I. A Very Brief History of Medicine

1. Among the greatest life-furthering advances in technology in modern times has been the advancement of scientific medicine.
2. Although the ancient Greeks, starting with Hippocrates **c.400 BC**, aspired to create such a science, and much collective wisdom was accumulated over the centuries in various cultures about how to treat illnesses and injuries with roots, herbs, mushrooms, and every other kind of natural cure, the cause of disease was not understood.
3. The first development that made a scientific understanding of health possible was the development of the microscope, by the Dutch scientist Antonie Van Leewenhoek **c.1668**. Leewenhoek was the first to see minuscule organism which he called "microbes," and which we today know as "bacteria" (and "viruses").
4. Microscopy led to the first scientific theory of medicine, called "germ theory."
   a) **c.1798**, a British scientist named Edward Jenner and other began to experiment with fighting microbes on their (microscopic) level. Jenner used a weak version of smallpox (a horrific, deadly disease) called "cowpox" (yes, it was taken from cows!) to treat humans who were infected. It turned out that the body's immune system learned from being in contact with the weaker disease, and became strong enough to fight the worst form of it. This was the first successful vaccine in history.
   b) Soon other scientists were gaining new insight into how to fight germs. Louis Pasteur of France became the most famous.
      i. "Pasteurization" is a process now widely used to remove germs from certain kinds of food.
      ii. Pasteur also developed a vaccine for rabies (transmitted by rabid animals) according to the Germ Theory **c.1857.**
      iii. Also relying on Germ Theory, the Scottish scientist Alexander Fleming developed the first *antibiotic*, known as penicillin, **c.1928.**
      iv. Each time an advance of this kind was made, countless lives were saved. Vaccines and antibiotics have saved people from many diseases from smallpox and rabies to polio and hepatitis.
5. In addition to the treatment of disease, modern scientific medicine has become incredibly advanced in the treatment of physical trauma.
   a) **c.1846**, an American dentist named William Morton pioneered the use of nitrous oxide for anesthesia (making patients unconsciousness to save them from experiencing physical pain during surgery).
   b) **c.1895**, a German scientist named William Rontgen developed the method of x-ray photography, allowing doctors to see inside the body and to better treat injuries like broken bones.
   c) In the most recent and spectacular advance in a long line of similar achievements, a South Africa doctor named Christiaan Barnhard performed the first heart transplant in **1967**. The doctor and his team literally replaced the heart of a sick person with a healthy heart from a donor (a person who had died but agreed to give their organs to science). The recipient was able to continue living!

J. The *Advanced* Industrial Period of Technology

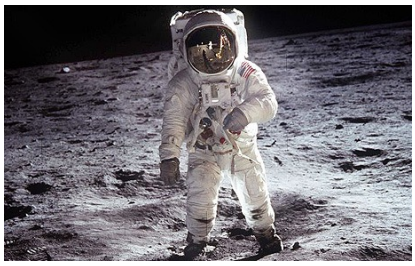
1. If the rate of progress of industrial times had continued, we would perhaps be living in a "*super*-industrial" period. Sadly, progress has not been consistent, and although we have three kinds of new technology, they have not all shown rapid progress:
   a) nuclear power
   b) space exploration

c) computers

2. The first of the milestones of the period of advanced technology is the use of the atomic bomb in **1945** as part of World War II.
3. This technological milestone marks an evolution towards a whole new level of power generation, as demonstrated by the size of the explosions created by the bombs that use this kind of power. A single atomic bomb can destroy an entire city. An atomic power plant can generate the electricity for many cities with greater efficiency than any other form of power.
4. Unfortunately, the science of atomic energy has stalled for now. Atomic power is generated using a process called "fission," which creates nuclear waste as a byproduct. This is an environmental concern. And the potential for radiation to harm humans and the environment when a fission reactor malfunctions or is damaged makes most people view this form of energy unfavorably.

The use of the atomic bomb in **1945** signaled the beginning of a new era of technological development.

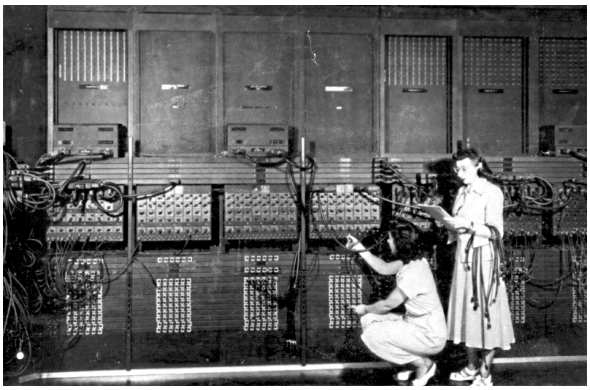
5. A form of nuclear power call "fusion" will eventually be developed that can overcome the limitations and environmental problems associated with fission. If and when we get there, we probably *will* reach a super-industrial stage of development. This is truly something to look forward to.
6. One area of human endeavor that will benefit enormously from the invention of nuclear fusion is space exploration and space travel.
7. Human beings began to develop rockets during World War II, and thereafter, space exploration proceeded with remarkable progress until **1969**, when Neil Armstrong become the first man to walk on the moon.
8. This is a tremendous milestone, and wonderfully symmetrical in a way. The Steam Engine was invented **c.1769**, the transcontinental railroad was completed in **1869**, and man first walked on the moon in **1969.** ***These milestone are the mnemonic basis of the timeline.***
9. However, as with nuclear power, space exploration has stalled. Modest efforts are underway to take the next step: manned space travel to Mars, but it has been nearly 50 years since the greatest accomplishment in the field of space exploration took place.



Space exploration has largely stalled since the amazing feat of placing a man on the moon in **1969**, but new private ventures hint at renewed space exploration, and the eventual *normalcy* of space travel.

10. The one technology that truly distinguishes our advanced society from any previous time is *computers*. This technology, driven by private innovation, has advanced by leaps and bounds and continues to push forward.
11. In **1946** a government project to calculate how to position artillery pieces (modern "cannons") in times of war more efficiently led to the design of the most famous early computer called the "ENIAC" (Electronic Numerical Integrator and Computer). It was 130 feet long and weighed 30 metric tons. It was nicknamed a "Giant Brain". It could perform mathematical calculations 2400 times faster than a person.
12. Since that time, computers have advanced with incredible speed. The most amazing modern computer, the *smartphone*, is 40,000,000 times smaller than the ENIAC, but 1700 times *more powerful*!

13. One of the strange points about technological progress is that it is driven by competition, including between nations, which sometimes translates into war. Rockets, computers, and atomic energy were all pushed forward because of **World War II.** *(Maybe we are having less progress, because we have fewer cultural conflicts today!)*
14. Regardless, we do live in the most technologically advanced society of all time, with the highest quality of life and the highest life expectancy.
    a) During pre-industrial times, humans lived on average 25-35 years.
    b) During the proto-industrial period that increased to 40.
    c) During industrial times, it catapulted to previously unheard-of level of 70 years.
    d) Now, with our latest advances, we are close to 80 as an average lifespan.



"Programmers" work to configure the ENIAC to perform a mathematical calculation. It was large and clunky by our standards, but once configured, it could perform a complex mathematical calculation 2400 times faster than a human being.