Name ______________________________

The Particle Adventure Internet Activity-III

Directions:

1. Proceed to **http://particleadventure.org**
2. Click on ***Start Here***
3. On the ***Home Glossary/Table of Contents*** at left, go to the ***How Do We Experiment With Tiny Particles?*** section, and click on ***Accelerators*** to begin this session. When you finish each page, click on the > icon at top right to proceed to the next page.

How Do We Experiment With Tiny Particles? Accelerators

1. What is used to accelerate particles in an accelerator?

   ____

2. What happens to these particles after they are accelerated?

   ____

3. What is used to record the result? ____________________________________

   ____

4. Where's the nearest particle accelerator to you right now?

   ____

How Do We Experiment With Tiny Particles? How to Obtain Particles to Accelerate

1. Which particles are obtained from hydrogen? ______________
2. Which particles are accelerated in TV's? ______________
3. How are antiparticles produced? ____________________________________

   ____

   ____

4. What is used to separate particle-antiparticle pairs?

   ____

How Do We Experiment With Tiny Particles? Accelerating Particles

1. What do particles "ride" that speeds them up?

   ____

How Do We Experiment With Tiny Particles? Accelerating Particles Animation

1. Watch the animation. Which particles accelerate more quickly, the ones near the crest (or trough) of the wave, or the one near the center? ____________________________

How Do We Experiment With Tiny Particles? Accelerator Design

1. What are the two types of collisions that occur in colliders?

   ____________________________ ____________________________

2. List the two shapes of colliders and describe how particles move in them. ____________________________

   ____

   ____

How Do We Experiment With Tiny Particles? Fixed-Target Experiments

1. What is an early historic example of a fixed-target experiment?

   ____

How Do We Experiment With Tiny Particles? Colliding-Beam Experiments

1. What is the advantage the colliding-beam arrangement?

   ____

   ____

   ____

How Do We Experiment With Tiny Particles? A Linear or Circular Accelerator?

1. What three purposes are linacs used for?

   ____

   ____

   ____

2. What are two uses for synchrotrons?

   ____

   ____

3. What is used to keep particles in synchrotrons moving is a circle? ____________________________

How Do We Experiment With Tiny Particles? What Makes a Particle Go in a Circle?

1. What do **electric** fields do to particles in a circular accelerator?

   ____

2. What are **three** key functions of magnets in a circular accelerator?
   1. ______________________________
   2. ______________________________
   3. ______________________________

3. Do magnets add energy or speed to particles? __________
4. In a circular accelerator, how do the directions of a particle and its respective antiparticle compare? ______________________

How Do We Experiment With Tiny Particles? Advantages of Accelerator Design

1. What advantages do circular accelerators have over linear accelerators? ______________________________

   ____

   ____

   ____

2. What advantages do linear accelerators have over circular accelerators? ______________________________

   ____

   ____

   ____

How Do We Experiment With Tiny Particles? A Linear or Circular Accelerator?

1. For each of the first **five** accelerators profiled on this page, list the name, location, **type** of accelerator (hint – only one is a linear accelerator), and major particle discoveries (and/or area of research):
   1. ______________________________

      ____
   2. ______________________________

      ____
   3. ______________________________

      ____
   4. ______________________________

      ____
   5. ______________________________

      ____

How Do We Experiment With Tiny Particles? The Event

Read and move to the next page>

How Do We Experiment With Tiny Particles? Detectors

1. What three specific things can detectors tell about particles?
   1. ______________________________
   2. ______________________________
   3. ______________________________

How Do We Experiment With Tiny Particles? Detector Shapes

1. Describe how particles travel after a collision in each of the two target styles and how this determines the detector design. Include a diagram (on the left) for each.

   Fixed target experiments:

   ____

   ____

   ____

   Colliding beam experiments:

   ____

   ____

   ____

How Do We Interpret Our Data? Modern Detectors

1. What types of particles are detected in the tracking chamber?

   ____
2. What the hadron calorimeter measure? ____________________
3. Why are muons and neutrinos the only particles detected in the muon chambers? ______________________________

   ____
4. How is the presence of neutrinos inferred from muon chamber data? ______________________________
5. What can be determined by interpreting the following aspects of the motions of particles moving in a magnetic field?

   radius of curvature: ______________________________

   direction of curvature: ______________________________

How Do We Interpret Our Data? Typical Detector Components

1. Why aren't neutrons and photons detected in the tracking chamber? ____
2. Where are these particles detected?
   neutrons: _________________________________
   photons: _________________________________

How Do We Interpret Our Data? Measuring Charge and Momentum

1. How can the sign of a charged particle be determined by the path of the particle in a magnetic field? ____________________
   ____
2. Which particle will bend more in a magnetic field, one with relatively high momentum or one with relatively low momentum? ______________________

How Do We Interpret Our Data? Modern Detectors

1. How do researchers know that a particle detected in the muon chamber is actually a muon and not some other particle? (Hint: it has to do with the layer just before the muon chamber.)
   ____
   ____
2. Why couldn't it be a neutrino? ____________________________
   ____