Part I: Einstein’s Dream

1. What was Einstein’s dream?
2. What word describes what scientists are trying to do with theories about the forces of nature?
3. Einstein discovered that the fastest speed in the universe was the speed of __________. How did this conflict with Isaac Newton’s theory of gravity?
4. Draw or describe Einstein’s theory of gravity & space-time (General Relativity).
5. What two forces were unified (explained by one theory) in the past?
6. What is similar about gravity and electromagnetism (E&M)? What difference kept Einstein from unifying the theories of gravity and electromagnetism (E&M)?
7. Give examples of how Quantum Mechanics (theory explaining the structure & behavior of atoms) seems strange to our everyday lives.
8. List the 4 forces of nature.
9. What can’t scientists understand until they unify General Relativity (gravity) with Quantum Mechanics (E&M, strong nuclear force, and weak nuclear force)?
Part II: String’s the Thing

1. Einstein’s General Relativity describes the universe on a __________ scale while Quantum Mechanics describes the universe on a __________ scale. Give one example of how the two theories disagree or conflict with each other.

2. What theory could unite the above two theories and also unite the four forces of nature under one explanation? Give at least two problems with this theory.

3. Leonard Suskind first viewed particles as __________ while other physicists viewed particles as __________, but experiments show that even forces could be explained with __________. This became known as the __________ Model, but this model still could not explain __________.

4. Experiments show protons and neutrons are made of quarks, but quarks and everything else might be made of __________. These are described as vibrating strands of energy. Draw an example of one below.

5. String theory requires __________ dimensions. What could these look like?

6. What could the different vibrations of strings in different dimensions explain?

Part III: Welcome to the 11th Dimension

1. If Einstein was correct, space could __________, but could not __________. If string theory is correct, space could __________ and using wormholes is possible.

2. In the 1980’s, while searching for one “theory of everything”, _______ string theories were actually
developed. Ed Witten was able to unify the different theories with _______ theory, but it requires the existence of _______ dimensions.

3. Where can we go to help us imagine a different number of dimensions?

4. The extra dimensions allows strings to become __________ and they could be as large as a __________. If that is true, there might be __________ universes.

5. Gravity is so much weaker than E&M. How can this now be explained and why does this only happen to gravity?

6. What are some problems with the big bang theory? What are possible solutions?

7. How are scientists trying to find experimental evidence for extra dimensions and super-symmetry to support String Theory’s predictions?