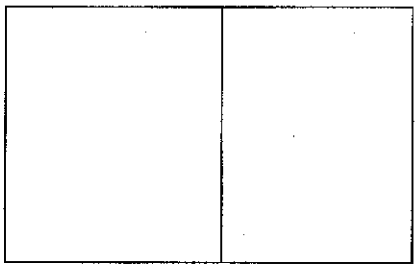
SCIENTIST – BIOCUBE DIRECTIONS

Overview: The biocube will show research about three scientists who have contributed to our current understanding of space topics:

- Nicholas Copernicus
- Percival Lowell
- Luis and Walter Alvarez

Directions:

1) Cut out the biocube pattern
2) Fold it (but do NOT glue it yet) to determine which sides touch.
3) Outline TWO adjacent sides in one color
4) Outline TWO adjacent sides in a second color
5) Outline TWO adjacent sides in a third color
    a. Each color will represent a different scientist! EX: blue might be for Copernicus, red for Lowell, and green for the Alvarezes.
    b.



Adjacent Sides

6) On one of the squares, write the name "Nicholas Copernicus", the country he was from, and the years of his scientific work

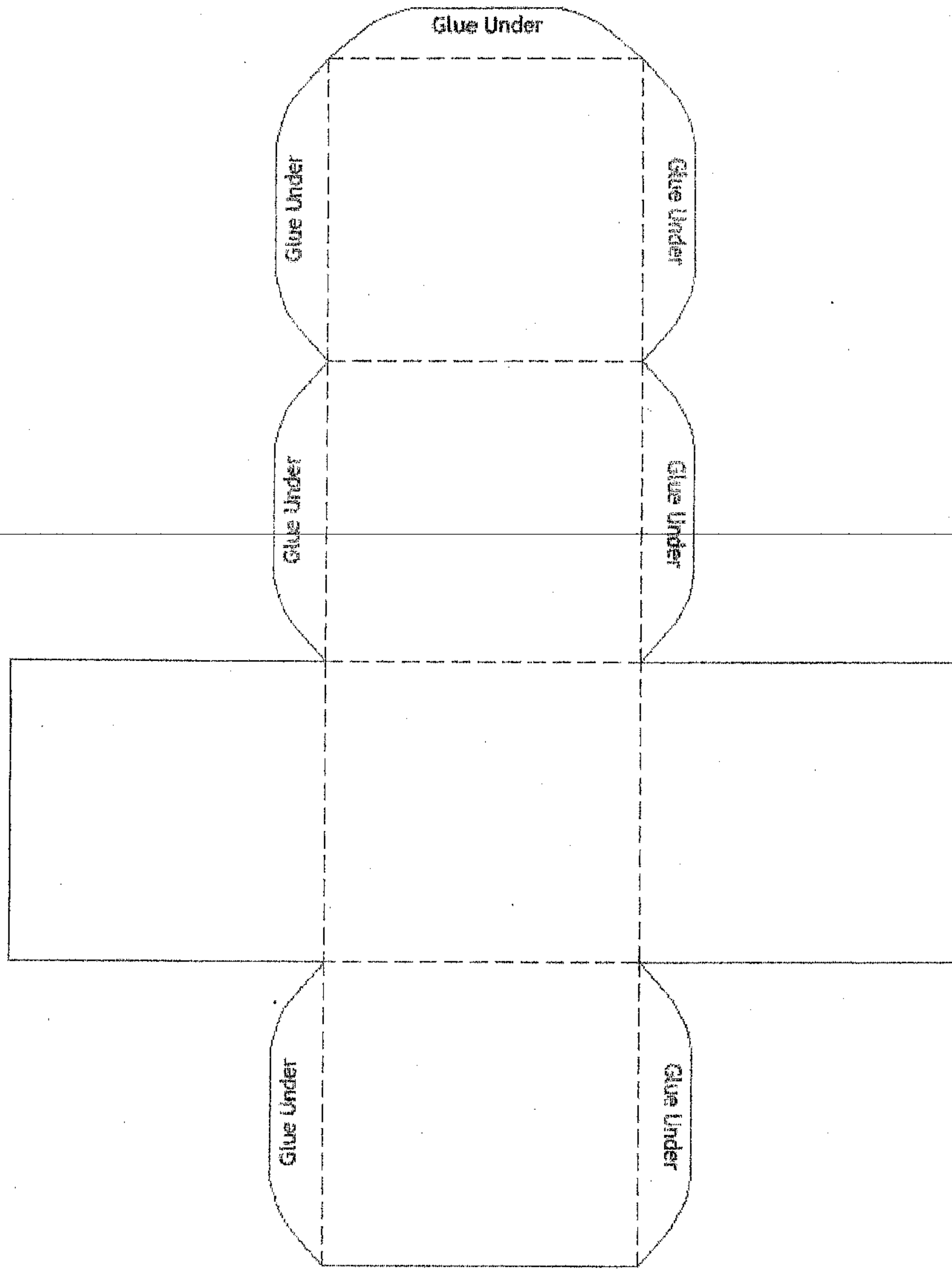
7) On the other square of the SAME color, write a summary of his contribution to the scientific community. This should be a 10-word sentence that tells what he did and/or learned that is important to science. YES, you need to narrow it down to 10 words ONLY!

