1. A carbon-14 atom spontaneously decayed to form a nitrogen-14 atom. This change took place because

   A) a transmutation occurred without particle emission
   B) a transmutation occurred with particle emission
   C) nitrogen-14 has an unstable nucleus
   D) carbon-14 has a stable nucleus

2. Which Group 16 element has only unstable isotopes?

   A) Po B) Te C) Se D) S

3. Which statement describes the stability of the nuclei of potassium atoms?

   A) All potassium atoms have stable nuclei that spontaneously decay.
   B) All potassium atoms have unstable nuclei that do not spontaneously decay.
   C) Some potassium atoms have unstable nuclei that spontaneously decay.
   D) Some potassium atoms have unstable nuclei that do not spontaneously decay.

4. Which particle has the greatest mass?

   A) an alpha particle B) a beta particle
   C) a neutron D) a positron

5. What is the mass number of an alpha particle?

   A) 1 B) 2 C) 0 D) 4

6. Which nuclear emission has the greatest mass?

   A) α B) γ C) β^- D) β^+

7. Positrons and beta particles have

   A) the same charge and the same mass
   B) the same charge and different masses
   C) different charges and the same mass
   D) different charges and different masses

8. Which statement describes the relative masses of two different particles?

   A) A neutron has less mass than a positron.
   B) A beta particle has less mass than a neutron.
   C) An alpha particle has less mass than a positron.
   D) An alpha particle has less mass than a beta particle.

9. Which particle has the *least* mass?

   A) alpha particle B) beta particle
   C) neutron D) proton

10. Alpha particles and beta particles differ in

    A) mass, only
    B) charge, only
    C) both mass and charge
    D) neither mass nor charge

11. An electron has a charge identical to that of

    A) a neutron B) a proton
    C) an alpha particle D) a beta particle

12. Which nuclear emission has the greatest penetrating power?

    A) alpha particle B) beta particle
    C) gamma radiation D) positron

13. Which statement best describes gamma radiation?

    A) It has a mass of 1 and a charge of 1.
    B) It has a mass of 0 and a charge of –1.
    C) It has a mass of 0 and a charge of 0.
    D) It has a mass of 4 and a charge of +2.

14. Which group of nuclear emissions is listed in order of increasing charge?

    A) alpha particle, beta particle, gamma radiation
    B) gamma radiation, alpha particle, beta particle
    C) positron, alpha particle, neutron
    D) neutron, positron, alpha particle

15. Which of these particles has the greatest mass?

    A) alpha B) beta
    C) neutron D) positron

16. Which type of radiation is most similar to high-energy x-rays?

    A) alpha B) beta
    C) neutron D) gamma

17. Compared to the mass and the penetrating power of an alpha particle, a beta particle has

    A) less mass and greater penetrating power
    B) less mass and less penetrating power
    C) more mass and greater penetrating power
    D) more mass and less penetrating power

18. Which type of radiation is identical in mass and charge to a helium nucleus?

A) alpha B) beta
C) positron D) proton

19. Which kind of nuclear radiation has high energy and no mass?

A) alpha B) beta
C) gamma D) neutron

20. As a radioactive element emits gamma radiation only, the atomic number of the element

A) decreases B) increases
C) remains the same

21. A beta particle may be spontaneously emitted from

A) a ground-state electron
B) a stable nucleus
C) an excited electron
D) an unstable nucleus

22. Which list of particles is in order of increasing mass?

A) proton $\rightarrow$ electron $\rightarrow$ alpha particle
B) proton $\rightarrow$alpha particle $\rightarrow$ electron
C) electron $\rightarrow$ proton $\rightarrow$ alpha particle
D) alpha particle $\rightarrow$ electron $\rightarrow$ proton

23. When an alpha particle is emitted by an atom, the atomic number of the atom will

A) decrease by 2 B) increase by 2
C) decrease by 4 D) increase by 4

24. Gamma rays are emanations that have

A) mass but no charge
B) charge but no mass
C) neither mass nor charge
D) both mass and charge

25. An unstable nucleus loses the most mass if the nucleus emits

A) an alpha particle B) a beta particle
C) a positron D) a gamma ray