Name: Key

Nuclear Physics

1. The subatomic particles that make up protons are called
   (1) hyperons
   (2) baryons
   (3) positrons
   (4) quarks

2. The number of nucleons in the nucleus of a $^{14}_{6}C$
   (1) 6
   (2) 8
   (3) 14
   (4) 20

3. An atom of $^{131}_{53}I$ and an atom of $^{127}_{53}I$ contain the same number of
   (1) quarks
   (2) neutrons
   (3) nucleons
   (4) protons

4. The atomic mass unit is defined as $^{1}/_{12}$ the mass of an atom of
   (1) $^{8}_{4}Be$
   (2) $^{12}_{6}C$
   (3) $^{22}_{11}Na$
   (4) $^{24}_{12}Mg$

5. The number of nucleons in a $^{206}_{82}Pb$ nucleus is
   (1) 0
   (2) 82
   (3) 124
   (4) 206

6. Which nuclide has a mass number of 8?
   (1) $^{6}_{2}He$
   (2) $^{8}_{4}Be$
   (3) $^{15}_{7}N$
   (4) $^{16}_{8}O$

7. Protons and neutrons are composed of smaller particles called
   (1) quarks
   (2) baryons
   (3) alpha particles
   (4) bosons

8. One atomic mass unit is defined as
   (1) the mass of an electron
   (2) the mass of an alpha particle
   (3) the mass of an atom of carbon–12
   (4) $\frac{1}{12}$ the mass of an atom of carbon-12

9. If the nucleus of an atom emits a positron, the atomic number of the atom will
   (1) decrease by one
   (2) increase by one
   (3) remain unchanged
   (4) decrease by two

10. A neutral atom could be composed of
    (1) 4 electrons, 5 protons, 6 neutrons
    (2) 5 electrons, 5 protons, 6 neutrons
    (3) 6 electrons, 3 protons, 6 neutrons
    (4) 0 electrons, 5 protons, 5 neutrons

11. Which nucleus has the largest number of neutrons?
    (1) $^{3}_{1}A$
    (2) $^{5}_{2}B$
    (3) $^{7}_{3}C$
    (4) $^{8}_{5}D$

12. How many neutrons are in an atom of $^{288}_{86}Rn$?
(1) 84
(2) 86
(3) 136
(4) 222

13. Isotopes of the same element have the same number of
(1) neutrons and protons, only
(2) neutrons and electrons, only
(3) protons and electrons, only
(4) electrons, protons, and neutrons

14. Which is an isotope of $^{44}_{22}Sc$
(1) $^{44}_{20}Ca$
(2) $^{46}_{20}Ca$
(3) $^{46}_{20}Sc$
(4) $^{44}_{22}Ti$

15. Base your answer on the information below which represents a nuclear reaction.

$$^{3}_{1}H + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + \text{energy}$$

The masses of the nuclei are:

$^{1}_{1}H = 1.00813$ u (amu)

$^{3}_{1}H = 3.01695$ u (amu)

$^{4}_{2}He = 4.00388$ u (amu)

The symbols, $^{3}_{1}H$ and $^{1}_{1}H$ represent
(1) electrons
(2) deuterium ions
(3) isotopes
(4) alpha particles

16. Atoms of different isotopes of the same element contain the same number of
(1) neutrons, but a different number of protons
(2) neutrons, but a different number of electrons
(3) electrons, but a different number of protons
(4) protons, but a different number of neutrons

17. In the fusion reaction:

$$^{3}_{1}H + {}^{2}_{1}H \rightarrow {}^{4}_{2}He + X + \text{energy},$$

X is
(1) a proton
(2) a neutron
(3) an alpha particle
(4) a beta particle

18. In the transmutation reaction,

$$^{30}_{15}P \rightarrow X + {}^{0}_{+1}e,$$

the ***X*** represents
(1) $^{30}_{16}S$
(2) $^{30}_{14}Si$
(3) $^{31}_{14}Si$
(4) $^{31}_{16}S$

19. The nuclear equation

$$^{30}_{15}P \rightarrow {}^{30}_{14}Si + {}^{0}_{+1}e$$

represents
(1) alpha bombardment
(2) electron capture
(3) neutron emission
(4) positron emission

20. What particle is represented by *X* in the nuclear reaction:

$$^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{12}_{6}C + X$$

(1) $^{0}_{-1}e$
(2) $^{1}_{1}e$
(3) $^{1}_{0}n$
(4) $^{2}_{1}H$

21. A particle accelerator can accelerate a
(1) neutron (3) proton
(2) gamma photon (4) hydrogen atom

22. Which device is normally used to accelerate charged particles?
(1) cyclotron (3) cloud chamber
(2) electroscope (4) Geiger counter

23. Which particle can not be accelerated by a cyclotron?
(1) a proton (3) an alpha particle
(2) a neutron (4) an electron

24. Which describes the nuclear forces that hold nucleons together?
(1) weak and long-range
(2) weak and short-range
(3) strong and long-range
(4) strong and short-range

25. Which device could be used to give a positively charged particle sufficient kinetic energy to penetrate the nucleus of an atom?
(1) electroscope
(2) Geiger counter
(3) cloud chamber
(4) Van de Graaff generator

26. The synchrotron and cyclotron are examples of
(1) high-energy particles (3) beta-emitting nuclei
(2) radiation detectors (4) particle accelerators

27. Which device makes visual observation of the path of a charged particle possible?
(1) Geiger counter
(2) Van de Graaff generator
(3) cyclotron
(4) cloud chamber

28. What is the purpose of a cloud chamber?
(1) to accelerate particles (3) to fuse particles
(2) to split particles (4) to detect particles

29. Which device can be used to separate isotopes of an element?
(1) a mass spectrometer
(2) an electroscope
(3) an induction coil
(4) two closely spaced double slits

30. How do cloud chambers, spark chambers, and Geiger counters aid in the study of the nucleus?
(1) They detect subatomic particles that exit the nucleus.
(2) They detect the Presence of a magnetic field around the nucleus.
(3) They accelerate the nucleus before it collides with the particle beam.
(4) They accelerate subatomic particles that exit the nucleus.

31. The background radiation of an area can be measured by using a
(1) control rod
(2) linear accelerator
(3) lead shield
(4) Geiger counter

32. A vapor trail produced by an ionizing particle may be seen if the observer uses a
(1) Geiger tube
(2) cloud chamber
(3) control rod
(4) electroscope

33. Radioactivity can be detected because of the ability of radioactivity to cause
(1) resonance
(2) ionization
(3) fusion
(4) resistance

34. The intensity of radiation measured by a Geiger counter will decrease when the distance from a radioactive source
(1) decreases
(2) increases
(3) remains the same

35. Which device listed below can not be used to detect the presence of nuclear radiations?
(1) Geiger counter
(2) electroscope
(3) photographic plate
(4) cyclotron

36. A cloud chamber can detect radiation because radiation
(1) will discharge a charged object
(2) allows electrons to jump between charged plates
(3) causes an ion trail along which vapor condenses
(4) fogs photographic film

37. Which device can be used to detect subatomic particles that exit nuclei?
(1) Van de Graaff generator
(2) Geiger counter
(3) linear accelerator
(4) cyclotron