual world. From a spinning wheel to a figure skater twirling gracefully, every rotation follows precise laws set by Allah. These laws are not arbitrary but perfectly designed and sustained by divine will.

Torque, the rotational effect of a force, teaches us how a small push at the right distance can produce a large effect. Observing seesaws, wrenches, or rotating machinery, we see that the placement and direction of force are crucial. This reminds us that in life, even small acts, if aligned with sincerity and divine guidance, can yield great results. The unseen influence of force in rotation mirrors the unseen power of Allah that shapes and sustains all creation.

“And the heaven He raised and imposed the balance, that you not transgress within the balance.” (Surah Ar-Rahman 55:7–8)

Angular momentum, the rotational counterpart of linear momentum, shows how objects resist changes to their state of motion. Just as a spinning top continues to turn unless acted upon by an external torque, human beings require guidance to remain on a straight and

purposeful path. Conservation of angular momentum reflects the continuity and preservation inherent in Allah's creation: nothing is lost without reason, and every action has a corresponding effect.

"So whoever does an atom's weight of good will see it, and whoever does an atom's weight of evil will see it." (Surah Al-Zalzalah 99:7–8)

The distribution of mass in rotating objects demonstrates the importance of balance and structure. A figure skater spins faster when arms are pulled in, illustrating how even small adjustments can significantly impact outcomes. Similarly, Allah has placed the faculties of intention, effort, and choice within us so that, when aligned correctly, even small acts can create meaningful change.

Through studying torque and angular momentum, students witness the precision, order, and balance embedded in the universe. These laws, though unseen, govern motion consistently, reminding us of Allah's attributes as *Ar-Raqeeb (The Watchful)*, *Al-Qadeer (The All-Powerful)*, and *Al-Muqet (The Sustainer)*. As learners explore rotational motion, they are encouraged to see every spinning wheel, every balancing beam, and every twirling skater not merely as physics phenomena, but as mirrors reflecting divine wisdom and guidance.

Unit 7 – Circular Motion and Gravitation

The study of circular motion and gravitation offers students a powerful opportunity to reflect on the majestic patterns of movement that govern both the smallest particles and the largest celestial bodies. From the orbit of electrons around a nucleus to the revolving of planets around the sun, everything follows a precise and consistent path set by Allah. These movements are not random or chaotic but are perfectly calculated and sustained by divine will.

"It is Allah who created the night and the day and the sun and the moon; all heavenly bodies in an orbit are swimming." (Surah Al-Anbiya 21:33)

When we analyze circular motion, we learn that even an object moving at a constant speed is constantly accelerating because its direction is changing. This acceleration requires a centripetal force pulling it toward the center. Although we cannot see this force with our eyes, its effect is undeniable. This unseen force serves as a powerful reminder of the unseen will and power of Allah that governs all things. Just as no object can follow a curved path without this inward pull, no soul can remain guided without the influence of divine mercy and guidance drawing it toward truth.

“And to Allah belongs the dominion of the heavens and the earth, and Allah is over all things competent.” (Surah Aali Imran 3:189)

Applications of circular motion in real life, such as amusement park rides, ice skating, cycling, and downhill skiing, reveal how these universal laws manifest in our everyday experiences. Allah has embedded these principles into creation so that we may observe, understand, and benefit from them. The thrill of a ride or the balance of an athlete is rooted in the same physical laws that govern the cosmos, encouraging awe and reflection on the unity of creation.

“Indeed, in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding.” (Surah Aali Imran 3:190)

The law of universal gravitation connects the fall of an apple to the orbit of the moon. Newton’s realization that the same invisible force pulling objects to the ground also keeps the moon in orbit is a striking testimony to the unity and perfection of Allah’s design. Gravity is not just a physical force, but a sign of divine order, showing us that no motion escapes Allah’s control and every force operates according to His decree.

