

1. **DESCRIPTION:** Teams use fossils to date and correlate rock units as well as demonstrate their knowledge of ancient life by completing tasks related to fossil identification and classification.
A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes
2. **EVENT PARAMETERS:**
 - a. Each team may bring one magnifying glass, the Science Olympiad Official Fossil List and one standard 3-inch or smaller, 3-ring binder containing information in any form and from any source attached using the available rings.
 - b. 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.
3. **THE COMPETITION:**
 - a. Participants will move from station to station, with the length of time at each station predetermined and announced by the event supervisor.
 - b. Participants may not return to stations but may continue to work on their responses throughout.
 - c. Emphasis will be placed upon task-oriented activities at each station.
 - d. Identification will be limited to specimens on the Science Olympiad Official Fossil List, but other samples may be used to illustrate key concepts. Questions will be chosen from the following topics:
 - i. Identification of all fossil specimens on the Science Olympiad Official Fossil List
 - ii. Taxonomic classification restricted to the hierarchy on the Science Olympiad Official Fossil List
 - iii. Conditions required for a plant or an animal to become fossilized
 - iv. Common modes of preservation: petrification/petrifaction (e.g., permineralization & mineral replacement including silicification and pyritization), cast/mold, imprints, carbonization, unaltered remains
 - v. Uncommon modes of preservation: encasement in amber, mummification, freezing
 - vi. Relative dating: law of superposition, original horizontality, cross cutting relationships, unconformities
 - vii. Absolute dating: radiometric dating, half-life, carbon dating, volcanic ash layers
 - viii. The Geologic Time Scale, its organization, major events, the 5 major mass extinctions, and the Pleistocene-Holocene extinction of megafauna. An official Science Olympiad Geologic Time Scale is posted at soinc.org & should be used for all competitions.
 - ix. Index Fossils: characteristics and use in determining the age of rocks & geologic formations
 - x. Fossil bearing sedimentary rocks: limestone, shale, sandstone, mudstone, coquina
 - xi. Modes of life: filter feeder, predator, scavenger, deposit feeder, benthic, pelagic
 - xii. Environments: shallow marine, deep marine, terrestrial, fresh water
 - xiii. Mineral and organic components of exoskeletons, shells, and bones/teeth (e.g., calcite, aragonite, silica, chitin, biological apatite)
 - xiv. Adaptations and morphologic features of major fossil groups
 - xv. Important paleontological discoveries (i.e., non-avian dinosaurs with feathers; transitional species such as *Tiktaalik* and *Archaeopteryx*)
 - xvi. Lagerstätten (conservation and concentration) and their significance, limited to: Burgess Shale, Beecher's Trilobite Bed, Mazon Creek, Ghost Ranch, Solnhofen Limestone, Yixian Formation (Liaoning), Green River Formation, and LaBrea Tar Pits
 - xvii. Fossils as evidence for evolutionary trends and patterns such as morphologic adaptations within groups and major evolutionary events (i.e., Cambrian explosion, fish to tetrapods, dinosaurs to birds, whales, horses)
4. **SAMPLE QUESTIONS/TASKS:**
 - a. Identify each fossil, record its mode of preservation, the type of rock the sample is embedded in, and the geologic period it represents.
 - b. List samples in order from oldest to most recent.
 - c. Based on the fossil and rock associations, determine the environment in which the organism lived.
 - d. Construct a range chart and determine the age of the fossil assemblage.
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 responses to several pre-identified questions.

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

KINGDOM PROTOZOA

Phylum Foraminifera (Forams)

- 1) Order Fusulinida (Fusulinids)
- 2) Genus *Nummulites*

KINGDOM ANIMALIA

INVERTEBRATES:

Phylum Porifera (Sponges)

- 3) Genus *Astraeospongia* (calcareous sponge)
- 4) Genus *Hydnoceras* (glass sponge)

Phylum Bryozoa

- (Growth forms: branching, massive, fenestrate)
- 5) Genus *Archimedes*
 - 6) Genus *Rhombopora*

Phylum Hemichordata

- 7) Class Graptolithina (Graptolites)

Phylum Cnidaria

- Class Anthozoa (Horn & Colonial Corals)
- 8) Genus *Favosites*
 - 9) Genus *Halysites*
 - 10) Genus *Heliophyllum*
 - 11) Genus *Hexagonaria*
 - 12) Genus *Septastraea*

Phylum Arthropoda

- 13) Subphylum Crustacea (shrimp, lobster, crabs, barnacles, **ostracods**)
 - 14) Order Eurypterida (Eurypterids)
 - 15) Class Insecta (Insects)
- Class Trilobita (Trilobites)
- 16) Genus *Cryptolithus*
 - 17) Genus *Calymene*
 - 18) Genus *Elrathia*
 - 19) Genus *Isotelus*
 - 20) Genus *Eldredgeops* (formerly *Phacops*)

Phylum Brachiopoda

- Class Inarticulata:
- 21) Genus *Lingula*
- Class Articulata:
- 22) Genus *Atrypa*
 - 23) Genus *Composita*
 - 24) Genus *Juresania*
 - 25) Genus *Leptaena*
 - 26) Genus *Mucrospirifer*
 - 27) Genus *Platystrophia*
 - 28) Genus *Rafinesquina*
 - 29) Order *Rhynchonellida*

