Station A: Clam and Gryphaea

1. What term refers to the two parts of the clam shell?
2. The non-mollusk in the following list is the:

   (a) oyster. (b) scallop. (c) mussel. (d) brachiopod.
3. What did clams use to burrow into the sand or mud on the ocean floor?
4. Its __?__ secretes the clam's outer shell.

   (a) siphon (b) mantle (c) cavity
5. Gryphaea were __?__ feeding on minute suspended animal life, etc.

   (a) deposit feeders (b) filter feeders
6. The two valves of clams were __?__ in size.

   (a) equal (b) not equal
7. What general term is used to describe the type of rock containing the numerous clam fossils?
8. Preceding the modern science of geology, gryphaea were known as:

   (a) Devil's toenails. (c) Aristotle's lanterns. (d) Devil's thunderbolts.
9. **Gryphaea** existed from the Triassic to the Jurassic. The clam, **Glycymeris Americana**, existed from the Cretaceous to Recent. Which specimen is the oldest?

Station B: News Release

SCIENCE

Tiny fossil has huge implications

THE NEW YORK TIMES

Scientists say they have discovered the world's oldest known insect fossil – a 400-million-year-old set of minuscule jaws that had been lying unrecognized for nearly a century in a drawer at the Natural History Museum in London.

The finding, published today in the journal Nature, pushes back the date for the appearance of insects by about 10 million to 20 million years in the fossil record. It also suggests insects were among the first animals to live on land.

The authors also argue these ancient insects flew. If true, it would mean flight – one of life's most important and vigorously investigated evolutionary innovations – evolved much earlier than suspected, 70 million years before the oldest fossilized insect wing. Scientists say the finding would put insects, already recognized as the earliest animal fliers, up in the air a good 170 million years before anything else, even flying dinosaurs.

"We were at the museum to look at another famous insect fossil, one that everyone's been discussing for the past 80 years," said David Grimaldi, a curator of entomology at the American Museum

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of Natural History in New York, who wrote the paper along with Michael Engle, a paleo-entomologist at the University of Kansas. The two could not resist examining another fragment in the same drawer, a curious bit of fossil that long ago had been dismissed as being of little interest. Grimaldi said, "We looked at each other and said, 'Holy moley!'"

The fossil, named Rhyniognatha, was uncovered in Rhynie, Scotland. Its jaw measures less than 0.004 inches across.

Embedded in a translucent crystalline rock known as chert, such fossils can be seen clearly only when the chert is cut with diamond saws, polished, and examined under a powerful microscope. Under bright lights and high magnification, the jaw fragments exhibit several telltale features – including sockets that formed part of a hinge-like mechanism – that clearly identify them as the mouthparts of a true insect.

10. Read the article above republished in Thursday's, Feb. 12, 2004, GAZETTE TELEGRAPH, Colorado Springs, Colorado. Then identify the obvious misconception appearing in this article and explain why this is a misconception.

Station C: Shark tooth, fish impression, and a component of fish anatomy

Part 1: Sharks

11. Each time a shark takes a bite it swallows its teeth which then become a part of its excrement.

    a. True b. False

12. Why were shark teeth (and fin spines) frequently preserved as fossils while its other body parts were seldom preserved?

13. To which subphylum of the phylum Chordata do sharks belong?

14. Sharks belong to a class of vertebrates called __?__, the cartilaginous fishes.

    (a) Agnatha (b) Placoderms (c) Chondrichthyes (d) Osteichthyes

15. During which period did sharks first appear in the fossil record?

16. The preservation technique for this shark tooth is:

    (a) replacement. (b) carbonization. (c) permineralization. (d) unaltered.

Part 2: Bony Fish

17. During which geologic era did the first bony fish appear?

18 Identify the cylindrically-shaped fossilized bone at this station.

19. These fish are classified as:

    (a) Agnatha. (b) Placoderms. (c) Chondrichthyes. (d) Osteichthyes.

20. The impression of the fish is classified as a/an:

    (a) external mold. (b) internal mold. (c) cast.

21. The rock in which the impression of the fish is found is classified as:

    (a) sedimentary. (b) igneous. (c) metamorphic.