“Indeed, all things We created with predestination.” (Surah Al Qamar 54:49)

Gravitation also reflects the deeper truth that Allah is the one who holds all things together. Without this invisible yet precise force, the universe would fall into disorder. Similarly, without the spiritual connection to our Creator, our lives drift without direction. Just as gravity anchors planets and stars in their orbits, the remembrance of Allah anchors the human heart in peace and purpose.

Kepler’s laws of planetary motion describe the movement of celestial bodies with perfect precision. Their paths, periods, and distances follow a pattern that is mathematically exact and divinely set. These laws remind us that everything in the heavens is in submission to its Lord, and nothing escapes His knowledge or control.

“He created the heavens without pillars that you see, and has cast into the earth firmly set mountains, lest it shifts with you...” (Surah Luqman 31:10)

Weightlessness in orbit, a result of continuous free fall, symbolizes the spiritual state of disconnection when one drifts without grounding in Allah’s guidance. Stability and purpose return only when one reorients themselves toward the Creator.

The study of satellites and their motion teaches us how knowledge, when used with humility and gratitude, allows us to benefit from Allah’s creation. It is through the understanding of His laws that humans can send satellites, predict planetary movements, and build technologies that serve communities.

“Say, travel through the land and observe how He began creation. Then Allah will produce the final creation. Indeed, Allah is over all things competent.” (Surah Al Ankabut 29:20)

This unit encourages students to see science not as a field separate from faith, but as a mirror reflecting the names and attributes of Allah. From the constant force of gravity to the delicate balance in motion, we witness the signs of Allah as Ar Raqeeb (The Watchful), Al Qadeer (The All Powerful), and Al Muqet (The Sustainer). Through the study of circular motion and gravitation, learners are invited to develop both intellectual understanding and spiritual reflection, seeing each scientific law as a doorway to deeper awareness of the Creator.

Unit 8 – Thermal Physics

The study of thermal physics invites students to reflect deeply on the power and wisdom of Allah in the design of heat and energy systems. The movement of heat from one object to another, the rise in temperature due to energy transfer, and the way materials respond to heat are not random phenomena. Rather, they are governed by exact laws set by Allah to sustain life and balance on Earth.

Understanding the difference between heat and temperature leads us to appreciate how Allah has given invisible forces both meaning and purpose. Heat, a form of energy in transit, is one of the many blessings that Allah has placed in the universe to make it livable. Whether it is the warmth of the sun, the comfort of a fire, or the functioning of the human body, all are signs of His mercy and knowledge.

“Do you not see that Allah sends down rain from the sky, and We produce thereby fruits of varying colors? And in the mountains are tracts white and red of varying shades and some extremely black.” (Surah Fatir 35:27)

The three methods of heat transfer: conduction, convection, and radiation, demonstrate how energy is distributed in a variety of ways. Each method operates under specific conditions and rules, showing us the diversity and precision in Allah’s creation. This reminds us of His name Al Hakeem, the Most Wise, who creates nothing without reason and governs everything with balance.

The use of thermometers and the ability to measure heat through calorimetry reflect the human capacity to observe and understand. This is a gift from Allah, who has made the universe knowable and subjected its systems to human inquiry.

“He has subjected to you whatever is in the heavens and whatever is in the earth, all from Him. Indeed, in that are signs for a people who give thought.” (Surah Al Jathiyah 45:13)

Calorimetry, in particular, allows students to measure how much heat energy is gained or lost in a process. This precision teaches that energy is neither created nor destroyed, but transferred and conserved—just as every action in life, big or small, is preserved and recorded by Allah.

“And every small and great thing is recorded.” (Surah Al Qamar 54:53)

Through this unit, students are encouraged to see heat as more than a scientific concept. It is a sign of life, motion, and change that reflects the power of the Creator. Even the rate of heat transfer varies based on material and environment, reminding us that nothing is accidental and all things unfold as Allah has willed them to. The way energy flows and transforms across systems mirrors the flow of blessings and the unfolding of events in our own lives, governed always by wisdom and justice.

