

## **EXAMPLE LONG ARGUMENTATIVE THEME**

**Prompt:** Choose a science topic and a claim related to current events in the world, and write a multi-section Argumentative Theme about it, based on your research. Be sure to have at least two sections in your theme: one supporting the claim and one supporting its counterclaim. Each section should have at least two paragraphs. Include at least one quotation, in-text citations where needed, and a reference list. Use the APA style.

TITLE OF PAPER: Asteroids: The New Frontier?

Asteroids:  
The New Frontier?  
Jean B. Schumaker  
Central High School

Mr. Renberger  
General Science  
19 March 2016

### Asteroids: The New Frontier?

Are asteroids a new frontier that humans should settle? Some people think that they are; others do not agree. Most people think of asteroids as big rocks floating randomly around in space, such as those in the asteroid field encountered by Han Solo, Princess Leia, and Chewbacca in the movie “The Empire Strikes Back” (Lucas, 1980). Nevertheless, asteroids are much more than big rocks. They are actually called “minor planets” because they orbit around the sun (“Asteroids,” n.d., p. 1). With regard to size, some of the smallest asteroids are almost a mile across. The largest is about a quarter of the size of the Earth’s moon (“Asteroids,” n.d.). All the asteroids together equal the mass of the Earth’s moon (“Asteroids,” n.d.). With regard to location, many of them are located in the asteroid belt. This is a region between the orbits of Mars and Jupiter (“Asteroids: Overview,” n.d.). Other asteroids are located throughout the solar system, and some are relatively close to the Earth. Because of their natural resources, opportunities for jobs and investments, and their possible use as way stations to other planets, asteroids offer great potential as places to live and work in the future and should be settled.

### Reasons for Settling Asteroids

Most importantly, asteroids should be settled because they contain valuable natural resources. For example, metals might be mined on asteroids that can be used back on Earth or in space. Very pure iron and nickel plus other byproducts like platinum and germanium can be used to produce steel and electronic equipment. John Lewis (1997) has calculated that the “...iron and nickel in Amun [an asteroid] have a market value of \$8,000 billion, the cobalt content adds another \$6,000 billion, and the platinum-group metals add another \$6,000 billion” (p. 25). For another example of a type of natural resource, volatiles can also

be found on asteroids. These are chemical elements and compounds with low boiling points, like sulfur, chlorine, and nitrogen. On some asteroids, volatiles like oxygen, carbon, and water might also be found. Such substances are critical to sustaining life and will aid the settlement of asteroids and the larger planets.

Also importantly, asteroids should be settled because they represent a great source of new opportunities. Clearly, workers will be needed to travel to asteroids to work in the mines and extract the metals and volatiles. Workers also may be needed to create steel and other products from the mined materials that can be used in constructing new homes and buildings on asteroids and larger planets. Additionally, inventors will be needed to create the technologies for extracting metals and volatiles and transforming them into useful products on the asteroids. Also, pilots will be needed to ferry workers to and from the asteroids. They will also be needed to take materials to other planets. Surely, investors and business people will be needed to supply the funds for space travel, salaries, starting up mines, buying equipment, and running the mines.

Then, once some asteroids have been settled and are productive, they will have great potential as way stations and testing stations. First, because asteroids are scattered throughout the solar system, they can be places for space travelers to stop to refuel and buy supplies. They can also be communities where space travelers get information or even have their space ships repaired. Second, because launching heavy materials into space from Earth is expensive, space pioneers can avoid that cost by stopping at the appropriate asteroid to pick up their heavy materials. The gravitational field of an asteroid will be less than that of the Earth, so less fuel will be required for all launches on asteroids. Third, because some asteroids are close to the Earth, they can be used to test new materials,

technology, and structures for space living. All kinds of inventions can be tried out in asteroid environments that are devoid of the amenities available on the Earth.

