Q1. The typical radius of a nucleus is of the order of

A. 10^{-10} m
B. 10^{-12} m
C. 10^{-15} m
D. 10^{-6} m

Answer: C
Explanation: Nuclear radius is typically ~1.2×10^{-15} m (femtometers). Atomic radius is ~10^{-10} m, much larger.

Q2. The volume of a nucleus is directly proportional to

A. A
B. √A
C. A^2
D. $A^{1/3}$

Answer: A
Explanation: Volume $\propto R^3$, and radius $R \propto A^{1/3} \Rightarrow$ Volume $\propto (A^{1/3})^3 = A$.

Q3. Which of the following nuclei has the highest binding energy per nucleon?

A. Uranium-238
B. Iron-56
C. Hydrogen-1
D. Helium-4

Answer: B
Explanation: Iron-56 has the maximum binding energy per nucleon (~8.8 MeV), indicating maximum stability.

Q4. The nuclear force between nucleons is

A. Long-range and repulsive
B. Long-range and attractive
C. Short-range and attractive
D. Short-range and repulsive

Answer: C

Explanation: Nuclear forces are strong but act only over ~1–2 femtometer range and are attractive at this scale.

Q5. The density of a nucleus is

A. Directly proportional to mass number
B. Inversely proportional to radius
C. Constant for all nuclei
D. Maximum for heavy nuclei only

Answer: C
Explanation: Nuclear density ≈ constant ≈ 2.3×10^{17} kg/m³, since volume ∝ A and mass ∝ A.

Q6. The mass of a nucleus is less than the sum of masses of its nucleons. This difference is known as

A. Mass number
B. Mass defect
C. Binding energy
D. Atomic mass

Answer: B
Explanation: The difference in mass is mass defect (Δm), which is converted into binding energy ($E = \Delta m \times c^2$).

Q7. Binding energy of a nucleus is the energy

A. Stored in protons only
B. Required to break the nucleus into its nucleons
C. Required to remove electrons
D. Released during beta decay

Answer: B
Explanation: Binding energy is the energy required to separate all nucleons. It's a measure of nuclear stability.

Q8. The binding energy per nucleon of a nucleus is 8 MeV. If the nucleus has 20 nucleons, the total binding energy is

A. 160 MeV
B. 8 MeV

C. 28 MeV
D. 40 MeV

Answer: A
Explanation: Total binding energy = 8 × 20 = 160 MeV.

Q9. Which reaction releases more energy per nucleon?

A. Nuclear fission
B. Chemical combustion
C. Alpha decay
D. Neutron capture

Answer: A
Explanation: Nuclear fission (e.g., U-235 splitting) releases ~200 MeV per nucleus, far greater than chemical processes.

Q10. In a nuclear reaction, which of the following is conserved?

A. Mass
B. Charge
C. Number of protons only
D. Energy and charge

Answer: D
Explanation: Total charge and energy (including mass-energy) are conserved. Mass alone is not necessarily conserved.

Q11. The fusion of four hydrogen nuclei into one helium nucleus results in

A. No energy release
B. Energy absorption
C. Loss of mass and energy release
D. Gain in mass

Answer: C
Explanation: Fusion results in a helium nucleus with less mass than 4 H atoms ⇒ mass defect ⇒ energy released.

Q12. The mass defect of a nucleus is 0.2 u. Its binding energy is (1 u = 931 MeV)

A. 186.2 MeV
B. 93.1 MeV
C. 931 MeV
D. 9.31 MeV

Answer: A
Explanation: Binding energy = 0.2 × 931 = 186.2 MeV.

Q13. A stable nucleus has the neutron/proton (n/p) ratio close to

A. 0.1
B. 1
C. 2
D. 10

Answer: B
Explanation: For light stable nuclei, n/p ≈ 1. For heavier ones, it increases slightly above 1, but close to unity.

Q14. Which of the following statements is true about nuclear binding energy per nucleon curve?

A. It decreases steadily with mass number
B. It increases continuously
C. It peaks around A = 56 and then decreases
D. It is zero for light nuclei

Answer: C
Explanation: The binding energy per nucleon curve peaks near A ≈ 56 (Fe-56) and decreases on both sides.

Q15. Why are very heavy nuclei like Uranium unstable?

A. Low binding energy per nucleon
B. High charge-to-mass ratio
C. Excess protons
D. Large neutron mass

Answer: A
Explanation: Heavy nuclei have lower binding energy per nucleon and are more likely to undergo fission to become stable.

Q16. Which of the following contributes most to the mass of an atom?

