

# Science Olympiad 2012

Dynamic Planet  
Earth's Fresh Waters  
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# Basic Rules

## Guidelines

- Team of 2
- “Freshwater hydrology”-  
Water Cycle
- Groundwater
- Classification and style of  
formation of landforms:
  - Lakes, streams, arroyos,  
rivers, alluvial fans, deltas,  
swamps, sand dunes,...
- Pollution Type,  
Contamination
- The effect freshwater has on  
the earth’s surface
- Map interpretation

### DYNAMIC PLANET: EARTH'S FRESH WATERS

1. **DESCRIPTION:** Students will use process skills to complete tasks related to **Earth's fresh waters**.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:** Each team may bring **four** 8.5" x 11" double-sided pages of notes containing information in any form from any source and bring up to two non-graphing calculators.

3. **THE COMPETITION:** Participants will be presented with one or more tasks, many requiring the use of process skills (i.e., observing, classifying, measuring, inferring, predicting, communicating, and using number relationships) from the following topics:

- Interpretation of fresh water features shown on USGS topographic maps
- Stream drainage systems: **stream order**, drainage patterns, main channel, tributaries and watersheds
- Channel types: braided, meandering, straight and **calculations of sinuosity**
- Sediment: weathering, erosion, forms and sizes, transportation, deposition
- River valley forms and processes: geology, gradient, base level, floodplain features, dynamic equilibrium, nick points, waterfalls, stream capture, deltas and fans
- Perennial and intermittent stream flow, stream gauging and monitoring, stream flow calculations, discharge, load, floods, recurrence intervals, (Division C only: Chezy and Manning equations)
- Groundwater: zone of aeration, zone of saturation, water table, porosity, permeability, aquifers, confining beds, hydraulic gradient, water table contour lines, flow lines, capillarity, recharge and discharge and **interactions between surface and groundwater**
- Karst features: sinkholes, solution valleys, springs, disappearing streams, caves
- Lake formation and types: faulting, rifting, volcanic action, glaciation, damming of rivers, changes over time
- Lake features: inflow and outflow, physical and chemical properties, stratification, shorelines, waves
- Wetlands: interactions between surface and groundwater **in the evolution** of bogs and marshes
- Destruction/Effects of land use changes, dams and levees: sedimentation, down-cutting, diversion of water, flooding, ecological changes
- Hydrologic cycle and water budgets: precipitation, runoff, evaporation
- Pollution: types, sources, transport



4. **REPRESENTATIVE TASKS:**

- Analyze and interpret features and actions of a stream or river appearing on a topographic map including watershed boundaries, elevation, gradient, direction of flow, drainage pattern, valley shapes, erosional landscapes, and depositional features
- Construct a water table contour map and indicate the direction of groundwater movement
- Analyze data on the thermal structure of a lake and determine how the stratification changes seasonally

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 **Bio/Earth CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>.

# Basic Rules (Continued)

## What to Bring

- 4 sheets of 8.5x11 inch notes
- Calculators
- Pencils/pens

# Format

- Types of Questions: Short Answer, Multiple Choice, Identification of Concept, Fill-in-the-Blank, light algebra, Definitions
- Test-Style Competition
- C has a little more math involved, Manning Equation
- **$V = (k/n) * (R^{2/3}) * (S^{1/2})$**
- **where**       **$R = \text{Area/Perimeter}$**   
                          **$S = \text{Some percent, turned back into a decimal, i.e, } 1\% = 0.01, 5\% = 0.05$**

# Examples

- Explain the difference between meandering, braided and straight streams. What type of stream is the Rio Grande River?

