

## Unit 5 - Project Mountain City

A wealthy tech-bro's space agency has decided that they want to build a fantastic stone city on top of a mountain on an alien world. Wealthy Tech-bro had decided he wants to build the city out of a marble that is plentiful on this world, but the marble is found 20 km (20,000 m) below the surface and the mountain is a further 10 km (10,000 m) in the air. **Tech-bro is therefore looking for proposals on how to transport the rock from the mines to the mountaintop.** I would suggest investigating a maglev device like the [commercial trains in Shang-hai](#) or the [maglev trains in Japan](#), but if you would like to investigate a different method, that is up to you (*a note - both links that have just been shown are from COMMERCIAL WEBSITES and the data there should be taken with a grain of salt. You will want to find research on more reputable sites*).

A few notes.

- The atmosphere on this planet is very thin, making it nearly impossible to have any sort of flying apparatus
- Because construction may take a while, it is okay to build semi permanent structures, provided the cost of them is worthwhile.
- Tech-bro wants this new planet to remain "fume-free," so all technology must be pue electric
- The marble is fairly massive, so you need to ensure that whatever proposal you make is for something that can accommodate that weight

Your proposal should be backed with math.

- Show how much electricity would be required to move the device. **Some research here is encouraged.**
  - Remember that your device may have different requirements when it is full
  - Empty
  - On top of the mountain
  - Below the ground
  - (these last two are because of the FORCE OF GRAVITY)
- Do not forget that you are not on earth. Power requirements should be based on the gravity of this planet.
- Give some idea too of material costs as well. Tech-bro is rich, but he wants to stay that way. **This is where research can be applied**

### Facts about the planet

- Radius =  $2.75 \times 10^5$  m
- Mass =  $3.85 \times 10^{23}$  kg
- Each marble block is two meters in length, .75 m in width and .75 m in height
- Each marble block has a mass of 3,050 kg

### Things to consider

- Force of gravity may be different in the mines and on the mountain top
- Your device must be able to support its own weight as well as the weight of the number of marble blocks it wants to bring up the mountain
- If you are using something like a maglev, remember that since the tracks need to support the train both with and without the blocks, you will want something on the train that will keep it on the tracks when the blocks are not there and that putting the blocks on the train will make the train hover closer to the tracks
- Assume that any magnets you are using are extremely strong

### Expected deliverables

- A flashy looking drawing and written out sales pitch which will hook Tech-bro and make him want to check out YOUR product instead of someone else's
  - The document should lay out approximate costs of your project vs
  - benefits of going with your design
- A clearly labeled technical drawing showing all relevant parts to understand your design
- An organized list that shows all math needed to understand your project as well as explains why you are using the math you are using to make your designs. Make sure this is VERY CLEAR and VERY READABLE. All math should be preceded by explanation
- A list of ALL RESOURCES used. Any website, magazine, article, book, video, chats with your uncle the engineer, etc., used should be cited
- Remember that Tech-bro will want to measure whether he wants to buy your device in terms of
  - Will it work
  - Is it cost effective
  - Is it cool?

This project will have a 1-4 grade for

- Unit 5 - Forces at a Distance
- Spiral Standard 1 - Scientific literacy & Numeracy
- Spiral Standard 2 - Engineering and Design

You may work in a group as small as 1 or as large as 3. All working together must be in the same class. All work should be submitted as a single pdf or word document no later than May 28th, 2021. Make sure that if you are working in a group that all group members are part of all phases of this work, from research to calculation to creation of the sales documents.

**A WARNING - Any indication of plagiarism is grounds for a zero on all parts of this project.**