What You Should Know

1.) Where did Schwartzchild derive his famous equation?

2.) What is the primary characteristic of a black hole.

3.) A black hole is both a tiny speck and incredibly heavy (an entire star crushed into that volume). So what problem does that generate if you are trying to describe what is happening there using physics?

4.) What is the fabric of space like at the macroscopic level where relativistic holds sway?

5.) What is the fabric of space like at the atomic level where quantum mechanics holds sway?

6.) What force(s) is/are described by relativity?

7.) What force(s) is/are described by quantum mechanics?

8.) What we need is a theory that embraces both the very tiny of the quantum mechanical world and the very big of the relativistic world? What theory may do the job?

9.) Within the “new physics,” what, exactly, is a string?

10.) What is the main objection to string theory?

11.) Are there different types of string and, if not, how does a given string act like, say, a proton?

12.) In 1968, physicist named Venetsiano was doing research.

a.) He was looking for a mathematical formulation to describe what force?

b.) He found the relationship in work that was done 200 years ago. Who was the mathematicians who did that work?

c.) The relationship he found seemed to describe what force?

d.) Upon close scrutiny by Leonard Suskind, it was noticed that the equation described a structure not unlike what?

13.) Around the time of Suskind's rejection, mainstream science was embracing particles, not as strings, but as what?

14.) During this period, how were physicists exploring the microscopic (atomic) world?

15.) What is "the Standard Model" about?

16.) What bizarre prediction does the Standard Model make about forces?

17.) What is an example of a messenger particle?

18.) In the Standard Model, what do we feel as force?

19.) Have messenger particles been observed?

20.) Theory predicts that at high enough temperatures, the weak force and electromagnetic force become indistinguishable. What is the name given to the "particle" they would be at those high temperatures?

21.) With the Standard Theory, we have a single theory of particle physics that all makes sense. But what does it leave out?

22.) As the theory was being developed, String Theory had three major problems (and being testable wasn't one of them). Explain what they were and how each was resolved.

23.) What did the mysterious massless particles turn out to be, and why did it take so long to see it—that is, what did this do to the theory of String Theory?

24.) How was the observation noted in #23 received by the scientific community?

25.) Once the anomalies were seen to be eliminated, what was String Theory christened?

26.) According to the theory, what are all particles in the universe made up of?

27.) If an atom were enlarged to the size of the solar system, how large would a string be?

28.) What makes one kind of particle different from another kind of particle?

29.) This elegant idea resolves the conflict between the jittery, unpredictable picture of space of the subatomic and the smooth picture of space on the large scale. It's the jitteriness on the quantum scale and the smoothness on Einstein's Theory of Relativistic that makes them so hard to stitch together? How does String Theory do this?

30.) Why do some feel that String Theory is not a theory at all?

31.) How many dimensions of space do String Theory claim?

32.) In 1919 (three years after Einstein proposed that gravitational effects were really ripples in the geometry of space), a mathematician named Kalutza sent a suggestion to Einstein. What was that suggestion?

33.) How are strings governed? That is, what makes an electron an electron?

34.) How do the fundamental constants fit into String Theory?

They are determined by how the extra dimensions curled up in the geometry of space.

35.) Once String Theory became popular, what was the big problem?

36.) How are gravitons different from other strings?

37.) According to String Theory, why is gravity so weak?

38.) What is it that strings do that makes one act like a proton and another act like a neutron and another act like the strong force?

39.) In the Standard Model, there was one last particle that scientists had to “find” to complete the model. What was that particle, what is it related to and has it been found?