DYNAMIC PLANET B

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

1. **DESCRIPTION:** Teams will complete tasks related to the properties and processes of Earth's fresh waters.
   A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes
   CALCULATOR: Class II

2. **EVENT PARAMETERS:**
   a. Each team may bring writing utensils.
   b. Each team may bring two Class II calculators.
   c. 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.

3. **THE COMPETITION:** Participants will be assessed through an exam and/or timed stations on the following topics:
   a. Hydrologic cycle, water budgets, and the critical zone
      i. Components and associated fluxes of the hydrologic cycle (e.g., precipitation, evaporation, transpiration, evapotranspiration, infiltration, runoff, condensation)
      ii. Storage reservoirs, residence times, and water budgets
   b. Climatic controls on freshwater distribution
      i. Precipitation and atmospheric inputs to freshwater systems (e.g., rainfall, snowfall, seasonality, intensity, spatial patterns)
      ii. Topographic and geographic controls on precipitation and climate (e.g., orographic lift and the rain shadow effect, continentality, lake effect, elevation)
      iii. The arid–semiarid–humid spectrum and its hydrologic and geomorphic expression (e.g., perennial vs. ephemeral streams, playas, evaporite deposits)
   c. Drainage basins and stream networks
      i. Watersheds, drainage divides, and drainage basin characteristics
      ii. Stream order and networks
      iii. Drainage patterns, density, and texture
   d. Fluvial sediment processes and channel form
      i. Channel types and planform (e.g., braided, meandering, straight, anastomosing) and calculation of sinuosity
      ii. Sediment properties (e.g., grain size, shape, sorting, rounding)
      iii. Sediment transport and deposition (e.g., bed load, suspended load, dissolved load) and the controls on sediment supply, competence, and capacity
      iv. Fluvial bedforms (e.g., ripples, dunes, antidunes, bars)
   e. Fluvial geomorphology — landforms and valley processes
      i. Longitudinal profile, gradient, and base level
      ii. Dynamic equilibrium and graded streams
      iii. Erosional features (e.g., knickpoints, waterfalls, v-shaped valleys)
      iv. Erosional processes (e.g. stream capture, downcutting, abrasion, meandering, hydraulic action)
      v. Channel and floodplain landforms (e.g., point bars, cut banks, oxbow lakes, floodplains, natural levees, deltas, alluvial fans)
   f. Streamflow and floods
      i. Flow regimes (e.g., perennial, intermittent, ephemeral)
      ii. Discharge, velocity, and load (water and sediment)
      iii. Mathematical relationships describing open-channel flow
      iv. Floods, flood frequency, and recurrence intervals
   g. Groundwater and karst
      i. Subsurface zones (e.g., zone of aeration, zone of saturation, water table)
      ii. Aquifers and their properties (e.g., confined, unconfined, and artesian aquifers; porosity, permeability)
      iii. Hydraulic gradient and groundwater flow
      iv. Recharge, discharge, and capillarity
      v. Interactions between surface water and groundwater, including saltwater intrusion
      vi. Karst processes, hydrology, landforms, and features (e.g., sinkholes, solution valleys, caves, disappearing streams, springs)

h. Lakes and wetlands
   i. Lake formation and types (e.g., tectonic/rifting, volcanic, glacial, fluvial damming)
   ii. Lake water budgets — inflow and outflow
   iii. Physical and chemical properties and stratification (e.g., seasonal turnover)
   iv. Shoreline processes (e.g., waves, shoreline features)
   v. Wetland types, formation, and hydrology (e.g., bogs, marshes, swamps, fens)

i. Geologic and paleohydrologic record
   i. Sedimentary structures as indicators of water and flow conditions (e.g., ripple marks, raindrop imprints, mud cracks, cross-bedding, graded bedding)
   ii. Paleochannels and preserved fluvial and lacustrine deposits

j. Human impacts and water quality
   i. Effects of land-use change on freshwater systems (e.g., altered runoff, sedimentation, ecological change)
   ii. Engineering structures, water extraction, and their effects (e.g., dams, levees, channelization, diversion, downcutting; wells and groundwater pumping, with effects such as aquifer depletion and land subsidence)
   iii. Water pollution (e.g., types, sources, transport)

k. Measuring and monitoring freshwater
   i. Interpreting freshwater features on topographic maps
   ii. Mapping the water table from well data (e.g., contour maps, flow lines, flow direction)
   iii. Stream gauging, discharge measurement, and hydrographs (e.g., stage–discharge relationships, baseflow vs. stormflow, peak discharge, lag time)
   iv. Monitoring networks and techniques (e.g., groundwater observation wells, tracer studies, remote sensing)

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. Preselected questions will be used as tiebreakers.

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