By studying thermal physics, students not only gain scientific knowledge but also strengthen their awareness of Allah’s names and attributes. The One who created fire for warmth is also the One who warns of it in the Hereafter. The One who grants the warmth of the sun is the same who gives light to the hearts of believers. Science, then, becomes a means of reflection and gratitude, drawing the heart closer to the One who made all things with purpose.

Unit 9 – Fluids

The study of fluids offers students a window into the hidden forces and balances that govern both the natural world and our daily lives. From the pressure at the bottom of the ocean to the gentle support a boat receives when floating, fluids demonstrate the precision, order, and harmony embedded in Allah’s creation.

Fluid pressure shows us how invisible forces act uniformly in all directions. Oceanic and atmospheric pressures remind us that even what we cannot see exerts influence and sustains life, just as Allah’s unseen will guides and supports every aspect of creation.

“Do they not see the water that We send down from the sky, and with it We bring forth fruit of various colors? Indeed in that is a sign for a people who give thought.” (Surah Al-Nahl 16:11)

Archimedes' principle teaches us about buoyancy: an object immersed in a fluid experiences a force proportional to the volume of fluid displaced. This principle is not merely a physical law but a reflection of divine support, demonstrating that Allah lifts and sustains creation according to precise measure. Pascal's Law, showing how pressure applied at one point is transmitted throughout a fluid, mirrors the universality of divine justice and mercy, reaching all points evenly and without prejudice.

Gas laws, including Boyle's Law, Gay-Lussac's Law, and the Universal Gas Law, reveal the relationships between pressure, volume, and temperature. These predictable relationships demonstrate that creation operates under consistent principles, allowing humans to understand, predict, and benefit from the natural world. The ability to harness these laws responsibly, whether in hydraulics or gas-filled containers, reflects the Qur'anic principle of stewardship (*khalifah*), encouraging ethical and mindful use of Allah's resources.

"Say, travel through the land and observe how He began creation. Then Allah will produce the final creation. Indeed, Allah is over all things competent." (Surah Al-Ankabut 29:20)

Through the study of fluids, students are invited to contemplate the unseen forces and balance that maintain life and the universe. Just as fluids exert pressure, provide support, and transmit forces invisibly, so too does Allah sustain and guide all of creation. Understanding these laws nurtures both intellectual insight and spiritual reflection, highlighting Allah's attributes as Al-Muqet (The Sustainer), Al-Hakeem (The Wise), and Al-Razzaq (The Provider).

Unit 10 -Static Electricity

The study of static electricity reveals the subtle and profound ways Allah's power manifests in the unseen forces that govern the natural world. Though electric charges and fields are invisible to the naked eye, their effects are real and measurable, serving as powerful signs of Allah's command over creation. This unit encourages students to reflect on the reality that much of what controls our universe lies beyond our direct perception, yet operates with perfect precision and order as decreed by the Creator.

The interaction between positive and negative charges demonstrates the divine balance and harmony Allah has embedded within nature. Just as opposite charges attract and like charges repel, the universe maintains equilibrium through complementary forces, reminding us of the spiritual and moral balances that Allah requires in our lives.

Electric fields act at a distance, influencing objects without physical contact, which invites reflection on Allah’s omnipresence and omnipotence. Though unseen, His influence sustains all existence and governs every interaction, inspiring awe and submission to His wisdom and power.

Grounding, the process of removing excess charge, serves as a metaphor for purification and spiritual cleansing. Just as an object becomes neutral by discharging excess electricity, believers are encouraged to cleanse their hearts and minds from harmful traits and sins to attain peace and purity before Allah.

The study of natural phenomena such as lightning highlights the awe-inspiring power of Allah, whose might is beyond human comprehension. Lightning’s sudden, powerful discharge reminds us of His ability to control forces that shape the world, reinforcing the importance of humility and reliance on Him.