8) Finally, draw a picture on one of the squares that represents SOMETHING about the scientist (who he is, where he is from, or what he did)

9) Repeat steps 6 & 7 on the other 4 squares - - two of the same color for Percival Lowell and two of the same color for the Alvarezes.

10) When you are done with the squares and you are satisfied that your work is NEAT and COMPLETE, write your name somewhere on the cube. Please HIGHLIGHT your name so that it stands out.

11) Finally, glue the tabs together to form the cube & turn it in!



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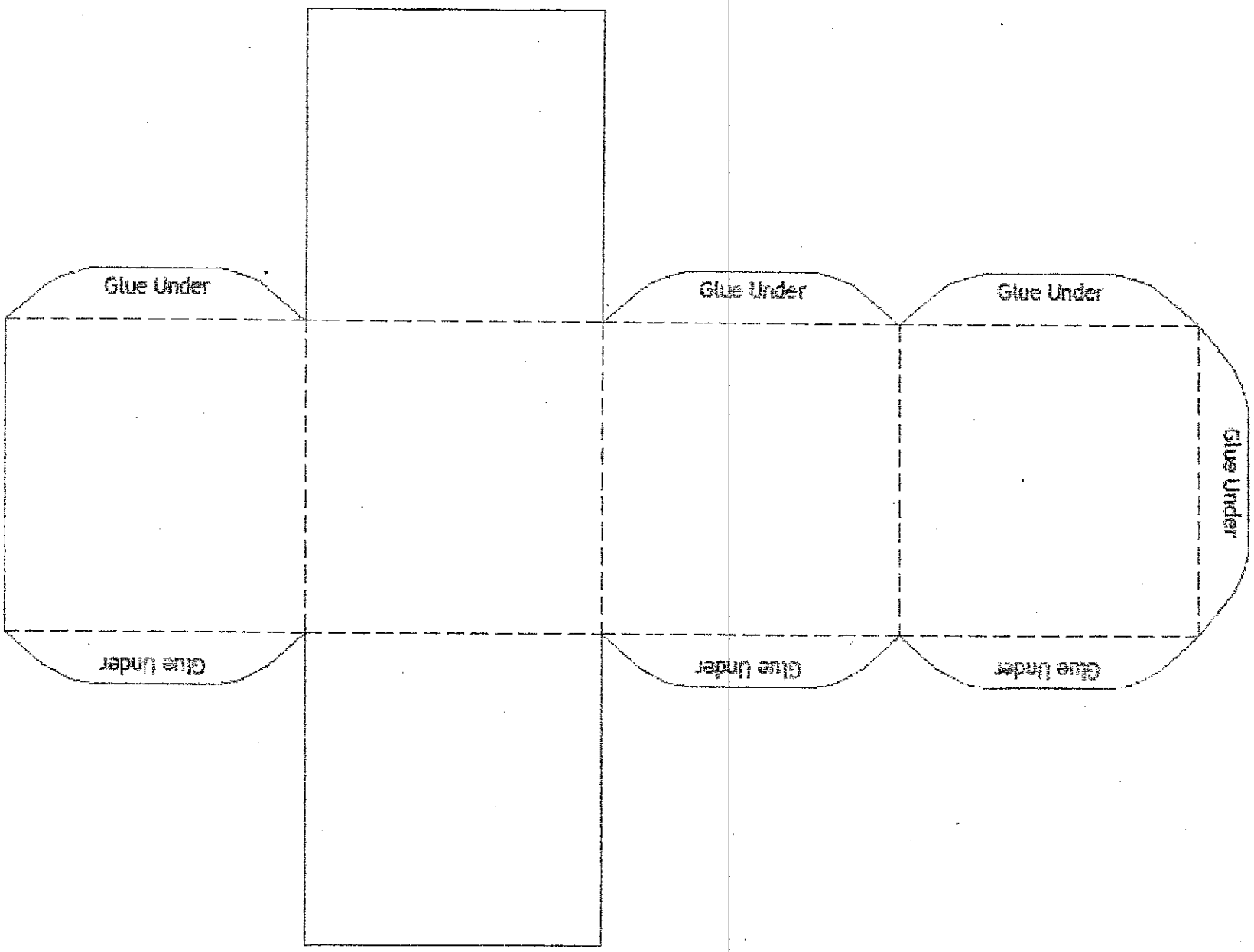
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THE ALVAREZ ASTEROID IMPACT THEORY