A. Electrons
B. Neutrons
C. Protons
D. Nucleus

Answer: D
Explanation: The nucleus (comprising protons and neutrons) contains over 99.9% of the atom's mass. Electrons contribute very little.

Q17. If a nucleus has a mass defect of 0.3 u, what is the binding energy? (1 u = 931 MeV)

A. 279.3 MeV
B. 3.1 MeV
C. 0.003 MeV
D. 310 MeV

Answer: A
Explanation: Binding energy = 0.3 × 931 = 279.3 MeV.

Q18. The radius of a gold nucleus (A = 197) is approximately

A. 1.2 × 197 m
B. $1.2 \times 10^{-15} \times (197)^{1/3}$ m
C. 10^{-10} m
D. 1.2×10^{-6} m

Answer: B
Explanation: Nuclear radius $R = R_0 \times A^{1/3} = 1.2 \times 10^{-15} \times (197)^{1/3}$ m.

Q19. If a nucleus splits into two equal parts, which of the following quantities remains conserved?

A. Mass
B. Volume
C. Binding energy
D. Number of nucleons

Answer: D
Explanation: In any nuclear reaction, the total number of nucleons (mass number A) is conserved.

Q20. Binding energy per nucleon is highest for nuclei with mass number around

A. 1
B. 14
C. 56
D. 238

Answer: C
Explanation: Binding energy per nucleon is maximum for iron (mass number ~56), making it the most stable nucleus.

Q21. The most stable nucleus is

A. Uranium-238
B. Iron-56
C. Helium-4
D. Carbon-12

Answer: B
Explanation: Iron-56 has the maximum binding energy per nucleon and is hence the most stable nucleus.

Q22. Nuclear fusion is the process in which

A. A heavy nucleus splits into two lighter nuclei
B. A nucleus emits alpha particles
C. Light nuclei combine to form a heavier nucleus
D. Neutrons are absorbed by nuclei

Answer: C

Explanation: In fusion, light nuclei like hydrogen combine to form helium, releasing energy due to mass defect.

Q23. The energy released in a nuclear fission reaction of U-235 is approximately

A. 1 MeV
B. 20 MeV
C. 100 MeV
D. 200 MeV

Answer: D
Explanation: Each fission of a U-235 nucleus releases about 200 MeV of energy.

Q24. What is the main reason for energy release in fusion and fission?

A. Conversion of proton to neutron
B. Conversion of mass to energy
C. Emission of gamma radiation
D. Absorption of neutrons

Answer: B
Explanation: In both fusion and fission, a small amount of mass gets converted into energy ($E = mc^2$).

Q25. Which of the following nuclear reactions represents fission?

A. $^{2}H + {}^{3}H \rightarrow {}^{4}He + n$
B. $^{235}U + n \rightarrow Ba + Kr + 3n$
C. $^{238}U \rightarrow {}^{234}Th + He$
D. $^{4}He \rightarrow {}^{2}H + {}^{2}H$

Answer: B
Explanation: This is a typical nuclear fission reaction of uranium-235 into smaller nuclei.

Q26. Which statement is true regarding nuclear fusion?

A. Requires low temperature to initiate
B. Occurs in nuclear reactors
C. Occurs in the Sun and stars

D. Uses uranium as fuel

Answer: C
Explanation: Fusion occurs naturally in the Sun, where hydrogen nuclei fuse under high temperature and pressure.

Q27. The nuclear binding energy per nucleon for helium-4 is

A. Lower than hydrogen-1
B. Around 1 MeV
C. Approximately 7 MeV
D. Around 100 MeV

Answer: C
Explanation: Helium-4 has binding energy per nucleon ≈ 7 MeV, showing significant nuclear stability for light nuclei.

Q28. Which of the following best explains nuclear stability?

A. Number of electrons
B. Number of neutrons
C. Binding energy per nucleon
D. Atomic number

Answer: C
Explanation: The greater the binding energy per nucleon, the more stable the nucleus.

Q29. The formula for nuclear radius is

A. $R = R_o / A$
B. $R = R_o \times A$
C. $R = R_o \times A^{1/3}$
D. $R = R_o \times \sqrt{A}$

Answer: C
Explanation: Nuclear radius is given by $R = R_o \times A^{1/3}$, where $R_o \approx 1.2 \times 10^{-15}$ m.

Q30. When light nuclei undergo fusion, the resulting nucleus has

A. Less mass and more energy
B. More mass and more energy
C. Less mass and less energy
D. Same mass and energy

Answer: A
Explanation: The fused nucleus has slightly less mass due to mass defect. This lost mass is released as energy.

