

**Fossils C - Fossils - BirdSO C 2021 Invitational - 03-07-2021**

Good luck on the test! For any inquiries please reach out to [cruzss@mit.edu](mailto:cruzss@mit.edu).

You will have a bit under an hour to complete the test. The tiebreakers will be counted as marked questions first. Then your score for station 21 will be used to break ties. If the tie is still unbroken, the tie will be decided by your response to the Bonus question (the Spongebob question discussed at the beginning of the video and shown at the bottom of your answer sheet. This is the only question which is actually shown entirely on your answer sheet. All other questions can only be fully understood by watching the video. You are free to increase the speed, slow down, skim through, pause, rewind, etc. the video. However, the full video is 33 minutes long, and the mandatory stations (1-20) make up 31 minutes of that video. The test is made to vary in difficulty, with some questions that nearly all competitors can fully understand to others that are based on advanced understanding of archaeology and paleontology pulled from lectures and content courtesy of UMass Boston and the Massachusetts Institute of Technology. A special thank you to Mark Kirste for inspiring the test format, Dr. John Steinberg and Dr. Barbara Imperiali for inspiring some of the test content, and an immense hug, salute, and thank you to Lisa Poole for inspiring much of my Fossils enthusiasm as well as that of the thousands of students who have competed at the NorCal State Championship and Central Valley Regional. **And as always, a special thank you to you competitors. While I may not know all of you, I hope that this test challenges you to learn new things while also dominating the competition stage! If you love this test, don't forget to fill out the feedback form! If you hate this test, then definitely don't forget to fill out the feedback form! It is linked in the test conclusion.**

**BirdSO Fossils Exam Video**

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If you don't see a video above, open this link in a new window, it is recommended you have one tab open with the exam and another with the video : <https://youtu.be/3b1GLCQtKw>  
(<https://youtu.be/3b1GLCQtKwc>) (<https://youtu.be/3b1GLCQtKwc>) .

**Station 1 : Don't Move**

- 1. (2.00 pts)** Fill in the first block with the organism which appears first in the video, then fill in the second box with the organism which appears second in the video. Please remember to not include taxonomic classification labels in your answer. For example, do not say "genus Velociraptor" say "Velociraptor".

- 2. (3.00 pts)** Fill in your response below:

**Expected Answer:** It ate fish (+1), The long snout or curved teeth or tail similar to that of a modern crocodile or hooked claws (any, +2)

3. (2.00 pts) Fill in your response below:

**Expected Answer:** No (+1), this creature likely had vision that was as good as or better (+1) than modern predators.

4. (2.00 pts) Enter your response below in the form #:#

13:1

5. (1.00 pts) Select the correct response below:

- ☒ A) The first organism in the video
- ☐ B) The second (sail-back) organism

## **Station 2 : Anatomy and Paleontology**

6. (1.00 pts) Fill in the name below:

Ischium

7. (2.00 pts) Fill in the name below:

ilium

8. (1.00 pts) Fill in the name below:

femur

9. (1.00 pts) Fill in the name below:

pubis

10. (3.00 pts) Fill in the answer below:

**Expected Answer:** Separate Ornithischians and Saurischians (+1), which means bird hipped (+1) or lizard hipped (+1), referring to the pelvis types later adapted by those respective groups

**11. (2.00 pts)** Select the problem number that corresponds to each bone. For example, to select the bone from problem 7, select "bone 7".

(Mark **ALL** correct answers)

- ☒ A) Bone 6
- ☒ B) Bone 7
- ☒ C) Bone 8
- ☒ D) Bone 9

## **Station 3 : Deep Blue Sea**

**12. (1.00 pts)** Give the species, but remember not to say "species" in your answer.

Carcharodon Megalodon

**13. (1.00 pts)** Give your estimate below:

- ☐ A) 1-2
- ☐ B) 2-5
- ☒ C) 5-10
- ☐ D) 10-14
- ☐ E) 14-20
- ☐ F) 20-30

**14. (3.00 pts)** Give your theory here:

**Expected Answer:** Cannibalism by young as they eat their way out of the mother (all or nothing, must say something about pups eating mother) (all or nothing, must say something about cannibalism)

**15. (1.00 pts)** Identify the organism:

Dunkleosteus

**16. (1.00 pts)** Identify the prey's class:

Placodermi

17. (1.00 pts) Is the statement true or false?

☐ True ☒ False

18. (2.00 pts) Give the period in which it lived and the nickname below:

**Expected Answer:** The Devonian (+1), "age of fish" or "age of heavily armored fish" (+1)

## Station 4 : Silty Shores

19. (2.00 pts) Name the law:

**Expected Answer:** Walther's Law

20. (1.00 pts) Give the image:

☐ A) Image A  
☒ B) Image B

21. (2.00 pts) Describe the process in the box below:

**Expected Answer:** Rising coastlines displace sediment forward (something about coastlines rising +1 and sediment being displaced for +1)

22. (1.00 pts) Why or why not?