### **Reasons Against Settling Asteroids**

Of course, some people object to trying to obtain resources from and settling on asteroids. Not surprisingly, they indicate that traveling to and working on asteroids will be dangerous. A well-known fact is that any space launch from the Earth can be deadly. For example, on January, 28, 1986, the Challenger space shuttle broke apart about a minute after it was launched, and seven crew members died (Workman, 2016). Additionally, reentry into the Earth's atmosphere and landings can be dangerous. For example, the space shuttle Columbia disintegrated over Texas on February 1, 2003 as it was reentering the atmosphere (Howell, 2013). Again, all crew members were lost. Certainly, living on an asteroid will be dangerous and difficult, too. All kinds of unexpected accidents might occur because of malfunctioning equipment or technology. Moreover, working in mines has always been dangerous. Miners have been trapped for days and weeks with no food, water, and oxygen even here on Earth. In fact, more than a thousand men have been lost in one mining disaster (Johnson, n.d.). No one really knows the hazards that might be associated with mining certain metals and volatiles on asteroids. Finally, space travel and living in space do damage to the human body. Astronauts have experienced brittle bones, damaged immune systems, and other physical ailments after traveling in space. For example, astronauts can lose 1 to 2% of their bone mass per month in space. Traveling to and working on an asteroid will not be a picnic or a vacation.

Another reason against mining and settling asteroids is that space travel is very expensive. A single space launch can cost millions of dollars. Space X advertises that they

can launch the Falcon 9 (their smaller rocket) for 62 million dollars (“Capabilities...,” 2016). Also, ferrying the needed materials to an asteroid to create a mining community will be very expensive. Mining equipment is very heavy, and powerful rockets will be required to boost it out of the Earth’s atmosphere. Likewise, the equipment and materials needed to build homes and other structures initially needed on an asteroid would also be difficult to transfer there. People wonder whether the money that would be spent on settling an asteroid should be spent to cure diseases and feed the world’s hungry people.

Finally, the many international legal issues associated with the idea of mining and settling asteroids add to the argument against it. Just as people had many conflicts during the California Gold Rush in the 1940s, conflicts have arisen and will continue to arise regarding ownership of land, mines, and resources on asteroids. While the 1967 Outer Space Treaty (Kimball & Collina, 2012) does not allow nations or individuals to own land in space, some people wonder whether companies can own mines on celestial bodies. Since the treaty states that use of equipment necessary for peaceful activities is allowed and that anything built in space or extracted from a celestial body is the property of the builder, people have concluded that building mines and mining on asteroids is legally possible. One unsettled issue relates to whether one company can build a mine on an asteroid and ban other companies from doing so because they might interfere with the first company’s mining. Another issue relates to whether a company can move an asteroid’s orbit closer to the Earth and then claim that the asteroid belongs to the company because the company “extracted” it from its natural orbit. Thus, although some questions have been resolved, future court cases are sure to surface.

### **Summary**

In conclusion, despite the drawbacks, living and working on asteroids should be seriously pursued. Obviously, resources such as metals and volatiles are going to be needed in space as more and more space travel and space settlement takes place. These resources can be mined and then processed on asteroids. Because many people are unemployed, they need the work opportunities that asteroids would provide. Because some asteroids are located near the Earth, they can be used as way stations for space travelers to obtain fuel, supplies, and repairs as they go to other planets. Yes, mining and living on asteroids might be dangerous, but mining and the settlement of any new place can be dangerous, even on the Earth. Humans are adventurers, and many humans are willing to risk danger, expense, and lawsuits if they can explore and tame new worlds. Thus, asteroids should be a new frontier to be explored, mined, and settled, especially by individuals who want to fund the endeavor and others who are willing to take personal risks to their lives and limbs.

