

**Texas University Interscholastic League**

**Contest Event: Science (Physics)**

The contest challenges students to read widely in physics, to understand the significance of experiments rather than to recall obscure details, and to be alert to new discoveries and information in the areas of science. It is designed to help students gain an understanding of the basic principles as well as knowledge of the history and philosophy of science, and to foster a sense of enthusiasm about science and how it affects our daily lives.

The Texas Essential Knowledge and Skills are categorized by course area and grade level. The following are course area abbreviations used for the TEKS in Physics:

Physics = PHY  
Astronomy = AST  
Integrated Physics and Chemistry = IPC

Each TEKS begins with the outline number for the appropriate course area.

| <b>Texas Essential Knowledge and Skills</b>   | <b>Contest Knowledge and Skills</b>  |
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| <p><u>History of Physics:</u></p> <p>c3E. Research and describe the history of physics and contributions of scientists. (PHY)<br/>c3C. Evaluate the impact of research on scientific thought, society, and the environment. (PHY)<br/>c6B. Research and describe the historical development of the concepts of gravitational, electrical, and magnetic force. (PHY)<br/>c3E. Research and describe the history of astronomy and contributions of scientists. (AST)<br/>c3E. Research and describe the history of physics, chemistry, and contributions of scientists. (IPC)</p> | <p><u>History of Physics:</u></p> <ul style="list-style-type: none"> <li>- Identify the contributions of key figures in the history of physics.</li> <li>- Know the approximate time frame in which significant discoveries were made.</li> <li>- Identify Nobel prize winners in physics as well as the nationality of each winner and the year the award was presented.</li> </ul> |
| <p><u>Kinematics and Vectors:</u></p> <p>c3B. Express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems. (PHY)<br/>c4A. Generate and interpret graphs describing motion including the use of real-time technology. (PHY)</p>  | <p><u>Kinematics and Vectors:</u></p> <ul style="list-style-type: none"> <li>- Find average and instantaneous velocity.</li> <li>- Find average acceleration.</li> <li>- Solve freely falling body problems.</li> <li>- Find resultant vectors.</li> <li>- Find equilibrant vectors.</li> <li>- Solve projectile motion problems.</li> </ul>   |
| <p><u>Newton's Laws of Motion:</u></p> <p>c4C. Demonstrate the effects of forces on the motion of objects. (PHY)<br/>c4D. Develop and interpret a free-body diagram for force analysis. (PHY)<br/>c4E. Identify and describe motion relative to different frames of reference. (PHY)<br/>c4B. Investigate and describe applications of Newton's laws such as in vehicle restraints, sports</p>  | <p><u>Newton's Laws of Motion:</u></p> <ul style="list-style-type: none"> <li>- Apply Newton's first law.</li> <li>- Apply Newton's second law (<math>F = ma</math>).</li> <li>- Apply Newton's third law.</li> <li>- Use free body diagrams to solve problems.</li> </ul>   |