Through understanding static electricity, students gain insight into the unseen dimensions of Allah’s creation. They are reminded that true knowledge encompasses both what is visible and what is hidden, encouraging a holistic view that integrates scientific inquiry with spiritual awareness.

This unit nurtures gratitude for the wisdom and perfection in Allah’s design, fostering a sense of responsibility to use knowledge in ways that honor the Creator. As students explore the principles of static electricity, they are invited to deepen their faith by recognizing the signs of Allah’s power, wisdom, and mercy in every aspect of the natural world.

Unit 11 -Electric Circuits

The study of electric circuits invites students to reflect on the divine order and precision that Allah has established in the universe. Just as electric potential difference drives charges through a circuit, it is Allah who sets everything in motion and guides creation according to His perfect will. The movement of charge under the influence of electric fields reminds us of how unseen forces govern much of what happens in the world, just as Allah’s unseen power governs all affairs.

“Allah is the Creator of all things, and He is, over all things, Disposer of affairs.” (Surah Az-Zumar 39:62)

The concept of current, where charges flow steadily through a complete path, reflects the need for structure and guidance in life. Just as a circuit must be complete for current to flow, our actions must be connected to purpose and guided by divine principles to be

beneficial. The ability of moving charges to perform work is a reminder that every small effort can produce an effect, and no deed escapes Allah's knowledge.

“And whatever good you put forward for yourselves, you will find it with Allah. It is better and greater in reward.” (Surah Al-Muzzammil 73:20)

The idea of resistance within circuits encourages students to think about obstacles that slow or hinder progress. In life, resistance can be seen as challenges and tests that require perseverance. Ohm's Law teaches the balance between potential, current, and resistance. This balance reflects the fairness and justice of Allah's creation where every cause has an effect in exact measure.

“Indeed, all things We created with predestination.” (Surah Al-Qamar 54:49)

The study of circuit connections in series and parallel encourages reflection on unity and cooperation. In a series circuit, all components share the same current, just as believers are urged to support one another in a single path. In parallel circuits, while the components have separate paths, they work together for the same purpose, reminding us of diversity within unity in the ummah.

“The believers are but brothers, so make settlement between your brothers. And fear Allah that you may receive mercy.” (Surah Al-Hujurat 49:10)

By examining the flow of energy in circuits, students are reminded that all power and energy ultimately originate from Allah, Al-Qadir, the All Powerful. Just as circuits transform electrical energy into light, heat, or motion, our lives should transform the blessings we receive into acts of worship, service, and goodness. The precise laws of electric circuits are signs for those who reflect, pointing to the One who has created and sustained all systems in perfect balance.

Unit 12 – Magnetic Fields and Electromagnetism

The study of magnetism and electromagnetism reveals the unseen forces that govern the interaction of charges and currents, reflecting the profound wisdom and perfect order established by Allah ﷻ in the universe. Just as magnetic fields are invisible yet exert powerful influences on matter, Allah's power is beyond human sight but manifests clearly through the harmony and balance in creation. The poles of magnets, their fields, and their connections with electric charges all testify to a precise and intentional design.

“Indeed, Allah is over all things competent.” (Surah Al-Baqarah 2:20)

Exploring the magnetic field of a current-carrying wire and the operation of electromagnets unveils the intricate relationships between electricity and magnetism that sustain countless phenomena in nature and technology. These relationships illustrate the unity and interdependence within Allah’s creation, reminding us that all forces and systems are interconnected under His command.

The force experienced by moving charges in magnetic fields and its practical applications, such as in mass spectrometers and electric motors, demonstrate the complexity and perfection of natural laws. These laws operate with unerring precision, embodying Allah’s attribute Al-Ḥakīm, The All-Wise, who has crafted every aspect of existence with perfect knowledge and purpose.

“The Most Merciful taught the Qur’an, created man, [And] taught him eloquence.” (Surah Ar-Rahman 55:1–4)

The invisible magnetic forces acting on current-carrying wires and their role in devices like speakers and motors show how Allah’s power flows through the universe in both seen and unseen ways. Just as these forces produce sound and motion, Allah’s will moves the entire cosmos in harmony and balance.

