Science Exam Syllabus
Grades 8 & 9

INTERNATIONAL
STEM OLYMPIAD

Physics

1. **Mechanics:** Concepts of motion, forces, and Newton's laws of motion.

   Phet Links:
   Forces and Motion: Basics
   Pendulum Lab
   Projectile Motion
   Friction
   Collision Lab

   LabXchange Links:
   Properties of Water
   Energy and Phase Changes
   Dynamics: Force and Newton's Laws of Motion
   Motion in Two Dimensions
   Forces and Vectors
   Linear Momentum and Collisions
   Kinematics

2. **Energy:** Understanding different forms of energy, conservation of energy, and energy transformations.

   Phet Links:
   Energy Forms and Changes
   Energy Skate Park
   Energy Skate Park: Basics

   LabXchange Links:
   Energy and Phase Changes
   Energy in Cells
   Energy Storage in the 21st Century
   Work, Energy and Simple Machines
   Excellent Energy Engineering

3. **Waves:** Properties of waves, types of waves, and wave behavior.

   Phet Links:
   Sound Waves
   Wave Interference
   Wave on a String
   Waves Intro

   LabXchange Links:
   Waves
   Waves and Energy Transfer
   Sound

4. **Optics:** Light and its properties, reflection, refraction, and lenses.

   Phet Links:
   Geometric Optics
   Geometric Optics: Basics
   Bending Light

   LabXchange Links:
   Light
   Wave Optics
   Geometric Optics

5. **Electricity:** Basics of electric circuits, Ohm's law, and electrical safety.

   Phet Links:
   Circuit Construction Kit: DC
   Circuit Construction Kit: DC - Virtual Lab
   Ohm's Law
   Resistance in a Wire
   Capacitor Lab: Basics

   LabXchange Links:
   Electric Circuits
   Electric Current, Resistance, and Ohm's Law

6. **Magnetism:** Properties of magnets, magnetic fields, and electromagnetic induction.

   Phet Links:
   Faraday's Law

   LabXchange Links:
   Magnetic Fields
   Magnetism
   Electromagnetic Induction, AC Circuits, and Electrical Technologies

7. **Thermodynamics:** Laws of thermodynamics, heat transfer, and thermal properties of matter.

   Phet Links:
   Under Pressure

   LabXchange Links:
   Thermodynamics
   Heat and Heat Transfer Methods

8. **Sound:** Properties of sound waves, sound propagation, and its applications.

   Phet Links:
   Sound Waves

   LabXchange Links:
   Sound

9. **Modern Physics:** An introduction to quantum mechanics and relativity.

   LabXchange Links:
   Introduction to Quantum Physics
   Black Holes: The Meeting of Gravity and Quantum Physics

10. **Nuclear Physics:** Basics of nuclear reactions, radioactivity, and nuclear energy.

    Phet Links:
    Isotopes and Atomic Mass
    Build a Nucleus

    LabXchange Links:
    Radioactivity and Nuclear Physics

11. **Astronomy:** Introduction to the solar system, stars, and galaxies.

    Phet Links:
    Gravity and Orbits
    My Solar System
    Blackbody Spectrum

    LabXchange Links:
    The Origin of Stars and Planets
    Galaxy Formation and Evolution

12. **Scientific Instruments:** Understanding and using scientific instruments like microscopes and telescopes.

Chemistry

1. **Atomic Structure:** Fundamentals of atomic structure, subatomic particles, and the periodic table.

   Phet Links:
   Build an Atom

   LabXchange Links:
   Chemical Bonding
   Molecular Shapes
   The Atom
   Atomic Physics
   Organizing Atoms and Electrons: The Periodic Table

2. **Chemical Bonding:** Types of chemical bonds and their properties.

   Phet Links:
   Molecule Shapes: Basics
   Build a Molecule

3. **Chemical Reactions:** Types of chemical reactions, balancing equations, and reaction rates.

   Phet Links:
   Balancing Chemical Equations
   Reactants, Products and Leftovers

4. **Acids and Bases:** Properties of acids and bases, pH scale, and neutralization reactions.

   Phet Links:
   ph Scale
   pH Scale: Basics
   Acid-Base Solutions

   LabXchange Links:
   Acids and Bases
   What Is pH Again?
   How Can We Measure pH?

5. **States of Matter:** Understanding different states of matter (solid, liquid, gas) and phase changes.

   Phet Links:
   States of Matter
   States of Matter: Basics
   Gases Intro

   LabXchange Links:
   Building Blocks and States of Matter
   Energy and Phase Changes

6. **Organic Chemistry:** Basics of organic compounds and their properties.

   LabXchange Links:
   Organic Chemistry

7. **Chemical Equilibrium:** Understanding reversible reactions and dynamic equilibrium.

8. **Environmental Chemistry:** Examining chemical processes affecting the environment.

   Phet Links:
   Greenhouse Effect

Biology

1. **Cells and Cell Functions:** Understanding cell structure, organelles, and their functions.

   Phet Links:
   Diffusion

   LabXchange Links:
   Cells
   Cell Structure I
   Cell Structure II
   Cell Structure and Function
   Cellular Structure and Function
   The Cellular Basis of Inheritance
   Diversity of Microbes, Fungi, and Protists

2. **Genetics and Heredity:** Basic concepts of genetics, inheritance, and genetic variation.

   Phet Links:
   Natural Selection

   LabXchange Links:
   DNA Structure and Function I
   DNA Structure and Function II
   Patterns of Inheritance
   Modern Understandings of Inheritance

3. **Human Anatomy and Physiology:** In-depth study of human body systems, organ functions, and homeostasis.

   LabXchange Links:
   The Cardiovascular System: Blood
   The Cardiovascular System: Blood Vessels and Circulation
   The Cardiovascular System: The Heart
   The Circulatory System
   The Immune System and Disease
   The Immune System I
   The Immune System II
   The Muscular System
   The Musculoskeletal System
   Anatomy of the Nervous System
   The Nervous System I
   The Nervous System II
   The Nervous System III
   The Nervous System IV
   The Reproductive System
   The Respiratory System
   The Respiratory System I
   The Respiratory System II
   The Respiratory System III
   The Sensory System
   Animal Nutrition and the Digestive System

4. **Ecosystems and Biodiversity:** Exploring ecological interactions, food chains, and energy flow in ecosystems.

   Phet Links:
   Greenhouse Effect

   LabXchange Links:
   Ecology
   Population and Community Ecology
   Ecosystems
   Ecosystems and the Biosphere
   Conservation and Biodiversity
   Conservation Biology and Biodiversity

5. **Evolution:** Mechanisms of evolution, evidence for evolution, and its impact on biodiversity.

   Phet Links:
   Natural Selection

   LabXchange Links:
   Evolution

6. **Animal Biology:** The physiology, anatomy, and behavior of animals, exploring how they survive, reproduce, and adapt to their environments.

   LabXchange Links:
   Animal Reproduction and Development
   Diversity of Animals
   The Body's Systems

7. **Plant Biology:** The processes of photosynthesis, plant anatomy, growth, and reproduction, highlighting the ecological roles of plants.

   LabXchange Links:
   Diversity of Plants
   Photosynthesis
   Healthy Eating, Plant Foods and Vitamins