

1 An unknown chemical element is presented by the following formula: A_ZX . What is the name of index Z?

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- ☐ B Atomic number
- ☐ C Principle quantum number
- ☐ D Orbital quantum number
- ☐ E Magnetic quantum number

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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

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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 $^{12}_6\text{C}$ atom?

☐ A 12

☐ B 6

☐ C 18

☐ D 3

☐ E 9

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

☐ A 12

☐ B 30

☐ C 18

☐ D 10

☐ E 20

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

☐ A 12

☐ B 11

☐ C 18

☐ D 24

☐ E 9

11 How many protons are in the $^{14}_7\text{N}$ 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 levels?

- ☐ 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 ${}_{+1}^0e$

☐ B ${}_{-1}^0e$

☐ C ${}_0^1n$

☐ D ${}_1^1H$

☐ E ${}_2^4He$

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

☐ A ${}_{+1}^0e$

☐ B ${}_{-1}^0e$

☐ C ${}_0^1n$

☐ D ${}_1^1H$

☐ E ${}_2^4He$

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

☐ A ${}_{+1}^0e$

☐ B ${}_{-1}^0e$

☐ C ${}_0^1n$

☐ D ${}_1^1H$

☐ E ${}_2^4He$

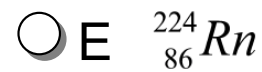
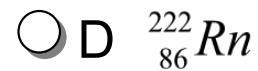
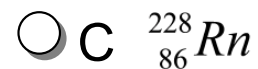
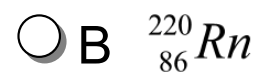
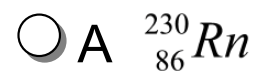
26 Which of the following about the gamma ray is true?

- ☐ A It carries a positive charge.
- ☐ B It carries a negative charge.
- ☐ C It can be deflected by a magnetic field.
- ☐ D It 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 ${}_{88}^{226}\text{Ra} \rightarrow ? + {}_2^4\text{He} ?$



29 What is the missing element from the following equation ${}^{14}_6\text{C} \rightarrow ? + {}^0_{-1}e$?



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: ${}_0^1n + {}_{92}^{235}\text{U} \rightarrow {}_{56}^{141}\text{Ba} + {}_{36}^{92}\text{Kr} + 3{}_0^1n$ is called:

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

33 The following reaction: ${}^2_1H + {}^3_1H \rightarrow {}^4_2He + {}^1_0n$ is called:

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