Reflecting on these principles invites humility, as we recognize that the forces governing electromagnetism are beyond human control yet perfectly accessible through study and understanding granted by Allah’s mercy. This encourages gratitude for the intellect bestowed upon us and motivates us to use knowledge responsibly in ways that honor the Creator.

By contemplating the phenomena of magnetism and electromagnetism, students deepen their awareness of Allah’s comprehensive governance over all aspects of the universe, from the smallest particle to the vast systems of energy and matter. This understanding nurtures a holistic worldview where faith and science complement each other, fostering both awe and devotion.

“Say, ‘Travel through the land and observe how He began creation.’ Then Allah will produce the final creation. Indeed Allah, over all things, is competent.” (Surah Al-Ankabut 29:20)

Unit 13-Vibrations and Waves

The study of vibrations and waves invites students to reflect on the rhythms and cycles that Allah has embedded in creation. From the swinging of a pendulum to the oscillation of a mass on a spring these repetitive motions reflect the order and balance Allah maintains in the universe. Just as vibrations follow precise patterns so too does the alternation of night and day the changing of the seasons and the orbits of the celestial bodies all by Allah’s perfect command.

“Indeed in the creation of the heavens and the earth and the alternation of the night and the day are signs for those of understanding.” (Surah Aal Imran 3:190)

Waves remind us of the unseen forces at work in the world. They carry energy across vast distances without moving matter reflecting how Allah’s mercy and decree reach all parts of His creation even though we may not perceive them. The properties of waves such as frequency amplitude and speed showcase the precision and consistency of Allah’s laws that govern the universe.

The behavior of waves at boundaries including reflection refraction and diffraction teaches us to think about how we as believers should respond to challenges and changes. Waves adapt and continue their journey just as we are called to navigate trials with patience and trust in Allah. The patterns formed by standing waves and harmonics point to the beauty and harmony in creation inviting us to glorify Allah and recognize His artistry and wisdom.

“And of His signs is the creation of the heavens and the earth and the diversity of your languages and your colors. Indeed in that are signs for those of knowledge.” (Surah Ar Rum 30:22)

The Doppler Effect reminds us that our perception of reality can change based on our position or motion but Allah’s knowledge is absolute and His view of creation is perfect. Studying waves strengthens our sense of awe and gratitude for Allah’s creation and encourages us to use the intellect He has given us to seek knowledge and reflect on His signs.

Unit 14-Sound Waves

The study of sound waves invites students to reflect on the remarkable gift of hearing and the subtle, invisible systems Allah has created to enable communication, awareness, and connection. Though sound waves themselves are unseen, their effects are powerful and essential, much like Allah’s commands and decrees that shape the universe in ways we may not always perceive.

The structure of sound as a mechanical wave needing a medium reminds us that nothing functions independently but always within the framework Allah has created. The precision of frequency, pitch, and intensity echoes the perfection and order Allah has placed in His creation. The ability of sound to travel, reflect, refract, and interfere shows the complexity of His design and the balance of His laws, where even the smallest vibrations follow His decree.

Resonance, where objects vibrate at natural frequencies, can be seen as a reflection of the fitrah, the natural inclination toward truth and goodness that Allah has placed in human beings and creation. When we live in harmony with this natural order, we resonate with what is true and beneficial.

The human ear, a marvel of divine engineering, reminds us of the immense blessing of hearing. This gift carries responsibility, as emphasized in the Qur'an:

“Indeed, the hearing, the sight and the heart, about all those one will be questioned.” (Surah Al-Isra 17:36)

The Doppler Effect illustrates how our perception can change depending on our position and movement, reminding us that human understanding is limited and relative, while Allah's knowledge is absolute.