**Expected Answer:** Yes, Pecten is a very common bivalve and is light enough to be carried by tides. (anything about commonality or ease of movement for points)

23. (1.00 pts) Give an estimate as to how long you expect it to take:

**Expected Answer:** Over the course of around 100-1000 years, anywhere in between for points too

24. (2.00 pts) Closer or farther from the yellow post?

- ☐ A) Closer  
☒ B) Farther

25. (1.00 pts) True or False?

- ☒ True ☐ False

## **Station 5 : A Good Show**

26. (1.00 pts) Identify the organism:

Batoidea

27. (2.00 pts) Give the time period:

**Expected Answer:** Late Triassic or Early Jurassic

28. (2.00 pts) Give the purpose of the behavior:

**Expected Answer:** To attract a mate

29. (2.00 pts) What does this mean?

**Expected Answer:** Teeth that grow together to form a larger tooth

30. (1.00 pts) Give the Phylum of their prey:

Mollusca

31. (2.00 pts) What part(s) are preserved?

dermal spines

## **Station 6 : One of Five Ends**

32. (2.00 pts) Give the event below:

**Expected Answer:** The meteor impact that ended the KT extinction (all or nothing)

33. (1.00 pts) Give the formation and location (which state of what country) of the formation:

**Expected Answer:** Chixculub Crater (+0.5), Yucatan, Mexico (+0.5)

34. (2.00 pts) Give the element:

- ☐ A) Iron
- ☐ B) Copper
- ☐ C) Uranium
- ☒ D) Iridium
- ☐ E) Francium

35. (1.00 pts) Give the name of the scientist:

- ☐ A) Othniel Marsh and Cope
- ☐ B) Mary Anning
- ☒ C) Walter or Luis Alvarez
- ☐ D) Barnum Brown
- ☐ E) Walter White
- ☐ F) Jack Horner

**36. (4.00 pts)** \*Tiebreaker\* Give your calculations in the space below:

**Expected Answer:** 66 mya (or similar) +2, +2 for any calculations

## Station 7 : Nerd War

**37. (1.00 pts)** Name the man in the image:

**Expected Answer:** Edward Drinker Cope

**38. (2.00 pts)** Give your answer below:

**Expected Answer:** The Bone Wars (+1) against Othniel Marsh (+1)

**39. (3.00 pts)** Identify the order and discuss the misrepresentation below:

**Expected Answer:** Order Plesiosauria (+1), he reconstructed it with a very long tail rather than a very long neck. (+2)

**40. (1.00 pts)** Did they evolve gills?

☐ True ☒ False

41. (3.00 pts) The length of the neck (for the long-necked group) usually...

- ☐ A) longer than the length of the body.
- ☒ B) about equal to the length of the body.
- ☐ C) shorter than the length of the body.

## **Station 8 : Atomic Anomalies**

42. (2.00 pts) Name the process:

**Expected Answer:** Alpha Decay

43. (3.00 pts) Give the example element and what it produces:

**Expected Answer:** Uranium-238 decays in Thorium-234 and alpha particle, Uranium-234 decays into Thorium-230 and alpha particle, Ra226 into Rn222 and alpha particle... the list goes on, if any other examples are mentioned look them up. One point for both elements correct, one point for both numbers correct, one point for mentioning the alpha particle

44. (1.00 pts) Is the decay accomplished through the process seen in the video?

- ☐ A) Yes
- ☒ B) No

45. (2.00 pts) How many years will have passed, and what is the expected concentration?

**Expected Answer:** 28,650 years (+1) 3.125% (+1)

46. (2.00 pts) What organism could this be?



**Expected Answer:** All or nothing. Could be m. primigenius, smilodon, homo sapiens, homo neanderthalensis, latimeria, equus, lingula, hydnoceras, astarte, pecten, conus, glycymeris

## **Station 9 : Out on a Limb**

**47. (3.00 pts)** Identify the genus of the organisms in each box. 'A' in the left box, 'B' in the middle, 'C' on the right.

Tiktaalik

Acanthostega

Diplocaulus

**48. (1.00 pts)** When did it go extinct?

**Expected Answer:** 255 Mya, or at the end of the permian during the Permian-triassic extinction

**49. (2.00 pts)** Which of the three organisms matches with the fin?

- ☒ A) Organism A  
☐ B) Organism B  
☐ C) Organism C

**50. (4.00 pts)** **\*Tiebreaker\*** Explain what a transition species is:

**Expected Answer:** A transition species is a species that establishes fills in an evolutionary gap between two major groups of organisms, in this case fish and amphibians (+1 for mentioning evolution, +1 for mentioning a gap, +2 for establishing that tiktaalik links fish and amphibians).