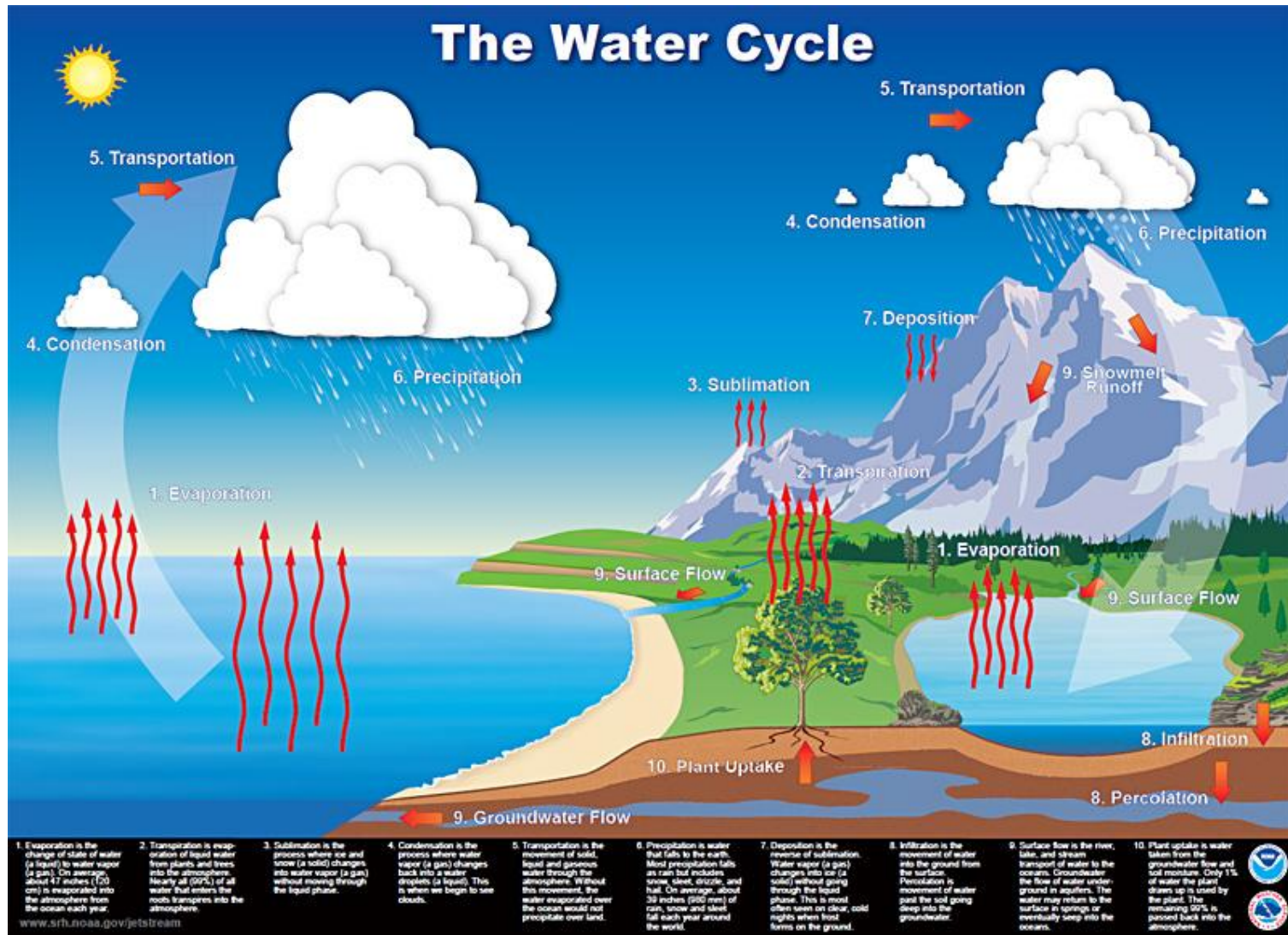
**Meandering:** Curved and windy river channel, water erodes outer banks (high energy) and deposits sediments in the inside of bends (low energy). **Braided stream** is a river where individual channels connect and reconnect in a network of branches separated by small islands. Braided channels have erodible banks and are made of gravels because the stream transports large volumes of bedloads. **Straight stream** is rare and usually cover only small distances, found in high energy environments such as steep mountain slopes, they are also often controlled by faults and fractures.

**The Rio Grande is meandering and braided**

# Examples (Continued)

- Sketch the hydrologic cycle and label all components.

# Water Cycle from NOAA Website (From Study Materials)



# Examples (Continued)

- What type of pollution source is a single pipe of untreated stormwater runoff being discharged to a river?



- What is the difference between a fan and a delta (settings, formation)?

# Examples (Continued)

- For C-Division: Compare and contrast fans and deltas (settings, formation).
- Find the average velocity, *using Manning's equation*, in **ft/s** for the mine drainage channel. Assume Manning's  $n$  is 0.02. ( $k=1.486$ )

# Map Interpretation

- “Freshwater features on a USGS map”
- Rivers, lakes, canals, swamps, marshes, impoundments/dams, intermittent streams vs perennial
- <http://egsc.usgs.gov/isb/pubs/booklets/symbols/>
- Google: “USGS map symbols”

# Scoring

- Points based on difficulty of question
- Labeled Tie-Break Question

# References/Study Materials

- ✓ Bio/Earth Science CD- Lessons and Sample tests
- ✓ <http://www.epa.gov/watertrain/pdf/limnology.pdf>
- ✓ <http://bioannexlabs.unm.edu/BIOL/LimnoLecture3-revised.pdf>
- ✓ NOAA Freshwater Page,  
<http://www.education.noaa.gov/Freshwater/>
- ✓ NOAA Education Resource Website,  
<http://www.education.noaa.gov/>
- ✓ University of Wisconsin Center for Limnology,  
<http://limnology.wisc.edu/>
- ✓ Soil & Water Conservation Society Webpage,  
<http://www.chebucto.ns.ca/ccn/info/Science/SWCS/swcs-limne.html>
  
- ✗ Introduction to Limnology - McGraw Hill Site, Not terribly useful
- ✗ West Virginia University - Division of Forestry Site, Site taken down

# Questions

