1 An unknown chemical element is presented by the following formula: ${}^{A}_{Z}X$. What is the name of index Z?

- A Atomic mass number
- B Atomic number
- C Principle quantum number
- D Orbital quantum number
- E Magnetic quantum number

2 An unknown chemical element is presented by the following formula: ${}^{A}_{Z}X$. What is the name of index A?

- A Atomic mass number
- B Atomic number
- C Principle quantum number
- D Orbital quantum number
- E Magnetic quantum number

3 The atomic number is equivalent to which of the following?

- A The number of neutrons in the atom.
- B The number of protons in the atom.
- C Then number of nucleons in the atom.
- D The number of alpha particles in the atom.
- E None of the above

4 The atomic mass number is equivalent to which of the following?

A The number of neutrons in the atom.

B The number of protons in the atom.

C Then number of nucleons in the atom.

D The number of alpha particles in the atom.

E None of the above

5 Which of the following particles has the smallest mass?

- A Proton
- B Electron
- C Neutron
- D Nucleus
- E Nucleon

6 Which of the following statements about the mass of an atom is true?

A It is evenly divided between the protons and the orbiting electrons.

B It is evenly divided between the nucleons and the orbiting electrons.

C It is concentrated in the electron cloud.

D It is concentrated in the nucleus.

E It is evenly divided between protons, neutrons and orbiting electrons.

7 Which of the following is correct for the number of neutrons in the nucl

A $N = A - Z$

B $N = Z - A$

C $N = Z + A$

D $N = Z$

E $N = A$

8 How many electrons are in the ${}^{12}_{6}C$ atom?

- A 12
- B 6
- C 18
- D 3
- E 9

9 How many nucleons are in the ${}^{20}_{10}Ne$ atom?

A 12

B 30

C 18

D 10

E 20

10 How many nucleons are in the $^{23}_{11}Na$ atom?

A 12

B 11

C 18

D 24

E 9

11 How many protons are in the ${}^{14}_{7}N$ atom?

- A 14
- B 6
- C 7
- D 10
- E 9

12 What law did Ernest Rutherford use to estimate the size of the nucleus?

- A Conservation of nucleon number
- B Conservation of angular momentum
- C Conservation of linear momentum
- D Conservation of energy
- E Conservation of charge

13 Why are nuclear energy levels more complex than electron energy le

- [ ] Nuclear energy levels depend only on attractive forces.
- [ ] Nuclear energy levels depend on attractive and repulsive forces.
- [ ] Nuclear energy levels are an order of one hundred times as great as electron energy levels.
- [ ] Electron energy levels depend on the interaction between neutrons and electrons.
- [ ] Electron energy levels have greater energy than the nuclear energy levels.

14 Which of the following about the nuclear force is true?

A It is an attractive force between electrons and protons in an atom.

B It is an attractive force between electrons and neutrons in an atom.

C It is much weaker than the electromagnetic force.

D It is much weaker than the gravitational force.

E It is a strong, short-range, attractive force between the nucleons.

15 What force is responsible for the radioactive decay of the nucleus?

- A Gravitational force
- B Weak Nuclear force
- C Strong Nuclear force
- D Electromagnetic force

16 Isotopes of an element:

- A have the same number of protons and electrons, but a different number of neutrons.
- B have the same number of protons and neutrons, but a different number of electrons.
- C have different number of protons.
- D have different number of electrons.
- E have the same number of neutrons and protons.

17 Binding energy is:

- A the amount of energy required to break a nucleus apart into protons and neutrons.
- B the amount of energy required to break a nucleus apart into protons and electrons.
- C the amount of energy required to break a nucleus apart into electrons and neutrons.
- D the amount of energy released when neutrons change energy levels.
- E the amount of energy released when protons change energy levels.

18 If m_H is the atomic mass of Hydrogen, m_n is the mass of a neutron, and M is the atomic mass of the atom, which of the following is the mass defect formula?