Phylum Mollusca

Class Bivalvia (**clams, oysters, mussels**)

- 30) Genus *Exogyra*
- 31) Genus *Gryphaea*
- 32) Genus *Pecten*
- 33) Genus *Glycymeris*

Class Cephalopoda

- 34) Subclass Ammonoidea (**Ammonoids**)
- (**Goniatites, Ceratites, Ammonites**)

- 35) Genus *Baculites*
- 36) Genus *Dactylioceras*

Subclass Coleoidea

- Order Belemnitida (**Belemnites**)
- 37) **Genus *Belemnitella***

Subclass Nautiloidea (Nautiloids)

- 38) Genus *Nautilus*
- 39) Genus *Orthoceras*

Class Gastropoda (Snails)

- 40) Genus *Conus*
- 41) Genus *Cypraea*
- 42) Genus *Platyceras*
- 43) Genus *Turritella*
- 44) Genus *Worthenia*

Phylum Echinodermata

45) Class Asteroidea (**Starfish**)

Class Blastoidea

- 46) Genus *Pentremites*

47) Class Crinoidea (stems, columns, calyxes)

48) Class Echinoidea (**regular or irregular echinoids including** sea urchins, sand dollars and heart urchins)

49) Class Ophiuroidea (brittle stars)

VERTEBRATES:

Phylum Chordata

Subphylum Vertebrata

Class Placodermi (Armored Jawed Fish)

- 50) Genus **Bothriolepis**
- 51) Genus **Dunkleosteus**

Class Chondrichthyes (Cartilaginous Fish)

- 52) Superorder Selachimorpha (Sharks)
- 53) Genus *Carcharodon*
- 54) **Genus *Carcharocles***

(formerly *Carcharodon*)

55) **Species *C. megalodon***

- 56) Superorder Batoidea (Rays)

Note: Numbers indicate that members of that taxon rank should be identifiable to that level. For ranks not underlined, indented ranks are in the rank above it.

- Superclass Osteichthyes (Bony Fish)
 57) Class Actinopterygii (ray-finned)
 Class Sarcopterygii (lobe-finned)
 58) Order Coelacanthiformes (Coelacanth)
 59) Genus *Tiktaalik*
- Class Amphibia (**Amphibians**)
 60) Genus *Acanthostega*
 61) Genus *Eryops*
 62) Genus *Diplocaulus*
- Class Reptilia (**Reptiles**)
 63) Order Ichthyosauria (Ichthyosaurs)
 64) Family Mosasauridae (Mosasaurs)
 65) Order Plesiosauria (Plesiosaurs & Pliosaurus)
 66) Order Pterosauria (Pterosaurs)
- Clade Dinosauria (**Dinosaurs**)
 Order Saurischia (lizard-hipped)
 67) Genus *Allosaurus*
 68) Genus *Diplodocus*
 69) Genus *Coelophysis*
 70) Genus *Dilophosaurus*
 71) Genus *Plateosaurus*
 72) Genus *Velociraptor*
 73) Genus *Tyrannosaurus*
- Order Ornithischia (bird-hipped)
 74) Genus *Iguanodon*
 75) Genus *Parasaurolophus*
 76) Genus *Stegosaurus*
 77) Genus *Triceratops*
 78) Genus *Ankylosaurus*
 79) Genus *Dracorex*
- Class Aves (**Birds**)
 80) Genus *Archaeopteryx*
 81) Genus *Titanis* (**Terror Bird**)
- Clade Synapsida
Mammal-like reptiles
 82) Genus *Dimetrodon* (**pelycosaurs**)
 83) Genus *Lystrosaurus* (**therapsids**)
- Class Mammalia (**Mammals**)
 84) Genus *Basilosaurus* (**prehistoric whale**)
 85) Genus *Equus* (**modern horse**)
 Genus *Homo* (**human**)
 86) Species *H. neanderthalensis*
 87) Genus *Mammut* (Mastodon)
 88) Genus *Mammuthus* (Mammoth)
 89) Genus *Megacerops* (**Brontothere**)
 90) Genus *Mesohippus* (**three-toed horse**)
 91) Genus *Smilodon* (**saber-toothed cat**)

KINGDOM PLANTAE

Phylum Anthophyta (Flowering plants)

- 92) Genus *Acer*
 93) Genus *Populus*
 94) Genus *Platanus*

Phylum Ginkgophyta (Ginkgos)

- 95) Genus *Ginkgo*

Phylum Lycopodiophyta (Club Mosses)

- 96) Genus *Lepidodendron* (scale tree)

Phylum Pinophyta (Conifers)

- 97) Genus *Metasequoia*

98) Phylum Sphenophyta (Horsetails)

- 99) Genus *Calamites*
 100) Genus *Annularia*

Phylum Pteridospermatophyta (Seed Ferns)

- 101) Genus *Glossopteris*

Phylum Pteridophyta (True Ferns)

- 102) Genus *Pecopteris*

OTHER

Trace Fossils:

- Trails, Tracks, Trackways,
 Borings, Burrows, Tubes
 Predation marks, Repair scars
 Coprolites

Stromatolites

Amber/copal

Petrified wood

Sedimentary Rocks

- Coquina
 Limestone (**Chalk/Fossil limestone**)
 Sandstone
 Shale
 Mudstone/Siltstone

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