The Particle Adventure go to: http://www.particleadventure.org/standard-model.html

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notice on this page there is a glossary, back arrow, home, and forward arrow at the top right. This is how you navigate through the site regarding the standard model. What does the standard model mean? This website explains the fundamental particles of matter in greater detail than the protons, neutrons and electrons that you have studied so far in science. Read carefully and answer the questions as you interact and progress through the website. Use the forward arrow to move to the next page the backward arrow to go back to review. The page summary at the left of the screen highlights your current page so you can keep track of where you are.

1. What is the basic question the particle adventure tries to answer?

2.Define ‘fundamental’ as it relates to matter.

3. Describe early scientists thoughts on matter. Be as specific as possible.

4. Physicists have discovered that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are composed of even smaller particles called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . As far as we know \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are like points in geometry. They’re not made up of anything else. After extensively testing this theory, scientists new suspect that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

5. Describe the modern atomic model.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. Draw a picture to represent the scale of an atom.

7. Physicists constantly look for new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. When they find them, they categorize them and try to find \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that tell us\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. We have now discovered about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ particles but most of them are not \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . Most of these particles are named with letters from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ alphabet.

9. The standard model contains

\_\_\_\_ quarks

\_\_\_\_\_ leptons. The best known lepton is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, like the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. All the known matter particles are composites of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and they interact by exchanging ­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

11. It is known that the 100s of particles are all made from how many fundamental particles?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. For how many years have physicists known that there were more than just protons, neutrons, electrons, and photons? \_\_\_\_\_\_\_\_\_\_\_\_\_

13. As you have read, everything from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is made from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. But that is not the whole story. Quarks behave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than leptons, and for each kind of matter particle there is a corresponding \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ particle.

14. For every type of matter particle we’ve found there also exists a corresponding antimatter particle or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Antiparticles look and behave just like their corresponding matter particles, except they have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . For instance, a proton is electrically positive whereas an antiproton is electrically \_\_\_\_\_\_\_\_\_\_\_\_.

15. When a matter particle and antimatter particle meet, they \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into pure energy.

16. Describe how the bubble chamber photo shows evidence of antimatter.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**17. How would you designate an up antiquark? \_\_\_\_\_\_\_ What would this symbol? \_\_\_\_\_\_\_\_\_\_\_\_**

18. List by name the 6 quarks and show their charge. Also list their year of discovery it it is given.

19. Quarks only exist in groups with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and are never found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Composite particles made of quarks are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

20. Although individual \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrical charges, they combine such that hadrons have a net \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (whole number) electric charge.

21. Baryons are any hadron which is made of \_\_\_\_\_\_ quarks.

22. List the quark complement of a proton\_\_\_\_\_\_\_\_\_\_\_\_\_. Show how the partial charges of these quarks makes up the +1 charge of a proton.

List the quark complement of a neutron \_\_\_\_\_\_\_\_\_\_\_\_\_. Show how the partial charges of these quarks makes up the 0 charge of a neutron

.

23. Mesons contain one quark and one \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. One example of a meson is a pion, which is made of an \_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ .

24. The other type of matter particles are the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. After reading the feline analogy, show the symbols and charges of the 6 leptons.

25. What makes the muon and tau leptons different from the electron?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Using the Glossary define the following words.

26. Annihilation

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

27. Antiparticle

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

28. Antiquark

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

29. Lepton

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

30. Positron

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

31. Quark

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_