## **Station 10 : The Ancient World**

**51. (2.00 pts)** What defines Arkose?

**Expected Answer:** Is more than 25% feldspar (+2)

52. (2.00 pts) The monuments were constructed of...

fossiliferous limestone

53. (3.00 pts) Give the genus and the etymology of the name:

**Expected Answer:** Nummulites (+2) meaning "Little coin" (+1)

54. (3.00 pts) Identify the plant and explain the meaning and history behind the name.

**Expected Answer:** Populus (+2) , as in "populated" as it was used in the courtyards of Rome (+1)

## **Station 11 : TheOddOneOut**

55. (1.00 pts) Name the class:

Articulata

56. (2.00 pts) Give the defining characteristics of the class:

**Expected Answer:** hinged valves, teeth near valves, ringlike structures, lateral symmetry (any of these for full points)

57. (1.00 pts) True/False: Is the class extinct?

☐ True ☒ False

58. (1.00 pts) Give the letter and class:

**Expected Answer:** B (+0.5) in class Bivalvia (+0.5)

59. (5.00 pts) Identify the genus of organisms A-E:

**Expected Answer:** (+1 each) A-Mucrospirifer, B-Glycymeris, C-Rafinesquina, D-Atrypa, E-Composita

## Station 12 : Not Asteroidea

60. (1.00 pts) Give the organism's class:

61. (2.00 pts) Give the condition here:

**Expected Answer:** Anatomic similarity to fossils, few species in genus, must be "old" compared to original creature. (Any for full points)

62. (2.00 pts) What is the process called?

63. (2.00 pts) This event was known as the...

64. (1.00 pts) The long stalk on organism 'B' is known as a \_\_\_\_\_. 'B' is a \_\_\_\_\_ feeder.

**Expected Answer:** pedicle, filter/detritus

65. (2.00 pts) Explain why the the classification as a living fossil is inaccurate:

**Expected Answer:** It is not anatomically similar to fossils of lingula.

## **Station 13 : Claw on This**

66. (2.00 pts) Identify the two samples below:

mammuthus primigenius

mastodon

67. (1.00 pts) Which sample matches the creature in the video?

- ☒ A) Sample A  
☐ B) Sample B  
☐ C) Sample C

68. (3.00 pts) Explain the dietary differences below:

**Expected Answer:** The flat teeth of the mammoth were made to chew up grass and ferns on vast plains while mastodons chewed on some bark and thick shrubbery in forests and needed nipple teeth to pierce thicker material (+1 for mentioning shrubbery and thick brush or similar for mastodon, +1 for mentioning grasses or similar for mammoths, +1 for mentioning flat vs nipple tooth shape)

69. (2.00 pts) Identify the species:

homo sapiens

70. (2.00 pts) Explain why 'B' is responsible for the extinction of one of the other organisms.

**Expected Answer:** Homo sapiens potentially hunted Mammoths (A) to extinction, often hunting with spears and arrows. +2 for something about hunting to extinction, all or nothing

## **Station 14 : Continental Drift**

71. (2.00 pts) Give continent 'A' and then give continent 'B'.

72. (2.00 pts) Name the formation:

**Expected Answer:** Bering Strait or Bering Land Bridge

73. (3.00 pts) About how long ago did it appear and when did it disappear?

**Expected Answer:** 22,000-18,000 years ago (+1.5), 11,000-9,000 years ago (+1.5)

74. (3.00 pts) **\*Tiebreaker\*** Where would you find greater genetic diversity?

☒ A) South Africa

☐ B) Canada

## **Station 15 : Rocky Roads**

75. (2.00 pts) Define the term:

**Expected Answer:** +2 for mentioning "colonial"

76. (3.00 pts) Identify the locations. Please label them appropriately:

**Expected Answer:** (A) La Brea Tar Pits, (B) Solnhofen Limestone, (C) Beecher's Trilobite Bed

**77. (2.00 pts)** Is the statement true or false?

☐ True ☒ False

**78. (1.00 pts)** Identify the genus:

Eldredgeops

**79. (1.00 pts)** Name the state:

Pennsylvania

**80. (1.00 pts)** Order the locations. Concatenate the letters (For example, BAC). Oldest on the left and most recent on the right.

