Short Answer

23.1 The Four Fundamental Forces 47.

Why do people tend to be more aware of the gravitational and electromagnetic forces than the strong and weak nuclear forces?

a. The gravitational and electromagnetic forces act at short ranges, while strong and weak nuclear forces act at comparatively long range.
b. The strong and weak nuclear forces act at short ranges, while gravitational and electromagnetic forces act at comparatively long range.
c. The strong and weak nuclear forces act between all objects, while gravitational and electromagnetic forces act between smaller objects.
d. The strong and weak nuclear forces exist in outer space, while gravitational and electromagnetic forces exist everywhere.

48.

What fundamental force is responsible for the force of friction?

a. the electromagnetic force
b. the strong nuclear force
c. the weak nuclear force

49.

How do carrier particles relate to the concept of a force field?

a. Carrier particles carry mass from one location to another within a force field.
b. Carrier particles carry force from one location to another within a force field.
c. Carrier particles carry charge from one location to another within a force field.
d. Carrier particles carry volume from one location to another within a force field.

50.

Which carrier particle is transmitted solely between nucleons?

a. graviton
b. photon
c. pion
d. W and Z bosons

51.

Two particles of the same mass are traveling at the same speed but in opposite directions when they collide head-on.
What is the final kinetic energy of this two-particle system?

a. infinite

b. the sum of the kinetic energies of the two particles
c. zero
d. the product of the kinetic energies of the two particles

52.

Why do colliding beams result in the location of smaller particles?

a. Colliding beams create energy, allowing more energy to be used to separate the colliding particles.
b. Colliding beams lower the energy of the system, so it requires less energy to separate the colliding particles.
c. Colliding beams reduce energy loss, so less energy is required to separate colliding particles.
d. Colliding beams reduce energy loss, allowing more energy to be used to separate the colliding particles.

23.2 Quarks 53.

What two features of quarks determine the structure of a particle?

a. the color and charge of individual quarks
b. the color and size of individual quarks
c. the charge and size of individual quarks
d. the charge and mass of individual quarks

54.

What fundamental force does quantum chromodynamics describe?

a. the weak nuclear force
b. the strong nuclear force
c. the electromagnetic force
d. the gravitational force

55.

Is it possible for a baryon to be constructed of two quarks and an antiquark?

a. Yes, the color of the three particles would be able to sum to white.
b. No, the color of the three particles would not be able to sum to white.

56.

Can baryons be more massive than mesons?

a. no
b. yes

57.

If antimatter exists, why is it so difficult to find?

a. There is a smaller amount of antimatter than matter in the universe; antimatter is quickly annihilated by its matter analogue.
b. There is a smaller amount of matter than antimatter in the universe; matter is annihilated by its antimatter analogue.
c. There is a smaller amount of antimatter than matter in universe; antimatter and its matter analogue coexist.
d. There is a smaller amount of matter than antimatter in the universe; matter and its antimatter analogue coexist.

58.

Does a neutron have an antimatter counterpart?

a. No, the antineutron does not exist.
b. Yes, the antineutron does exist.

59.

How are the four fundamental forces incorporated into the Standard Model of the atom?

a. The four fundamental forces are represented by their carrier particles, the electrons.
b. The four fundamental forces are represented by their carrier particles, the gauge bosons.
c. The four fundamental forces are represented by their carrier particles, the leptons.
d. The four fundamental forces are represented by their carrier particles, the quarks.

60.

Which particles in the Standard Model account for the majority of matter with which we are familiar?

a. particles in fourth column of the Standard Model
b. particles in third column of the Standard Model
c. particles in the second column of the Standard Model
d. particles in the first column of the Standard Model

61.

How can a particle gain mass by traveling through the Higgs field?

a. The Higgs field slows down passing particles; the decrease in kinetic energy is transferred to the particle's mass.
b. The Higgs field accelerates passing particles; the decrease in kinetic energy is transferred to the particle's mass.
c. The Higgs field slows down passing particles; the increase in kinetic energy is transferred to the particle's mass.
d. The Higgs field accelerates passing particles; the increase in kinetic energy is transferred to the particle's mass.

62.

How does mass-energy conservation relate to the Higgs field?

a. The increase in a particle's energy when traveling through the Higgs field is countered by its increase in mass.
b. The decrease in a particle's kinetic energy when traveling through the Higgs field is countered by its increase in mass.
c. The decrease in a particle's energy when traveling through the Higgs field is countered by its decrease in mass.
d. The increase in a particle's energy when traveling through the Higgs field is countered by its decrease in mass.

23.3 The Unification of Forces 63.

Why do scientists believe that the strong nuclear force and the electroweak force will combine under high energies?

a. The electroweak force will have greater strength.
b. The strong nuclear force and electroweak force will achieve the same strength.
c. The strong nuclear force will have greater strength.

64.

At what energy will the strong nuclear force theoretically unite with the electroweak force?

a. 10^{12}\,\text{eV}
b. 10^{13}\,\text{eV}
c. 10^{14}\,\text{eV}
d. 10^{15}\,\text{eV}

65.

While we can demonstrate the unification of certain forces within the laboratory, for how long were the four forces naturally unified within the universe?

a. 10^{-43}\, \text{seconds}
b. 10^{-41}\, \text{seconds}
c. 10^{-39}\, \text{seconds}
d. 10^{-38}\, \text{seconds}

66.

How does the search for the Grand Unified Theory help test the standard cosmological model?

a. Scientists are increasing energy in the lab that models the energy in earlier, denser stages of the universe.
b. Scientists are increasing energy in the lab that models the energy in earlier, less dense stages of the universe.

c. Scientists are decreasing energy in the lab that models the energy in earlier, denser stages of the universe.
d. Scientists are decreasing energy in the lab that models the energy in earlier, less dense stages of the universe.

67.

Why does finding proof that protons do not decay not disprove all GUTs?

a. Proton decay is not a premise of all GUTs, and current GUTs can be amended in response to new findings.
b. Proton decay is a premise of all GUTs, but current GUTs can be amended in response to new findings.

68.

When accelerating elementary particles in a particle accelerator, they quickly achieve a speed approaching the speed of light. However, as time continues, the particles maintain this speed yet continue to increase their kinetic energy. How is this possible?

a. The speed remains the same, but the masses of the particles increase.
b. The speed remains the same, but the masses of the particles decrease.
c. The speed remains the same, and the masses of the particles remain the same.
d. The speed and masses will remain the same, but temperature will increase.