DYNAMIC PLANET

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION**: Students will demonstrate an understanding of the large-scale processes affecting the structure of Earth's crust.

   A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minute

2. **EVENT PARAMETERS:** Each team may bring four 8.5" x 11" sheets of paper that may contain information on both sides in any form from any source. Each **participant** may **also** bring **a "non-graphing" calculator.**

3. **THE COMPETITION:** Participants will be presented with one or more tasks presented as an exam and/or timed stations. An emphasis will be placed on the NGSS Science and Engineering Practices shown on soinc.org. Topics will include the following:
   a. History of the theory of plate tectonics, including key scientists.
   b. Identification of Earth's layers - crust, lithosphere, mantle, asthenosphere.
   c. Types of plates, boundaries and margins - with specific examples. Identification of tectonic boundaries from paleogeographic reconstructions.
   d. Types of tectonic basins, processes that form them, and the nature of the sedimentary record for each (rift basin, back arc basin, foreland basin, intermontane basin).
   e. Driving forces of plate tectonics - mantle convection, mantle plumes, subduction.
   f. Plate movement and impacts of plate movement - Wilson Cycle, terranes, orogenic belts, past supercontinents, convergence, divergence, transform motion, associated faults, opening and closing of ocean gateways and landbridges (with impacts on biota).
   g. Aulacogens and hot spots.
   h. Isostatic adjustments - plate thickness, and the impact of mass wasting and glaciation. Hypsometry and the elevation/depth of continental and oceanic crust.
   i. Natural hazards due to plate tectonics - earthquakes, volcanoes, tsunamis and landslides.
   j. Magma formation - geological settings, chemistry, and properties.
   k. Geologic history of North America: Evolution of the North American craton, Rocky Mountains, Appalachian Mountains and Yellowstone Hot Spot.
   l. Interpretation of geophysical data to understand plate tectonics including brittle and ductile deformation in rocks, magnetic anomalies, gravity anomalies, stress, and seismicity.
   m. Engineering and societal practices to mitigate hazards and protect human life in tectonically active areas.

4. **REPRESENTATIVE TASKS:**
   a. Given a map of selected islands and seamounts of the Hawaiian chain accompanied by the approximate age and distance from the Island of Hawaii for each, participants may be asked to plot the movement of the Pacific Plate on a graph and respond to interpretative questions, including calculations, related to that graph.
   b. Using a paleogeographic reconstruction of the late Cretaceous identify the location of major plate boundaries represented (http://cpgeosystems.com/paleomaps.html).
   c. Given a rate of erosion of rock, estimate the actual movement of the mountaintops over time due to isostatic rebound.
   d. Deconstruct geological event histories from block diagrams.

5. **SCORING:** Points will be awarded for the quality and accuracy of responses. Ties will be broken by the accuracy and/or quality of answers to pre-selected questions.

Recommended Resources: All reference and training resources including the **Dynamic Planet CD (DPCD)** and the **Bio/Earth CD (BECD)** are available on the Official Science Olympiad Store or Website at http://www.soinc.org.

ECOLOGY

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION**: Students will answer questions involving content knowledge and process skills in the area of ecology and adaptations in featured North American biomes.
   A TEAM OF UP TO: 2 **APPROXIMATE TIME**: 50 Minutes
2. **EVENT PARAMETERS:** Each team may bring only one 8.5" x 11" two-sided page of information in any form from any source and up to 2 non-programmable, non-graphing calculators.
3. **THE COMPETITION:**
   This event will be composed of three sections of approximately equal point value. The event will emphasize these process skills as they apply to ecology: defining variables; analyzing data from graphs and tables; presenting data in graphs and tables; forming hypotheses; making calculations and predictions. If stations are used, students must spend the same amount of time at each station.
   a. Part 1: Review of the General Principles of Ecology
      i. General Principles of Ecology - food webs and trophic pyramids, nutrient cycling, community interactions, population dynamics (including density dependent/independent limiting factors, carrying capacity, doubling time, exponential/logistical growth and how to calculate population growth), extinction, selection and migration. At the regional and state level, the general ecological principles should focus on local and regional ecology.
      ii. **Division C State and Nationals only:** life history strategies (e.g., age structure, survival curves, life tables, succession, R and K strategies)
   b. Part 2: Terrestrial Ecosystems
      i. **Ecology of the Tundra, Taiga and Deciduous Forests** (next year's focus: Deserts and Grasslands)
      ii. Understand basic concepts of biodiversity
      iii. **Div. C State and Nationals only:** Be able to apply knowledge of biodiversity (plot maps, simulations of selection effects on populations)
      iv. **Div. C Nationals only:** Understand terminology and be able to calculate biodiversity of sample data (species richness, Simpson index, Shannon-Wiener index)
   c. Part 3: Human Impact on Ecosystems
      i. Topics such as climate change, invasive species, acid rain, erosion, and pollution
      ii. The pros and cons of using alternative energy and its effect on the environment
      iii. Understand the goals of conservation biology and how they can be obtained
      iv. Reclamation of disturbed areas versus reintroduction of species
      v. **Division C State and Nationals only:** Be able to answer questions as they pertain to case studies
4. **SAMPLE QUESTIONS:**
   Division B:
   a. From the description of community interactions, create a food web. Then predict what would happen to the food web if the primary producers were greatly reduced in number by a disease.
   b. Given a description of the interaction between two species, identify the type of community interaction.
   c. List three ways a tundra is different than a taiga.
   d. Compare a tundra with a taiga. What kinds of adaptations may be common in both environments? How are the organisms in each environment adapted for the rates of nutrient recycling that you would expect to find?
   Division C:
   e. Given a complex food web, create a trophic pyramid and determine the amount of energy in each level when given a quantity of energy entering the producer level.
   f. Students are given a graph depicting the changes in two interacting populations of different species in a habitat. Predict which population is the predator and which is the prey. Give reasons for your choices.
   g. Determine the population growth rate for an area given r (rate of increase) and N (number of individuals).
   h. Students are given three age structures and asked to determine which population has the highest birth rate, death rate, doubling time, and mean age.
5. **SCORING:** Questions will be assigned point values. Students will be ranked from highest to lowest score. Ties will be broken by pre-determined tiebreaker questions.
   Recommended Resources: All reference and training resources including the **Ecology CD (ECCD)** and the **Bio/Earth CD (BECD)** are available on the Official Science Olympiad Store or Website at http://www.soinc.org.