Station D: Sea Urchin, Sand Dollar, Pentremites, Crinoid

22. To what phylum do all these fossilized creatures belong?

23. What appendages, absent in these fossils, were used by both the sand dollar and the sea urchin to move along the ocean floor while also rendering protection from predation?

24. What telltale feature is most helpful in identifying the phylum to which these creatures belong?

25. What purpose did the hole at the center of the sand dollar serve?

26. Which one of these four specimens is now extinct?

27. Which <u>two</u> of these specimens were permanently attached to the sea floor by a stalk?

28. Why are the chances for members of this phylum to become fossilized better than average?

29. Which one of the statements below is <u>not true</u> of sea urchins?

    a. They use hard jaws to graze on algae, seaweed, and detritus on the sea floor.
    b. Their five teeth, called “Aristotle’s Lantern” could be protruded out of their mouths to feed.
    c. The bumps on the skeleton were the points at which their spines were attached.
    d. They were predators.

30. By what other name are crinoids known due to their living on a stem and having flower-like bodies?

31. Note the feathery arms surrounding the main body of the crinoid. What purpose did these appendages serve?

Station E: Three coral specimens

32. To what phylum do coral belong?

33. What parts of these creatures formed the fossils at this station?

34. What is the name of the creatures that once lived in the holes that can be seen in two of these fossils? [Caution: be specific!]

35. Why were those parts you now see the only ones to be preserved?

36. The creatures that inhabited the cavities within these fossilized structures had central stomachs surrounded by stinging cells at the ends of finger-like projections. What were those finger-like projections called?

37. These creatures thrived in:

    (a) cool, shallow seas. (b) cool, deep seas.
    (c) warm, shallow seas. (d) warm, deep seas.

38. What is the common name of the specimen with a cup-like depression at one end?

39. When alive, the specimen referred to in question 38, was oriented with its pointed end:

    (a) up. (b) down.

40. Complete this taxonomic scheme for the polished specimen.

    Phylum: (a)

    Class: Anthozoa

    Subclass: (b)

    Order: Stauriida

    Genus: (c)

41. The specimen referred to in question 40 is a ___?___ coral.

    (a) colonial. (b) solitary.

Station F: Ammonite, Belemnite fossil, Belemnite model

42. Which part of an ammonite is usually preserved as a fossil?

43. In which of its many chambers did the ammonite actually live?

44. Since no one has ever had an opportunity to study a living ammonite, what modern day cephalopod is used to understand its possible style and mode of life?

45. How might decreasing or increasing the amount of gas in its chamber have affected the ammonite's movements?

46. The spiraling seam line between the whorls on the surface of the ammonite is called a
(a) sulture. (b) septum. (c) siphuncle.

47. Directly to the rear of the tentacles and beneath the head of the belemnite model is a small tube-like projection. What purpose did this feature serve?

48. What is the the tube-like projection addressed in question 47 called?

49. The bullet-shaped fossil of the belemnite, called a guard, is actually its:

(a) head. **(**b) skeleton. (c) tentacle. (d) spine.

Station G: Dinosaur bone, petrified wood, amber, fossil leaf, dinosaur skin impression, and a slab containing a worm trail

50. The most common type of fossil preservation is with alteration. The original organic material is partially or totally changed into new material. There are four common types of preservation with alteration including **carbonization**, **permineralization**, **recrystallization**, and **replacement**. These processes involve a chemical reaction with the organism and its environment.

    a. The dark-appearing rock is a preserved dinosaur bone specimen. Which method of preservation was responsible for the formation of this fossilized material?

    b. The thin, light-brown colored specimen is petrified wood. Which method of preservation is responsible for the formation of this fossil?

    c. What mineral replaced the original wood in this specimen?

51. Without further information it is impossible to identify the genus to which this dinosaur bone belongs.

    (a) True (b) False

52. The fossils trapped within amber were preserved by:

    (a) replacement. (b) carbonization. (c) permineralization.
    (d) recrystallization. (e) remaining unaltered.

53. What tree-produced material was slowly transformed into amber? [Caution: “Sap” is not a correct response.]

54. Amber can contain dinosaur DNA which may be extracted from any mosquito that became trapped in the amber.

    (a) True (b) False

55. The fossil leaf was preserved by:

    (a) replacement. (b) carbonization. (c) permineralization.
    (d) recrystallization. (e) remaining unaltered.