CBA

## **Station 16 : Deep Blue, Part Two**

**81. (1.00 pts)** Identify what 'A' indicates:

Septa

**82. (1.00 pts)** Identify what 'B' indicates:

Septal Wall

**83. (1.00 pts)** Identify what 'C' indicates:

Siphuncle

**84. (3.00 pts)** Identify the purpose of 'C':

**Expected Answer:** +1 for mentioning bouyancy, +1 for mentioning salt/gas content, +1 for mentioning osmosis

85. (1.00 pts) Identify the genus shown in the video.

Expected Answer: Orthoceras

86. (1.00 pts) Identify sample 'X':

Expected Answer: Baculites

87. (1.00 pts) Identify sample 'Y':

Expected Answer: Belemnitella

88. (1.00 pts) Is this sexual dimorphism? Answer True or False:

☒ True ☐ False

## Station 17 : Cutting Edge

89. (3.00 pts) Identify all three organisms. Put them in each box from left to right as seen in the video ('A' is on the left and 'C' is on the right):

Ichthyosauria

Mosasauridae

Basilosaurus

90. (3.00 pts)

Enter the number for the tooth that matches video 'A' in the first box, the tooth that matches 'B' in the second box, and the tooth that matches 'C' in the third box. Only enter numbers.

2

3

1

91. (3.00 pts) Organize these by order of appearance, with the most ancient on the left and most recent on the right

A	B	C
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92. (1.00 pts) \*Tiebreaker\* Give your explanation below:

Expected Answer: +1 for mentioning land-dwelling ancestors

## Station 18 : A Millenia in the Making

93. (4.00 pts) Order all from most ancient to most recent and make sure to concatenate your answer:

GBCDAFEH

94. (2.00 pts) Name the stratigraphic law:

Expected Answer: Law of Lateral Continuity

95. (1.00 pts) They indicate...

contact metamorphism

96. (3.00 pts) Define an angular unconformity and say whether the E/D divide is one.

Expected Answer: +1 for saying something about non-lateral, angled, etc. +1 for mentioning erosion, +1 for saying Yes

## Station 19 : You are Gone!

97. (2.00 pts) Identify the organism from the video:



**98. (2.00 pts)** Identify the subphylum:

**99. (1.00 pts)** Identify the phylum:

**100. (3.00 pts)** Name the chemical compound:

**101. (2.00 pts)** Give your explanation here:

**Expected Answer:** All or nothing, must say something about re-growing plates or appendages.

## Station 20 : Dino Shuffle

**102. (1.00 pts)** Identify the genus of 'A' and then the genus of 'B':

**103. (1.00 pts)** Identify the suborder of 'C' and genus of 'D':

**104. (1.00 pts)** Identify the genus of 'E' and order of 'F':

**105. (2.00 pts)** Did 'F' lay eggs? How do we know?

**Expected Answer:** No (+1), fossils of live birth at sea (or similar, +1)

106. (1.00 pts) Which is out of place and why?

**Expected Answer:** All or nothing. 'E' because it lived in a different time period (Jurassic) (or similar)

107. (1.00 pts) Were they swimmers? If so, how long did they spend swimming?

**Expected Answer:** No, not swimmers (+1)

108. (3.00 pts) Give the picture number, identify the picture's genus, and name the supercontinent.

**Expected Answer:** '4' (+1), Glossopteris (+1), Gondwana or gondwanaland (+1)

## **Station 21 : Free for All**

109. (10.00 pts) \*Tiebreaker\* Identify as many as you can!

**Expected Answer:** (A) Order Goniatitida, (B) Latimeria/Coelocanth, (C) Carcharocles, (D) Knightia, (E) Eryops, (F) Spinosaurus, (G) Mesohippus, (H) dinosauria, (I) Dimetrodon, (J) Mosasauridae or Mosasaur

110. (0.10 pts)

### **Final Tiebreaker/Bonus Question**

Spongebob Squarepants is, as his name implies, a Sponge (Phylum Porifera). In real life, Spongebob would be classified as genus Aplysina. However, this reality aside, which of the two genuses on your fossils list is he most similar to, Hydnoceras or Astraeospongia? This is a bonus question, so there is no wrong answer. You can use what you know about sponges, anything from the video below, or any knowledge you might have about Spongebob and his pals to construct your answer. Points are given for thoroughness, creativity,

and funniness of a response. This question awards no points on the actual exam, but the score you get on this question will be used to break any significant ties, so make sure to go all out if you have time!



**Expected Answer:** Grade based on how funny the answer is. Just like there is no real question there is no real rubric. Use this only if all other tiebreakers are exhausted. Compare the two answers and decide which of the two is the most compelling.

Please fill out the test feedback form (<https://forms.gle/zmNm27mU3vZ7pXVv7>) if possible.

Make sure all answers are submitted, best of luck with the rest of the competition!