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| <p>activities, geological processes, and satellite orbits. (IPC)</p>   | <ul style="list-style-type: none"> <li>- Solve motion problems involving friction.</li> </ul>  |
| <p><u>Gravitation:</u></p> <p>c6A. Identify the influence of mass and distance on gravitational forces. (PHY)<br/> c6B. Research and describe the historical development of the concepts of gravitational, electrical, and magnetic force. (PHY)<br/> c7B. Research and describe the historical development of the laws of universal gravitation and planetary motion and the theory of special relativity. (AST)<br/> c9D. Relate the role of gravitation to the motion of the planets around the Sun and to the motion of moons and satellites around the planets. (AST)</p> | <p><u>Gravitation:</u></p> <ul style="list-style-type: none"> <li>- Apply Newton’s law of universal gravitation.</li> <li>- Find the acceleration of gravity.</li> <li>- Apply Kepler’s laws.</li> </ul>   |
| <p><u>Work, Energy, Conservation of Energy:</u></p> <p>c5A. Interpret evidence for the work-energy theorem. (PHY)<br/> c5B. Observe and describe examples of kinetic and potential energy and their transformations. (PHY)<br/> c5C. Calculate the mechanical energy and momentum in a physical system such as billiards, cars, and trains. (PHY)<br/> c5D. Demonstrate the conservation of energy and momentum. (PHY)<br/> c6A. Describe the law of the conservation of energy. (IPC)</p>   | <p><u>Work, Energy, Conservation of Energy:</u></p> <ul style="list-style-type: none"> <li>- Find the work done by a constant force.</li> <li>- Find the potential energy of a body.</li> <li>- Find the kinetic energy of a body.</li> <li>- Apply the law of conservation of mechanical energy.</li> <li>- Apply the work-energy principle.</li> <li>- Calculate power.</li> </ul> |
| <p><u>Linear Momentum:</u></p> <p>c5C. Calculate the mechanical energy and momentum in a physical system such as billiards, cars, and trains. (PHY)<br/> c5D. Demonstrate the conservation of energy and momentum. (PHY)<br/> c4A. Calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines. (IPC)</p>   | <p><u>Linear Momentum:</u></p> <ul style="list-style-type: none"> <li>- Apply the law of conservation of momentum.</li> <li>- Solve problems involving elastic collisions.</li> <li>- Solve problems involving inelastic collisions.</li> <li>- Find the center of mass of a system.</li> </ul>  |
| <p><u>Rotational Motion and Static Equilibrium:</u></p> <p>c5D. Demonstrate the conservation of energy and momentum. (PHY)<br/> c3B. Express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems. (PHY)<br/> c4D. Develop and interpret a free-body diagram for force analysis. (PHY)</p>  | <p><u>Rotational Motion and Static Equilibrium:</u></p> <ul style="list-style-type: none"> <li>- Calculate torque.</li> <li>- Calculate rotational inertia.</li> <li>- Apply the law of the conservation of angular momentum.</li> <li>- Calculate rotational kinetic energy.</li> </ul>   |

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| <p>c4A. Calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines. (IPC)</p>   | <ul style="list-style-type: none"> <li>- Find the moment of inertia of a body.</li> <li>- Solve statics problems.</li> </ul>  |
| <p><u>Fluids:</u></p> <p>c4D. Develop and interpret a free-body diagram for force analysis. (PHY)<br/> c7A. Investigate and identify properties of fluids density, viscosity, and buoyancy. (IPC)</p>   | <p><u>Fluids:</u></p> <ul style="list-style-type: none"> <li>- Calculate specific gravity.</li> <li>- Find the pressure due to a column of fluid.</li> <li>- Calculate buoyant force.</li> <li>- Apply Archimedes' principle.</li> <li>- Apply the equation of continuity.</li> <li>- Apply Bernoulli's equation.</li> </ul>  |
| <p><u>Oscillations:</u></p> <p>c4D. Develop and interpret a free-body diagram for force analysis. (PHY)<br/> c4A. Generate and interpret graphs describing motion including the use of real-time technology. (PHY)<br/> c5D. Demonstrate the conservation of energy and momentum. (PHY)<br/> c5A. Interpret evidence for the work-energy theorem. (PHY)<br/> c5B. Observe and describe examples of kinetic and potential energy and their transformations. (PHY)<br/> c4A. Calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines. (IPC)</p>  | <p><u>Oscillations:</u></p> <ul style="list-style-type: none"> <li>- Solve problems involving simple harmonic motion.</li> <li>- Find the period of a pendulum.</li> <li>- Find the period of a conical pendulum.</li> <li>- Analyze the motion of a mass attached to a spring.</li> </ul>  |
| <p><u>Waves and Sound:</u></p> <p>c8A. Examine and describe a variety of waves propagated in various types of media and describe wave characteristics such as velocity, frequency, amplitude, and behaviors such as reflection, refraction, and interference. (PHY)<br/> c8B. Identify the characteristics and behaviors of sound and electromagnetic waves. (PHY)<br/> c5B. Demonstrate wave interactions including interference, polarization, reflection, refraction, and resonance within various materials. (IPC)<br/> c5D. Demonstrate the application of acoustic principles such as in echolocation, musical instruments, noise pollution, and sonograms. (IPC)</p> | <p><u>Waves and Sound:</u></p> <ul style="list-style-type: none"> <li>- Identify longitudinal and transverse waves.</li> <li>- Understand refraction and diffraction of waves.</li> <li>- Find the intensity of waves.</li> <li>- Analyze vibrating strings.</li> <li>- Analyze vibrating air columns.</li> <li>- Apply the Doppler Effect equation.</li> <li>- Analyze sonic booms.</li> </ul> |