By studying sound waves, students are encouraged to see beyond the physical phenomena to the spiritual lessons they contain, strengthening their awe of Allah's creation and their gratitude for the faculties He has granted. This integration of science and faith nurtures both intellectual growth and spiritual awareness, fostering a deeper connection with the Creator through reflection on His signs.

Unit 15-Light Waves and Color

The study of light waves and color invites students to delve into one of the most profound signs of Allah's creativity. Light, essential for life and perception, reveals through its wave properties a universe governed by precise laws and harmonious patterns. The phenomena of interference and polarization show that even the smallest components of light behave with order and predictability, a reflection of the divine wisdom that governs all existence.

Allah, the Light of the heavens and the earth, is described in the Qur'an as the source of all illumination, both physical and spiritual. *“Allah is the Light of the heavens and the earth” (Surah An-Nur 24:35)*. Through studying how light waves interact and how colors emerge from complex processes of absorption, reflection, and transmission, students witness the balance and beauty Allah has woven into the fabric of creation.

The visible spectrum and the ability of the human eye to discern colors is a special blessing. This intricate design allows humans not only to survive but to experience joy and wonder through the colors around them. The blue sky and the red sunset serve as daily reminders of Allah's artistry and the perfection of His system.

Young's double-slit experiment is a striking example of how scientific inquiry uncovers the hidden order in Allah's creation. By observing the interference patterns produced by light, students see how Allah's laws manifest at both the grand and microscopic levels. This invites a deepened sense of humility and gratitude for the knowledge Allah has granted humankind.

This unit encourages students to view science as a path to strengthen faith, where the exploration of light and color becomes a journey toward understanding the unity, balance, and beauty established by the One who created all things with perfect measure. As they study these concepts, students are reminded that behind every wave and every color lies the wisdom of Al-Khāliq, The Creator, whose light guides both the physical world and the human soul.

Unit 16-Reflection and Mirrors

The study of reflection and the ray model of light invites students to appreciate the precise order and wisdom Allah has embedded in His creation. Light, as the fundamental means by which we see and understand the world, travels in straight lines and obeys the immutable law that the angle of incidence equals the angle of reflection. This unwavering law reflects the perfect justice and consistency of the Creator, who governs the universe with absolute precision.

The phenomena of specular and diffuse reflection reveal the diversity within Allah's creation, teaching us that light can be both focused and scattered, just as guidance may reach hearts in different ways. The reflection of light from mirrors is not merely a physical process but a profound metaphor for self-examination and spiritual clarity. Just as a mirror produces an image of an object, so does the heart reflect the light of faith or darkness, depending on its purity and attentiveness.

Concave mirrors, which magnify and clarify images, encourage us to delve deeper into our inner selves and the truths of the faith, seeking refinement and understanding. At the same time, the imperfection caused by spherical aberration reminds us of our human limitations and the need to rely on Allah's perfect knowledge and guidance.

Convex mirrors offer a wider perspective, symbolizing Allah’s all-encompassing vision that sees all from every direction. The mathematical relationships captured in the mirror equation demonstrate the harmony and balance inherent in the universe, showcasing Allah’s attribute Al-‘Adl (The Just) in the physical laws that govern both light and life.

Ultimately, light itself is a symbol of divine guidance. Allah describes Himself as An-Nur, The Light, illuminating the path for humanity through revelation and knowledge. As students study reflection and light, they are encouraged to seek both intellectual understanding and spiritual enlightenment, recognizing that the physical laws around them are signs pointing to the One who is the source of all light and truth.

“Allah is the Light of the heavens and the earth. The example of His light is like a niche within which is a lamp...” (Surah An-Nur 24:35)

This integration of scientific study and spiritual reflection nurtures a balanced worldview where faith and reason complement and reinforce each other, inspiring humility, gratitude, and a deeper awareness of the Creator’s perfect design.