Q31. Which of the following explains the high energy yield in fusion compared to fission?

A. Lighter nuclei are more unstable
B. Greater mass defect in fusion
C. Fusion involves gamma ray emission
D. Binding energy is lower in fission

Answer: B
Explanation: Fusion reactions result in larger mass defect per nucleon, which translates into higher energy release via E =
mc^2

Q32. The unit of nuclear binding energy is

A. Newton
B. Joule
C. MeV
D. erg

Answer: C
Explanation: Binding energy is typically expressed in MeV (million electron volts) for convenience in nuclear physics.

Q33. Which particle is not present in the nucleus?

A. Neutron
B. Proton
C. Electron
D. None of these

Answer: C
Explanation: Electrons revolve around the nucleus and are not a part of the nucleus itself.

Q34. The mass of a nucleus is always

A. Greater than the sum of individual nucleons
B. Equal to the sum of individual nucleons
C. Less than the sum of individual nucleons
D. Equal to atomic mass

Answer: C
Explanation: Due to the binding energy, the actual mass of the nucleus is slightly less than the sum of the masses of its individual nucleons.

Q35. The average binding energy per nucleon in stable nuclei lies in the range of

A. 1–2 MeV
B. 3–5 MeV
C. 6–9 MeV
D. 10–12 MeV

Answer: C
Explanation: Most stable nuclei have binding energy per nucleon between 6 to 9 MeV.

Q36. The nuclear radius of a nucleus having mass number 64 is approximately

A. 4.0×10^{-15} m
B. 5.0×10^{-15} m
C. $1.2 \times 64^{1/3} \times 10^{-15}$ m
D. 6.4×10^{-15} m

Answer: C
Explanation: Nuclear radius $R = R_o \times A^{1/3}$, where $A = 64$ and $R_o \approx 1.2 \times 10^{-15}$ m.

Q37. Which of the following reactions is a fusion reaction?

A. $^{235}U + n \rightarrow Ba + Kr + 3n$

B. $^{2}H + {}^{3}H \rightarrow {}^{4}He + n$
C. $^{238}U \rightarrow {}^{234}Th + He$
D. $^{14}C \rightarrow {}^{14}N + e^{-}$

Answer: B
Explanation: In this fusion reaction, two light nuclei (^{2}H and ^{3}H) combine to form helium and release a neutron.

Q38. For a nucleus with mass number A, the volume is proportional to

A. A
B. A^{2}
C. $A^{1/3}$
D. √A

Answer: A
Explanation: Volume $\propto R^{3} \propto (A^{1/3})^{3} = A$.

Q39. Which of the following is used as fuel in fusion reactions in the Sun?

A. Helium
B. Deuterium and tritium
C. Uranium
D. Plutonium

Answer: B
Explanation: The Sun uses deuterium and tritium (isotopes of hydrogen) in fusion to produce helium and energy.

Q40. What does mass defect represent in a nucleus?

A. The energy absorbed during fusion
B. The number of nucleons missing
C. The difference in mass of nucleons and nucleus
D. Total energy content of nucleus

Answer: C
Explanation: Mass defect = (Sum of individual masses of nucleons) – (Actual mass of nucleus), and it represents the binding energy.

Q41. Which one is true about binding energy per nucleon as atomic number increases beyond 56?

A. It increases
B. It remains constant
C. It decreases
D. It becomes zero

Answer: C
Explanation: After iron (A = 56), binding energy per nucleon decreases, making heavier elements less stable.

Q42. The most suitable material for controlled nuclear fission is

A. ^{238}U
B. ^{235}U
C. ^{2}H
D. ^{4}He

Answer: B
Explanation: Uranium-235 is fissile and used in reactors for controlled fission.

Q43. If the binding energy per nucleon of a nucleus is low, then the nucleus is

A. Highly stable
B. Unstable
C. Does not exist
D. More massive

Answer: B
Explanation: Low binding energy per nucleon means nucleons are weakly held, so the nucleus is unstable.

Q44. Why can fusion not be carried out easily on Earth?

A. Lack of uranium
B. Low atmospheric pressure
C. High temperature required
D. Low density of hydrogen

Answer: C
Explanation: Fusion requires very high temperatures (~10^7 K) to overcome repulsive forces between nuclei.

Q45. Which of the following is true for both fission and fusion?

A. Both involve gamma radiation only
B. Both convert mass to energy
C. Both increase binding energy per nucleon
D. Both occur naturally on Earth

Answer: B
Explanation: In both fission and fusion, part of the mass is converted to energy according to Einstein's equation .