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| <p><u>Temperature and Thermal Expansion:</u></p> <p>c6B. Investigate and demonstrate the movement of heat through solids, liquids, and gases by convection, conduction, and radiation. (IPC)</p>  | <p><u>Temperature and Thermal Expansion:</u></p> <ul style="list-style-type: none"> <li>- Solve problems involving the thermal expansion of solids and liquids.</li> </ul>   |
| <p><u>Kinetic Theory of Gases:</u></p> <p>c5B. Observe and describe examples of kinetic and potential energy and their transformations. (PHY)</p>   | <p><u>Kinetic Theory of Gases:</u></p> <ul style="list-style-type: none"> <li>- Apply the ideal gas law.</li> <li>- Calculate molecular speeds.</li> </ul>   |
| <p><u>The Laws of Thermodynamics, Heat, Heat Engines:</u></p> <p>c7A. Analyze and explain everyday examples that illustrate the laws of thermodynamics. (PHY)<br/> c7B. Evaluate different methods of heat energy transfer that result in an increasing amount of disorder. (PHY)<br/> c6B. Investigate and demonstrate the movement of heat through solids, liquids, and gases by convection, conduction, and radiation. (IPC)</p> | <p><u>The Laws of Thermodynamics, Heat, Heat Engines:</u></p> <ul style="list-style-type: none"> <li>- Apply the first law of thermodynamics.</li> <li>- Apply the second law of thermodynamics.</li> <li>- Understand heat transfer.</li> <li>- Calculate the work done by an expanding gas.</li> <li>- Solve calorimetry problems.</li> </ul>  |
| <p><u>Electric Charge, Electric Field, Electric Potential:</u></p> <p>c6C. Identify and analyze the influences of charge and distance on electric forces. (PHY)<br/> c6F. Identify examples of electrical and magnetic forces in everyday life. (PHY)</p>   | <p><u>Electric Charge, Electric Field, Electric Potential:</u></p> <ul style="list-style-type: none"> <li>- Apply Coulomb's law.</li> <li>- Calculate electric field.</li> <li>- Analyze the motion of a charged particle in an electric field.</li> <li>- Calculate electric flux.</li> <li>- Find electric potential and potential difference.</li> </ul>  |
| <p><u>Capacitance, Electric Currents, DC Circuits:</u></p> <p>c6E. Design and analyze electric circuits. (PHY)<br/> c6F. Investigate and compare series and parallel circuits (IPC)</p>   | <p><u>Capacitance, Electric Currents, DC Circuits:</u></p> <ul style="list-style-type: none"> <li>- Determine capacitance and stored energy.</li> <li>- Apply Ohm's law.</li> <li>- Calculate resistance and electric power.</li> <li>- Apply Kirchhoff's rules for DC circuits.</li> <li>- Solve problems involving RC circuits.</li> <li>- Understand how to convert a galvanometer to an ammeter or a voltmeter.</li> </ul> |

