FOSSILS

Massachusetts State Science Olympiad • B Division • March 5, 2016

ANSWER KEY

PART 1: QUICK RESPONSE

DIRECTIONS: *You have three minutes to answer the questions at a station. Each station is worth six points, but the individual point value of questions may vary. You are not allowed to revisit a station after the time is up. Be sure to write your responses in the appropriate blanks!* ***(5 points per station; 60 points total)***

STATION ONE: IDENTIFICATION

1. **Class:** Trilobita *(0.25 points for each blank)*

   Genus: Calymene

2. **Order:** Saurischia

   Genus: Coelophysis

3. **Class:** Placodermi

   Genus: Dunkleosteus

4. **Phylum:** Brachiopoda

   Genus: Platystrophia

5. **Phylum:** Echinodermata

   Class: Crinoidea

6. **Class:** Bivalvia

   Genus: Gryphaea

7. **Class:** None

   Genus: None

8. **Class:** Gastropoda

   Genus: Turritella

9. **Phylum:** Cnidaria

   Class: Anthozoa

10. **Order:** Ornithischia

    Genus: Iguanodon

STATION TWO: MODES OF PRESERVATION

1. a. _____

   b. _____

2. a. _____

   b. _____

3. a. _____

   b. _____

4. a. _____

   b. _____

5. a. _____

   b. _____

(0.5 points per blank)

STATION THREE: BIOSTRATIGRAPHY

1. Shade the appropriate boxes below. (3 points)

Era	Period	Fossil A	Fossil B	Fossil C
Cenozoic	Quaternary			
	Neogene			
	Paleogene			
Mesozoic	Cretaceous			
	Jurassic			
	Triassic			
Paleozoic	Permian			
	Carboniferous			
	Devonian			
	Silurian			
	Ordovician			
	Cambrian			

2. Circle the best response: A B C **D** E (1 point)

3. Circle the best response: **A** B C D E (1 point)

STATION FOUR: MORPHOLOGY

1 and 2.

Skull A: Must give two features (questions 1 and 2), 1 point each. Rounded teeth for grabbing and grinding plant matter, nostrils on TOP of the skull (no need to sense prey ahead of you), wide jaw for grabbing and grinding large amounts of plant matter.

3 and 4.

Skull B: Must give two features (questions 3 and 4), 1 point each. Sharp, pointy teeth which suggest carnivory of some sort, teeth like these would not be able to grind up plant matter, and thus would not be effective for an herbivore (there is controversy over whether or not T. rex was a predator or a scavenger, so you'll have to give full credit for either interpretation). Placement of the eye sockets in T. rex's skull indicate that the field of vision would be forward -- this is also typical of predators as they must be able to pursue prey visually. Large and narrow size of the jaw itself (for biting off large chunks, getting into an animal you've killed, etc). Inferred presence of nostril areas that point forward (for smelling prey).

5.	I. Dinosauria:	**Skull A**	**Skull B**	Neither skull
	II. Saurischian:	**Skull A**	**Skull B**	Neither skull
	III. Ornithischian:	Skull A	Skull B	**Neither skull** (1 point for all of 5)

STATION FIVE: LAGERSTATTEN

1. *(2 points)*

   Any event that would preserve large numbers of species in high quality. Examples: cement is pored into the harbor, giant mudslide into the harbor, etc. (1 point for an answer that explains fossilization but not Lagerstatten)

2. *(3 points)*

   Species preserved in high quality. Soft body parts, possible indicators of color, exceptional life position preserved, etc, tons of fossils.

   1 point for an explanation of Lagerstatten (high quality), 2 points for an explanation and an example, full points for both an explanation and 2+ examples. 2 points for just examples, unless they totally demonstrate what a Lagerstatten is, then full points.

STATION SIX: DIVERSITY

1. Complete below for time period #1. (0.1 points per box)

	Predatory	Eating plants, or foods on a surface	Filter feeding	Eating buried food	Photosynthesis
Living on land	1	2	3	4	5
Living on the ocean surface	6	7	8	9	10
Burrowing into the ocean floor	11	12	13	14	15
Flying	16	17	18	19	20
Floating in the ocean	21	22	23	24	25

2. Complete below for time period #2. (0.1 points per box)

	Predatory	Eating plants, or foods on a surface	Filter feeding	Eating buried food	Photosynthesis
Living on land	1	2	3	4	5
Living on the ocean surface	6	7	8	9	10
Burrowing into the ocean floor	11	12	13	14	15
Flying	16	17	18	19	20
Floating in the ocean	21	22	23	24	25

STATION SEVEN: MASS EXTINCTIONS, I

1.