56. This model of a dinosaur’s skin was created by pouring material into an impression left by a real dinosaur.

    A. The original impression left by the dinosaur is most like:

    (a) an external mold (b) an internal mold (c) cast.

    B. The actual object containing the dinosaur skin impression is most like a/an:

    (a) external mold (b) internal mold (c) cast.

57. The large slab contains the trail remaining as one or more worms moved through the soil consuming food. What name refers to the preservation of animal activity rather than the creature itself?

Station H: Brachiopod and Bivalve

58. Brachiopods used __?__ to obtain their food.

    (a) a feathery filter system (b) gills

59. Brachiopods:

    (a) were totally wiped out during the mass extinctions of the Permian-Triassic boundary.

    (b) remain alive today.

60. The preservation technique for this brachiopod fossil was:

    (a) replacement**.** (b) carbonization. (c) permineralization. (d) unaltered.

61. The mineral that replaced the material of which this brachiopod was originally composed is:

62. The replacement material of which this particular brachiopod is now made was formed when a kind of bacteria reduced sulfate to sulfide and combined with another metallic element. What is that element?

63. The dorsal (upper) and ventral (lower) valves of brachiopods are __?__ in size and shape.

    (a) similar (b) dissimilar

64. Brachiopods are commonly known as:

    a. Lamp shells. b. Devil's toenails. c. Devil's thunderbolts. d. Aristotle's lanterns.

65. Write **bivalves** if the phase refers to bivalve or **brachiopods** if it refers to a brachiopod.

    a. Are attached to the sea floor with a fleshy stalk called a pedicle.

    b. Have shells that are mirror images of each other.

    c. Feed by filtering small particles of food from the water around them.

    d. Display bilateral symmetry with the plane of symmetry passing through the center of each shell or valve.

    e. Display bilateral symmetry with the plane of symmetry passing between the two valves.

    f. The two valves differ in size and shape in most species.

Station I: Two specimens composed of numerous shells

66. The darker-colored impression of valved animals within the more colorful of the two specimens would be classified as a/an:

    (a) internal mold. (b) exterior mold. (c) cast.

67. The high-spired depressions would be classified as:

    (a) internal molds. (b) external molds. (c) casts.

68. Identify the darker-brown colored, smooth-appearing shelled fossils.

69. Identify the high-spired, coiled fossils by species.

70. Classify the high-spired, coiled fossils by phylum.

71. These shells are embedded within:

    (a) shale. (b) sandstone. (c) limestone.

72. a. Might the two types of creatures within this rock have coexisted during the Paleozoic era?

    b. Why or why not?

73. The second of the two specimens at this station is almost completely composed of shells. What type of rock is this specimen?

Station J: Fossil tree bark and images sheet

Compare the specimen of tree bark with those illustrated in the images.

74. This fossil specimen is the bark of a:

    a. Calamite.
    b. Metasequoia.
    c. Lepidodendron**.**
    d. Cordaite.

75. The era during which this tree thrived is known as the:

    a. Cenozoic.
    b. Mesozoic.
    c. Paleozoic**.**

76. The period during which this tree thrived is known as:

    a. Pennsylvanian**.**
    b. Mississippian.
    c. Devonian.
    d. Silurian.

77. This tree, represented by its bark, is classified as a spore-bearing plant – one that reproduces by spores rather than seeds. Of the three types of spore-bearing plants, this tree is classified as a:

    a. Lycopsida (club mosses, ground pine, scale tree).
    b. Sphenopsida (horsetails, scouring rushed, calamites).
    c. Filicopsida (ferns).

Station K: Trilobites and image sheet. [Drawings at this station are courtesy of Dr. Sam Gon III.]

78. Identify the genus of this specimen by matching it with those on the identification cards. *Note! The ID cards are double-sided.*

79. To what phylum do these creatures belong?

80. Did trilobites exist before, during, or after the reign of the dinosaurs?

81. In what type of an environment did these creatures live? Be specific.

82. What features led to the name given to this family of creatures?

83. Trilobite trails sometimes stop when they intersect worm trails. Why?

84. Why might one of these creatures choose to roll its body into the shape of a ball?

85. Trilobites may have been scavengers, predators, grazers, or filter-feeders. Why is it difficult to interpret the exact feeding habits of each type of trilobite?