There are a lot of theories about why the K-T (Cretaceous-Tertiary) extinction occurred, but a widely accepted theory (proposed in 1980 by physicist Luis Alvarez and his son Walter Alvarez, a geologist), is that an asteroid 4-9 miles (6-15 km) in diameter hit the Earth about 65 million years ago. The impact would have penetrated the Earth's crust, scattering dust and debris into the atmosphere, and causing huge fires, increasing already active volcanic eruptions, triggering tsunamis and severe storms with high winds and causing highly acidic rain. The impact could have caused chemical changes in the Earth's atmosphere, increasing concentrations of sulfuric acid, nitric acid, and fluoride compounds. The heat from the impact's blast wave would have incinerated (burned up) all the life forms in its path.

The dust and debris thrust into the atmosphere would have blocked most of the sunlight for months, and lowered the temperature globally.

Those organisms that could not adapt to the temperature and light changes would die out. Since plants' energy is derived from the sun, they would likely be the first to be affected by changes in climate. Many families of phytoplankton and plants would die out, and the Earth's oxygen levels may well have dramatically decreased, both on land and in the oceans, suffocating those organisms which were unable to cope with the lower oxygen levels.

Major changes in the food chain would result from all of these these environmental upheavals. The herbivores (plant eaters) who ate those plants would starve soon after the plants died. Then, at the top of the food chain, the carnivores (meat eaters), having lost their prey, would have to eat each other, and eventually die out. Their large carcasses must have provided smaller animals with food for quite a while.

Alvarez finds evidence of dinosaur-killing asteroid (1980)

In 1980 physicist Luis Alvarez and his son, geologist Walter Alvarez, both of the University of California, were working together on a geology expedition in Italy. They accidentally discovered a band of sedimentary rock that contained unusually high levels of a rare element, iridium. Chemical dating techniques put the rock at around 65 million years old. Coincidentally -- or not, that is around the time the dinosaurs died out.

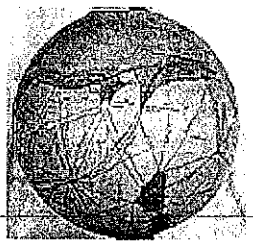
The Alvarezes hypothesized that the iridium, which was in a very even, widespread distribution (not just in Italy), was the result of a giant asteroid that hit Earth, sending smoke, dust, and iridium into the atmosphere. That smokescreen blocked the sun, lowering the earth's temperature, killing plants (but not seeds or roots), and eventually many species of animals, including dinosaurs. The plant-eaters died out first, followed by the meat-eaters who would have eaten them. Smaller mammals and birds could survive the cold, desolate period because of their fur, feathers, and ability to eat seeds, roots, and decaying vegetation. The pollution eventually settled to the ground, forming a thin layer of iridium.

The theory is still subject to debate.

Percival Lowell and Mars

Percival Lowell was born in 1855 in Boston. He came from a well known family; his brother, Abbott, was president of Harvard and his sister, Amy, was a famous poet and critic who was awarded the Pulitzer Prize for poetry in 1926.

Lowell graduated from Harvard in 1876 with distinction in mathematics. After working in the family business for several years, he traveled extensively in the Orient before finally deciding on a career in astronomy. In 1894, he founded an observatory in Arizona, initially to search for intelligent life on Mars. Atop Mars Hill, at Flagstaff's rarefied elevation of 7,000 feet, the sky and quality of astronomical seeing conditions were perfect for night observing.



Lowell spent 23 years intensively studying Mars. By viewing its surface through the 24-inch Clark Telescope, Lowell produced intricate drawings of the Red Planet, delineating hundreds of straight lines (termed "canals") and their intersections (which Lowell called "oases"). Lowell concluded that the bright areas were deserts and the dark were patches of vegetation. He further believed that water from the melting polar cap flowed down the canals toward the equatorial region to revive the vegetation. Lowell thought the canals were constructed by intelligent beings who once flourished on Mars. He published his views in three books: *Mars* (1895), *Mars and Its Canals* (1906), and *Mars As the Abode of Life* (1908). Today we know that there are no canals built by intelligent beings on Mars and that Lowell was mistaken in his conclusions.

Though he focused his attention on Mars, Lowell also initiated a number of other research projects. Perhaps his greatest contribution to planetary studies came during the last 13 years of his life, when he devoted much of his time and energy to his quest for "Planet X," a theoretical ninth planet. The search continued after his death in 1916 and led to the discovery of Pluto by Clyde Tombaugh in 1930. Pluto, in Greek mythology, is the god of the underworld -- a perfect name considering planet Pluto dwells at the outermost reaches of the solar system. The ninth planet's astronomical symbol became PL, the first two initials of the name Pluto, but also Percival Lowell's initials.