Trigger: Bolide impact; asteroid impact; meteor impact would all be appropriate. (1 point)

2, 3 and 4.

Kill mechanisms: Must give three kill mechanisms (questions 2-4), 1 point each, 3 points total. The impact itself hitting/vaporising organisms; acid rain; fire; dust blocking the sun and killing plants and then things that rely on plants; carbon dioxide poisoning from the vaporized carbonate platform the bolide hit; I'm probably forgetting a few more!

STATION EIGHT: MASS EXTINCTIONS, II

1. Circle the best response: A **B** (1 point)

2. *(4 points)*

   *Mass Extinctions are triggered by **global events** that affect life everywhere. Therefore, a wide geographic range does not shield a species from extinction. During "normal" times of background extinction, extinctions are caused by localized events and therefore species of small ranges are more likely to go extinct.*

   2 points for getting that mass extinctions are triggered by global events
   2 points for getting that background extinctions are local, so small ranges are more vulnerable

STATION NINE: ENVIRONMENTS

1. Circle the correct rock: A B C **D** (1/2 point)
2. Circle the correct rock: A **B** C D (1/2 point)
3. Circle the correct rock: **A** B C D (1/2 point)
4. Circle the correct rock: A **B** C D (1/2 point)
5. Change from deep ocean to shallow water (1 point)
6. Flooding, change in flow rates, periodicity of some sort, etc. – how graded bed forms, give 1 (1 point)
7. Limestone (1 point)

STATION TEN: TRACE FOSSILS

1. Circle the correct trace fossil: A **B** C (1/2 point)
2. Circle the correct trace fossil: **A** B C (1/2 point)
3. Circle the correct trace fossil: A B **C** (1/2 point)
4. Circle the correct trace fossil: A B **C** (1/2 point)
5. Circle the best response: A **B** C D E (1 point)
6. Circle the best response: A B **C** D E (1 point)
7. Circle the best response: **A** B C D E (1 point)

STATION ELEVEN: PRESERVATION POTENTIAL

1. D, C, A, E, B *(3 points)*

   To grade: *½ point for D before C, ½ point for C before A, ½ point for A before E, ½ point for E before B, ½ point for D at beginning, ½ point for B at end*

2. D - most fragile, not robust at all *(1/2 point)*; C is more robust, but shell is very thin and flat *(1/2 point)*; E shell is thicker than A and C, and also curved which supplies mechanical support *(1/2 point)*; B is not hollow like C, solid calcium carbonate *(1/2 point)*. *(2 points)*

STATION TWELVE: DATING

1. *(4 points)*

   J, K, F, H, B, G, E, D, I, C, A. (3 points if one is out of order, 1 point if 2 are out of order)

2. *(1 point total, 0.5 points for each feature, must give two)*

   Volcanic layer, index fossil, carbon dating

PART 2: DOCUMENT BASED QUESTION

1. Paleozoic (1 point)

2. Get precise dates on the ash layers using radiometric dating techniques to "sandwich in" possible dates for your outcrop (1 point)

   Match the fossil assemblage found in your outcrop to one found elsewhere that is sandwiched between ash layers that can be dated (1 point)

3. No, there is not diversity (1 point)

   Only stationary and floating organisms, none that can move and propel themselves in any way (1 point)

4. Fossils A and D (0.5 points each, 1 point total)

   Anything reasonable about why being colonial is advantageous (1 point)

5. Fossil A: carbonization (0.5 points)

   Fossil C: Imprint or external mold (0.5 points)

6. Fossil B (1 point)

7. Wrong (1 point)

   Organism had tentacles that it would use to capture little things moving by (1 point)

8. Depth: Deep, probably relatively off shore (0.5 points)

   Light levels: Likely had light reaching to the bottom because of diversity of life (0.5 points)

   Energy: low energy because of small grain size (0.5 points)

   0.5 points = gimme!

9. Likely could move a little bit albeit not far, cite blobby shape (1 point)

   Probably soft bodied with muscles of sorts that would propel its motion (1 point)

   -or- It couldn't move because I do not see any legs, and it seems soft-bodied and unable to control its own motion (2 points)