Unit 17-Refraction and Lenses

The study of refraction and lenses invites students to reflect deeply on the precision and mercy that Allah has placed in His creation. When light bends as it passes from one material to another, this is not random but follows exact laws decreed by the Creator. The bending of light so that it can enter our eyes correctly and form clear images is a daily blessing that most people take for granted. It is Allah who created the eye and its perfect system of focusing and accommodation so that we may see and appreciate His signs.

“Indeed, it is not the eyes that are blind, but it is the hearts in the breasts that are blind.” (Surah Al Hajj 22:46)

The phenomenon of total internal reflection where light remains trapped within a medium at certain angles shows the beauty of Allah’s laws which operate consistently and perfectly. The formation of rainbows after rain and the optical illusion of a mirage in the desert remind us of Allah’s power to create signs that invite us to ponder and recognize His greatness.

“And of His signs is the creation of the heavens and the earth and the diversity of your languages and your colors. Indeed in that are signs for those of knowledge.” (Surah Ar Rum 30:22)

The lens, whether in an optical device or within the human eye, serves as a tool to guide light and form images. This is a sign of Allah's mercy, as He gave human beings the ability to create instruments to aid vision and correct defects such as nearsightedness and farsightedness. These blessings should inspire gratitude and humility as we recognize that both natural vision and scientific knowledge are from Allah alone. The study of refraction and lenses thus becomes a means to strengthen faith, deepen awe, and encourage reflection on the wonders of Allah's creation.

Unit 18 – Modern Physics

The study of modern physics allows students to explore the deepest structures of matter and the universe, from fundamental particles to the vast fabric of spacetime. Leptons, quarks, and bosons form the building blocks of creation, while the fundamental forces such as electromagnetic, strong, and weak govern the interactions that shape all matter. Each discovery, from the electron to nuclear forces, reflects the intricate and precise design of Allah's creation.

"Do not those who disbelieve see that the heavens and the earth were a joined entity, and We separated them..." (Surah Al-Anbiya 21:30)

Tracing the historical development of atomic theory, from Dalton to Bohr and finally to the quantum mechanical model, reveals humanity's journey of understanding Allah's signs. Each step uncovers deeper layers of reality, demonstrating that knowledge is a gift from Allah, meant to be pursued with humility and awe. Isotopes, nuclear stability, and radioactivity illustrate that even at the atomic level, creation is balanced, ordered, and purposeful.

Nuclear reactions, whether fission or fusion, show how immense energy lies hidden within matter. Harnessing this energy responsibly requires ethical stewardship and careful reflection on human responsibility in using Allah's resources.

The revolutionary concepts of the Special and General Theories of Relativity extend our understanding of space, time, and gravity. Time dilation, length contraction, and the curvature of spacetime reveal both the limits of human perception and the infinite wisdom of Allah. The universe, though vast and complex, operates according to precise laws that reflect divine knowledge, power, and sustenance.

"Indeed, Allah is over all things competent." (Surah Al-Baqarah 2:20)

At the same time, the study of modern physics reminds us of the limitations of the human mind. While we have uncovered remarkable truths, there is always more to explore. Classical physics gave way to modern physics, and today's knowledge may only hint at the mysteries that future generations will reveal. The evolution of scientific understanding shows that every answer opens new questions, reflecting that human knowledge is finite while Allah's knowledge encompasses all things.

"And with Him are the keys of the unseen; none knows them except Him..." (Surah Al-An'am 6:59)

Modern physics invites learners to see the microcosm and macrocosm as interconnected, governed by laws that are both observable and unseen. The study of particles, atoms, and relativistic phenomena is a mirror reflecting Allah's attributes as Al-Khaaliq (The Creator), Al-'Aleem (The All-Knowing), and Al-Qadeer (The All-Powerful). By exploring these laws, students develop both intellectual understanding and spiritual reflection, recognizing the unity, precision, and wisdom inherent in the universe. The continual unfolding of knowledge encourages humility, awe, and gratitude toward Allah, inspiring learners to pursue inquiry responsibly while acknowledging the infinite scope of creation.