DYNAMIC PLANET B - GLACIERS

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

1. **DESCRIPTION:** Participants will demonstrate an understanding of the processes involving the cryosphere of the Earth, with an emphasis on glaciers.

   A TEAM OF UP TO: 2 **CALCULATOR:** Class II **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**
   a. Each team may bring a binder of any size containing information in any form and from any source. Sheet protectors, lamination, tabs and labels are permitted. If the event features a rotation through a series of laboratory stations where the participants interact with samples, specimens, or displays, no material may be removed from the binder throughout the event.
   b. Each team may bring two stand-alone non-programmable, non-graphing calculators (Class II).
3. **THE COMPETITION:** Participants will be given one or more tasks presented as an exam and/or timed stations. Topics will include the following:
   a. Glacier formation
      i. Properties of ice (e.g., crystal structure, density)
      ii. Formation of glacial ice from snow, névé, firn
      iii. Glacial budget/mass balance: ablation and accumulation, equilibrium line
      iv. Glacial flow: influence of bed (e.g., basal sliding), and relation of flow to elevation and slope
   b. Types of glaciers & their geographic distributions:
      i. Valley/alpine (cirque, hanging, piedmont)
      ii. Ice sheet/continental, including ice stream, ice shelf, ice rise, ice cap, ice tongue
   c. Features in glacial ice:
      i. Crevasses, ogives, icefalls
      ii. Ice shelves and related processes (e.g., calving, marine ice sheet instability, ice shelf buttressing)
   d. Formation of landscape features by glaciers:
      i. Erosional – cirque, tor, U-shaped valley, hanging valleys, arêtes, horns, striations, Rôche moutonnée
      ii. Depositional – moraines (end/terminal, recessional, lateral, medial, ground), kames, drumlins, eskers,
      iii. erratics
      iv. Lakes – tarns, the Great Lakes, Finger Lakes, kettles, moraine–dammed lakes, proglacial lakes
   e. Periglacial processes and landforms (e.g., permafrost, pingos)
   f. Sea ice (ice floe, draft vs freeboard, pressure ridge, formation (e.g., frazil ice, pancake ice))
   g. Glacial hydrology: surface melt, surface lakes, moulins, drainage and subglacial lakes
   h. Global connections of glaciation:
      i. Atmosphere – effect of greenhouse gases & aerosols on glaciation (e.g., amplified melting due to changes in albedo, release of gases from glacial melting)
      ii. Oceans – sea level change and ice sheet variation (thickness and extent)
      iii. Lithosphere – isostatic effects on Earth's crust
      iv. Planetary/orbital influence on glaciation (e.g., Milankovitch cycles)
   i. History of ice on Earth and its evidence (e.g., drop stones, striations, sedimentary deposits), limited to:
      i. Neoproterozoic snowball Earth
         (1) Late Paleozoic ice ages
         (2) Eocene Oligocene Transition and the impact of opening oceanic seaways such as the Drake Passage
      ii. Pleistocene Northern Hemisphere glaciation (e.g., Laurentide Ice Sheet retreat & melting history)
      iii. Recent records of cryospheric change (e.g., Larsen B, Thwaites Glacier, Amundsen Sea Embayment)
   j. Sedimentary sequences produced in glacial environments (e.g., varves, outwash vs till)
   k. Methods of studying glaciers & interpretation of related data:
      i. Altimetry, radar, optical imagery, seismology, and gravimetry
      ii. Ice cores as archives of past environments, including the use of gases, aerosols, and stable isotope compositions
   l. Glacial hazards, including but not limited to ice avalanches and glacial lake outburst floods

4. **SCORING:**
   a. High score wins.
   b. Points will be awarded for the quality and accuracy of answers, the quality of supporting reasoning, and the use of proper scientific methods in responses.
   c. Ties will be broken by the accuracy and quality of answers to pre-selected questions and/or sections.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase; other resources are on the Event Pages at soinc.org.

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