2006 UAH REGIONAL SCIENCE OLYMPIAD

DYNAMIC PLANET EXAM

INSTRUCTIONS

WRITE YOUR GROUP NUMBER ON THE ANSWER SHEET NOW!!!

Do not open the test until we tell you.

Write your answers ONLY on the answer sheet.

If you are writing more than what fits in the space you are given, you are either writing too large or writing too much.

High School groups: *make sure you complete the three (3) extra questions on the last page.*

For middle school groups, the test is worth 27 total points. For high school groups, the test is worth 45 total points.

The exam ends at 1 p.m. Take the exam with you when you leave.

Our names are **Cody** and **Thomas**. Ask a question if you need to. Good luck!

Required words: Blah blah, blah blah, and blah blah. More later.

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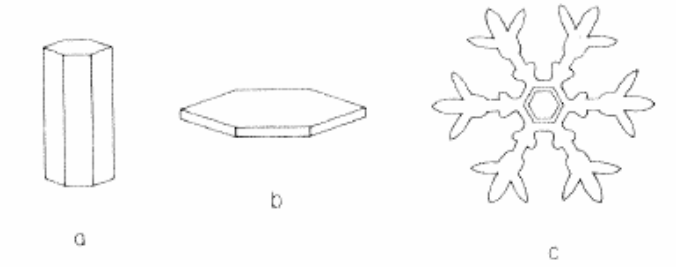
DYNAMIC PLANET EXAM

WRITE YOUR ANSWERS ON THE ANSWER SHEET.

You may take this exam with you when you leave; do not write any answers on it!

1. Glaciers originate as snow, and three types of snowflakes are shown below. Snowflakes of which type are most likely to "aggregate" into clumps while falling to the ground? (1 point)



The three most common ice crystal types: (a) column, (b) plate, (c) dendrite.

2. On the glacier surface, what separates the ablation zone from the accumulation zone? (1 point)

3. How old is the "oldest" ice in Antarctica? (1 point)
   a. 50,000 years
   b. 500,000 years
   c. 10,000,000 years
   d. 50,000,000 years

4. The Earth is closest to the Sun in January, yet this is when it is coldest in the Northern Hemisphere! How this can be true? (2 points)

5. Why do icebergs float? (2 points)

6. Explain how fallen snow transforms into glacial ice. (2 points)

7. Would the earth's ocean tides be any different if we had two moons instead of one? Explain your answer. (3 points)

8. If Antarctica melted completely, would sea levels across the globe rise or fall? Why? (3 points)

9. Why, from a human standpoint, is it important to know if a glacier is advancing or retreating? What effects can glacial movements and evolution have upon human activity? (4 points)

10. An important glacial process is sublimation. How does sublimation affect glaciers? Does sublimation lead to warming or cooling of the atmosphere? (4 points)

11. Explain how an increase in cloud cover surrounding the earth would increase the earth's albedo, yet not necessarily lead to a lower earth surface temperature. (4 points)

HIGH SCHOOL GROUPS: YOU MUST ALSO COMPLETE THE FOLLOWING THREE (3) QUESTIONS

12. A number of glaciers in North America have been *receding* over the last 50 years, yet recent studies show that the Greenland Ice Sheet is actually getting *thicker*! How do you resolve the apparent contradiction? (6 points)

13. Scientists know that the earth's incoming and outgoing radiation are in balance according to the relationship:

$$(1 - A) \sim T^4 ,$$

where A is albedo and T is temperature. What increase in earth's albedo would be necessary to reduce the earth's effective temperature by approximately 1°C? (Show your work or explain your reasoning for full credit. 6 points)

a. 0.3
b. 0.1
c. 0.01
d. 0.003

14. Geological evidence suggests that major glaciations extended all the way into the tropics several times in earth's history, most recently 280 million years ago. The resulting "Snowball Earth" is almost completely covered by snow and ice. Please answer the following questions on Snowball Earth, ignoring the effects of orbital mechanics and human interaction with the environment. (6 points)

    (a) Will atmospheric carbon dioxide (CO_2) increase or decrease on Snowball Earth? Explain.
    (b) Name and describe one geological or meteorological process that would lead to the formation of Snowball Earth.
    (c) Name and describe one geological or meteorological process that would allow earth to warm from its snowball phase.