DYNAMIC PLANET

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

1. **DESCRIPTION:** Students will use process skills to complete tasks related to glaciers, glaciation, and long-term climate change.

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

2. **EVENT PARAMETERS:**
   a. Each team may bring four 8.5" x 11" sheets of paper containing information on both sides in any form and from any source. The sheets may be **laminated** or in sheet protectors without annotations affixed.
   b. Each team may bring two **stand-alone non-programmable, non-graphing** calculators.

3. **THE COMPETITION:**
   Participants will be presented with one or more tasks, many requiring the use of process skills (e.g., observing, classifying, measuring, inferring, predicting, communicating, and using number relationships) from the following topics:
   a. Glacier formation: Properties of ice, ice crystal structure, and formation of glacial ice from snow & firn
   b. Glacial mass-balance and flow: ablation and accumulation zones, equilibrium line, influence of bed (wet or dry, bare rock, and sediment), and relation of flow to elevation and gradient
   c. Glacier/ice sheet types and forms: valley/**alpine (cirque, hanging, piedmont)**, ice sheet/**continental including** ice stream, ice shelf, ice rise, ice cap, ice tongue, & the geographic distribution **of these features**
   d. Glacial features: crevasses, ogives, icefalls, what they are, & what they indicate about flow and melt
   e. Formation of landscape features:
      i. Erosional - cirque, tor, U-shaped valley, hanging valleys, aretes, horns, **striations & grooves, and Rôche moutonnée**
      ii. Depositional – moraines **(end/terminal, recessional, lateral, medial, ground),** kettles, kames, drumlins, eskers, and **erratics**
   f. Glacial hydrology: Surface melt, surface lakes, moulins, drainage and subglacial lakes, & Jökulhlaups
   g. Global connections of glaciation:
      i. Atmosphere - greenhouse gases, insolation, and aerosols
      ii. Oceans - sea level change and ice sheet variation
      iii. Lithosphere - Isostatic effects on Earth's crust
   h. History of ice on Earth:
      i. Neoproterozoic snowball Earth
      ii. Late Paleozoic ice ages
      iii. Eocene Oligocene Transition and the impact of opening oceanic seaways
      iv. Pleistocene onset of Northern Hemisphere glaciation
   i. Ice cores as archives of past environments including gases, aerosols, and stable isotope composition
   j. Sedimentary sequences produced in glacial environments in the marine and terrestrial realms
   k. Milankovitch cycles' role in producing climate cyclicity and role in dating
   l. The Laurentide Ice Sheet retreat & melting history; impact on river drainage; and oceanic circulation
   m. Modeling rates and size of ice sheet changes (e.g., marine ice sheet instability, ice shelf buttressing)
   n. Methods of studying glaciers & what they tell you: Altimetry, radar, Landsat, seismology, and gravity
   o. Recent records of cryospheric change: (e.g., Larsen B, Kilimanjaro, Amundsen Sea Embayment)

4. **SAMPLE QUESTIONS/TASKS:**
   a. Analyze and interpret glacial features on a USGS topographic map or satellite image.
   b. Analyze a geologic map of glacial deposits to determine the sequence of events over the course of several episodes of advance and retreat.
   c. Interpret oxygen isotope data from a marine sediment core to identify changes in sea level caused by global ice volume changes.
   d. Apply glaciological principles to predict where one might find meteorites in ice fields.

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

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Dynamic Planet and Bio/Earth Science CDs; other resources are on the event page at soinc.org.

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