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| <p><u>Magnetism, Electromagnetic Induction:</u></p> <p>c6D. Demonstrate the relationship between electricity and magnetism. (PHY)<br/> c6G. Analyze the relationship between an electric current and the strength of its magnetic field using simple electromagnets. (IPC)</p>   | <p><u>Magnetism, Electromagnetic Induction:</u></p> <ul style="list-style-type: none"> <li>- Determine the force on a moving charge in a magnetic field.</li> <li>- Find the magnetic field around a current carrying wire.</li> <li>- Find the force between two current carrying wires.</li> <li>- Calculate induced EMF.</li> <li>- Calculate voltage and current as a result of step down transformers.</li> </ul>                        |
| <p><u>Light, Reflection, Refraction, Optical Equipment:</u></p> <p>c8A. Examine and describe a variety of waves propagated in various types of media and describe wave characteristics such as velocity, frequency, amplitude, and behaviors such as reflection, refraction, and interference. (PHY)<br/> c5B. Demonstrate wave interactions including interference, polarization, reflection, refraction, and resonance within various materials. (IPC)</p>   | <p><u>Light, Reflection, Refraction, Optical Equipment:</u></p> <ul style="list-style-type: none"> <li>- Find the index of refraction.</li> <li>- Describe images formed by mirrors.</li> <li>- Describe images formed by lenses.</li> <li>- Apply Snell's law.</li> <li>- Describe images formed by telescopes.</li> </ul>   |
| <p><u>Wave Nature of Light, Interference, Diffraction, Polarization:</u></p> <p>c8A. Examine and describe a variety of waves propagated in various types of media and describe wave characteristics such as velocity, frequency, amplitude, and behaviors such as reflection, refraction, and interference. (PHY)</p>  | <p><u>Wave Nature of Light, Interference, Diffraction, Polarization:</u></p> <ul style="list-style-type: none"> <li>- Solve problems involving double slit diffraction patterns.</li> <li>- Solve problems involving thin films.</li> <li>- Find the limits of resolution of telescopes.</li> <li>- Solve problems involving polarization of light.</li> </ul>  |
| <p><u>Nuclear Physics, Quantum Theory, Elementary Particles, Special Relativity:</u></p> <p>c9A. Describe the photoelectric effect. (PHY)<br/> c9B. Explain the line spectra from different gas-discharge tubes. (PHY)<br/> c4B. Describe characteristics of galaxies. (AST)<br/> c6A. Describe nuclear reactions in stars. (AST)<br/> c6B. Identify the characteristics of stars such as temperature, age, relative size, composition, and radial velocity using spectral analysis. (AST)<br/> c7A. Demonstrate the use of units of measurement in astronomy such as light year and Astronomical Units. (AST)</p> | <p><u>Nuclear Physics, Quantum Theory, Elementary Particles, Special Relativity:</u></p> <ul style="list-style-type: none"> <li>- Calculate binding energy of nuclei.</li> <li>- Balance and analyze nuclear reactions using conservation laws.</li> <li>- Identify the components of alpha decay, beta decay and gamma decay.</li> <li>- Understand radiometric dating.</li> <li>- Identify the wave function graphs of potential</li> </ul> |

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| <p>c7B. Research and describe the historical development of the laws of universal gravitation and planetary motion and the theory of special relativity. (AST)</p> <p>c8A. Identify the approximate mass, size, motion, temperature, structure, and composition of the Sun. (AST)</p> <p>c8B. Identify the source of energy within the Sun and explain that the Sun is the major source of energy for the Earth. (AST)</p> <p>c8C. Describe the Sun's effects on the Earth. (AST)</p> <p>c7B. Research and describe the historical development of the atomic theory. (IPC)</p> <p>c8C. Investigate and identify the law of conservation of mass. (IPC)</p> <p>c8D. Describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production. (IPC)</p> | <p>wells.</p> <ul style="list-style-type: none"> <li>- Identify subatomic particles.</li> <li>- Solve problems involving relativistic effects.</li> </ul> |
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