A $\Delta m = Z \cdot m_H + N \cdot m_n - M$

B $\Delta m = Z \cdot m_H + N \cdot m_n + M$

C $\Delta m = Z \cdot m_H - N \cdot m_n - M$

D $\Delta m = Z \cdot m_H - N \cdot m_n + M$

E $\Delta m = M - Z \cdot m_H - N \cdot m_n$

19 When nucleons form a stable nucleus, binding energy is:

- A created from nothing.
- B destroyed into nothing.
- C transformed into visible light.
- D absorbed as high energy photons or particles.
- E released as high energy photons or particles.

20 When a nucleus is divided into its constituents, energy is:

- A created from nothing.
- B destroyed into nothing.
- C transformed into visible light.
- D absorbed by the nucleus which then breaks apart.
- E released by the nucleus as it breaks apart.

21 An isotope with a high Binding Energy per nucleon:

- A will decay in a short period of time.
- B is very unstable.
- C is very stable.
- D has very few electrons.
- E has more protons than neutrons.

22 Why do heavier nuclei have a greater ratio of neutrons to protons than lighter nuclei?

- A to add more nucleons so that the binding energy is greater.
- B provide a greater weak nuclear force.
- C to provide more attractive electromagnetic force.
- D provide more attractive strong nuclear force to balance the repulsive electromagnetic force.
- E to provide more repulsive strong nuclear force to balance the attractive electromagnetic force.

23 Which of the following is the alpha particle?

A $_{+1}^{0}e$

B $_{-1}^{0}e$

C $_{0}^{1}n$

D $_{1}^{1}H$

E $_{2}^{4}He$

24 Which of the following is the β^- particle?

A $_{+1}^{0}e$

B $_{-1}^{0}e$

C $_{0}^{1}n$

D $_{1}^{1}H$

E $_{2}^{4}He$

25 Which of the following is the β^+ particle?

A $_{+1}^{0}e$

B $_{-1}^{0}e$

C $_{0}^{1}n$

D $_{1}^{1}H$

E $_{2}^{4}He$

26 Which of the following about the gamma ray is true?

- A It carries a positive charge.
- B It carries a negative charge.
- C It can be deflected by a magnetic field.
- D In can be deflected by an electric field.
- E It has zero rest mass and a neutral charge.

27 What type of radiation is stopped by a sheet of paper?

- A alpha particle
- B beta particle
- C Gamma ray
- D X-ray
- E Ultraviolet radiation

28 What is the missing element from the following equation $^{226}_{88}Ra \rightarrow ? + {}^{4}_{2}He$?

A $^{230}_{86}Rn$

B $^{220}_{86}Rn$

C $^{228}_{86}Rn$

D $^{222}_{86}Rn$

E $^{224}_{86}Rn$

29 What is the missing element from the following equation ${}^{14}_{6}C \rightarrow ?+ {}^{0}_{-1}e$?

- A ${}^{13}_{7}N$
- B ${}^{12}_{6}C$
- C ${}^{17}_{8}O$
- D ${}^{16}_{8}O$
- E ${}^{14}_{7}N$

30 A 100 g sample of a radioactive element has a half-life of 5 days. How many grams of radioactive material will remain after 15 days?

- A 100 g
- B 50 g
- C 25 g
- D 12.5 g
- E 0 g

31 A reaction that releases more energy than is put into it is called:

- A endothermic
- B exothermic
- C nuclear
- D chemical
- E radioactivity

32 The following reaction: ${}_{0}^{1}n + {}_{92}^{235}U \rightarrow {}_{56}^{141}Ba + {}_{36}^{92}Kr + 3\,{}_{0}^{1}n$ is called:

- A Fusion
- B Fission
- C alpha decay
- D beta decay
- E gamma decay

33 The following reaction: ${}_{1}^{2}H + {}_{1}^{3}H \rightarrow {}_{2}^{4}He + {}_{0}^{1}n$ is called:

- A Fusion
- B Fission
- C alpha decay
- D beta decay
- E gamma decay