

CHAPTER 2	Thought Lab 2.5: Design a Self-Sustaining Mars Colony Answer Key	BLM 2.3.8A
ANSWER KEY		

Answers to Analysis Questions

1. The water in the polar ice caps could be melted with solar panels to provide water for the Mars colony. This water could be used for drinking, washing, cooking, and other uses, and the wastewater could be recycled and used for agriculture and small-scale industrial use. You could also suggest that the poles be melted entirely so that the water vapour would enter the air and enhance the planet's greenhouse effect, thus helping increase temperatures on Mars.
2. Solar power is probably still a power option on Mars. Despite the distance from the Sun and the presence of atmospheric dust, solar power could still be collected and stored using large solar mirrors to concentrate solar energy. Other power options include wind, nuclear, and geothermal energy. All energy would need to be used sparingly.
3. Reduced gravity would have effects on all living organisms. The biological systems of humans, animals, and plants may all function differently under conditions of reduced gravity. Humans may experience health problems associated with weightlessness. The effects of reduced gravity could be addressed by effectively preparing the colonists for the realities of space living, using weighted suits to assist colonists in getting around (these would not influence the systemic effects of reduced gravity), and developing some means of artificial gravity.
4. Nutrients might be recycled by composting plants and food waste.
5. The atmosphere of Mars mainly consists of carbon dioxide, but it is very thin. As a result, the greenhouse effect on the planet is minimal. To engineer a runaway greenhouse effect, colonists would have to release carbon dioxide into the Mars atmosphere. A large amount of carbon dioxide is currently stored in the polar regions of the planet in a frozen state. If this carbon dioxide were vapourized into a gaseous form, the planet would warm. This would result in a feedback loop as further warming releases more solid carbon dioxide from the poles, which enters the atmosphere in a gaseous state, again increasing global temperatures. A possible consequence of creating a runaway greenhouse effect is that, true to its name, it can run away, causing more warming than desired. This is not that likely on Mars, however, as carbon dioxide is not a very effective greenhouse gas, compared with others, such as methane.
6. Give a logical, well-supported opinion.