Since his death in 1916, Percival Lowell remains close to the observatory he founded in 1894. A mausoleum, located on Lowell Observatory's Mars Hill campus, was built in his honor, and is where Percival Lowell is buried.

Percival Lowell is one of the best known observers of the planet Mars. Lowell is pictured here in the observer's chair of the 61-centimeter (24-inch) refracting telescope in the observatory he established in Flagstaff, Arizona. Lowell Observatory is still one of the foremost sites for telescopic studies of Mars and the other planets.

Nicolas Copernicus (1473-1543)

Copernicus is said to be the founder of modern astronomy. He was born in Poland,1 and eventually was sent off to Cracow University, there to study mathematics and optics; at Bologna, canon law. Returning from his studies in Italy, Copernicus, through the influence of his uncle, was appointed as a canon in the cathedral of Frauenburg where he spent a sheltered and academic life for the rest of his days. Because of his clerical position, Copernicus moved in the highest circles of power; but a student he remained. For relaxation Copernicus painted and translated Greek poetry into Latin. His interest in astronomy gradually grew to be one in which he had a primary interest. His investigations were carried on quietly and alone, without help or consultation. He made his celestial observations from a turret situated on the protective wall around the cathedral, observations were made "bare eyeball," so to speak, as a hundred more years were to pass before the invention of the telescope. In 1530, Copernicus completed and gave to the world his great work *De Revolutionibus*, which asserted that the earth rotated on its axis once daily and traveled around the sun once yearly: a fantastic concept for the times. Up to the time of Copernicus the thinkers of the western world believed in the Ptolemiac theory that the universe was a closed space bounded by a spherical envelope beyond which there was nothing. Claudius Ptolemy, an Egyptian living in Alexandria, at about 150 A.D., gathered and organized the thoughts of the earlier thinkers. (It is to be noted that one of the ancient Greek astronomers, Aristarchus, did have ideas similar to those more fully developed by Copernicus but they were rejected in favour of the geocentric or earth-centered scheme as was espoused by Aristotle.) Ptolemy's findings were that the earth was a fixed, inert, immovable mass, located at the center of the universe, and all celestial bodies, including the sun and the fixed stars, revolved around it. It was a theory that appealed to human nature. It fit with the casual observations that a person might want to make in the field; and second, it fed man's ego.

Copernicus was in no hurry to publish his theory, though parts of his work were circulated among a few of the astronomers that were giving the matter some thought; indeed, Copernicus' work might not have ever reached the printing press if it had not been for a young man who sought out the master in 1539. George Rheticus was a 25 year old German mathematics professor who was attracted to the 66 year old cleric, having read one of his papers. Intending to spend a few weeks with Copernicus, Rheticus ended up staying as a house guest for two years, so fascinated was he with Copernicus and his theories. Now, up to this time, Copernicus was reluctant to publish, -- not so much that he was concerned with what the church might say about his novel theory (*De Revolutionibus* was placed on the Index in 1616 and only removed in 1835), but rather because he was a perfectionist and he never thought, even after working on it for thirty years,

that his complete work was ready, -- there were, as far as Copernicus was concerned, observations to be checked and rechecked.
(Interestingly, Copernicus' original manuscript, lost to the world for 300 years, was located in Prague in the middle of the 19th century; it shows Copernicus' pen was, it would appear, continually in motion with revision after revision; all in Latin as was the vogue for scholarly writings in those days.)
Copernicus died in 1543 and was never to know what a stir his work had caused. It went against the philosophical and religious beliefs that had been held during the medieval times. Man, it was believed (and still believed by some) was made by God in His image, man was the next thing to God, and, as such, superior, especially in his best part, his soul, to all creatures, indeed this part was not even part of the natural world (a philosophy which has proved disastrous to the earth's environment as any casual observer of the 20th century might confirm by simply looking about). Copernicus' theories might well lead men to think that they are simply part of nature and not superior to it and that ran counter to the theories of the politically powerful churchmen of the time.
The most important aspect of Copernicus' work is that it forever changed the place of man in the cosmos; no longer could man legitimately think his significance greater than his fellow creatures; with Copernicus' work, man could now take his place among that which exists all about him, and not of necessity take that premier position which had been assigned immodestly to him by the theologians.

> "Of all discoveries and opinions, none may have exerted a greater effect on the human spirit than the doctrine of Copernicus. The world had scarcely become known as round and complete in itself when it was asked to waive the tremendous privilege of being the center of the universe." [Goethe.]