## References

Asteroid. (2014). *Wikipedia*. Retrieved from: <http://www.en.wikipedia.org/wiki/Asteroid>

Asteroids. (n.d.). *National Space Society*. Retrieved from:

<http://www.nss.org/settlement/asteroids>

Asteroids: Overview. (n.d.). *Solar System Exploration*. Retrieved from:

<https://solarsystem.nasa.gov/planets/profile.cfm?Object=Asteroids>

Asteroids: Read more. (n.d.) *Solar System Exploration*. Retrieved from:

<https://solarsystem.nasa.gov/planets/profile.cfm?Object=Asteroids&Display=OverviewLong>

Atkinson, N. (2011, August 23). Human mission to an asteroid: Why should NASA go?

*Universe Today*. Retrieved from: <http://www.universetoday.com/88383/human-mission-to-an-asteroid-why-should-nasa-go>

Bonsor, K. (2012). How asteroid mining will work. *How Stuff Works*. Retrieved from:

<http://howstuffworks.com/asteroid-mining.htm>

Capabilities & services. (2016) *Space X*. Retrieved from:

<http://www.spacex.com/about/capabilities>

Cohen, M. M. (2012). Robotic asteroid prospector (RAP) staged from L-1: Start of the deep space economy. *Space Technology Mission Directorate*. Retrieved from:

[http://www.nasa.gov/directorates/spacetech/niac/2012\\_phase\\_I\\_fellows\\_cohen.html](http://www.nasa.gov/directorates/spacetech/niac/2012_phase_I_fellows_cohen.html)

Hollingham, R. (2014, May 4). The effects of space travel on the human body. *Future*. Retrieved

from: <http://www.bbc.com/future/story/20140506-space-trips-bad-for-your-health>

Howell, E. (2013). Columbia disaster: What happened, what NASA learned. *Space.com*.

Retrieved from : <http://www.space.com/19436-columbia-disaster.html>



How will NASA's asteroid redirect mission help humans reach Mars? (2014, August 4). *Asteroid and Comet Watch*. Retrieved from: [http://www.nasa.gov/content/how-will-nasas-](http://www.nasa.gov/content/how-will-nasas-asteroid-redirect-mission-help-humans-reach-mars/#.VMUex95TOZY)

[asteroid-redirect-mission-help-humans-reach-mars/#.VMUex95TOZY](http://www.nasa.gov/content/how-will-nasas-asteroid-redirect-mission-help-humans-reach-mars/#.VMUex95TOZY)

Johnson, B. (n.d.) World's worst mining disasters. *World News*. Retrieved from:

<http://worldnews.about.com/od/disasters/tp/Worlds-Worst-Mining-Disasters.htm>

Kimball, D., & Collina, T. (2012). The Outer Space Treaty at a glance. *Arms Control*

*Association*. Retrieved from: <https://www.armscontrol.org/factsheets/outerspace>

Lewis, J. S. (1997). *Mining the sky*. Boston, MA: Addison-Wesley Publishing Co.

Lewis, J. S., & Lewis, R. A. (1987). *Space Resources: Breaking the bonds of the Earth*. NY: Columbia University Press.

Sonter, M. (2006, February). Asteroid mining: Key to the space economy. *Ad Astra Online*.

Retrieved from: <http://www.nss.org/settlement/asteroids/key.html>

Szoka, B., & Dunstan, J.. (2012). Space law: Is asteroid mining legal? *Wired Science*. Retrieved from: <http://www.wired.com/wiredscience/2012/05?opinion-asteroid-mining>

Thomson, I. (2015, January 24). Massive asteroid to play chicken with Earth on Monday. *The Register*. Retrieved from:

[http://www.theregister.co.uk/2015/01/24/massive\\_asteroid\\_to\\_fly\\_past\\_earth\\_on\\_Monday](http://www.theregister.co.uk/2015/01/24/massive_asteroid_to_fly_past_earth_on_Monday)

Workman, K. (2016, Jan. 28). The Challenger space shuttle disaster, thirty years later. *The New York Times*. Retrieved from:

[http://www.nytimes.com/interactive/2016/01/29/science/space/challenger-explosion-30-year-anniversary.html?\\_r=0](http://www.nytimes.com/interactive/2016/01/29/science/space/challenger-explosion-30-year-anniversary.html?_r=0)