PHYSICS MCQ BOOKLET

Grade 10 · Chapter 12 · Nuclear Physics

FBISE / National Book Foundation Model Textbook companion

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Independent MCQs on the nucleus, isotopes, radioactivity, half-life, ionizing radiation, fission and fusion as energy concepts, dark matter, and falsifiability. Not copied from the book exercise. Educational physics only. Total: 108 questions. Each item has four options, the correct letter, and a short explanation of why it is correct.

A. Important / Main Topics

1. Nuclear physics is the study of the atomic:

(A) nucleus, made of protons and neutrons
(B) electron cloud only as a chemical bond
(C) only outer electron shells in molecules
(D) only sound waves in air

Correct Answer: A

Explanation: Nucleons in the tiny central nucleus are the subject of the unit.

2. J.J. Thomson's 1898 model pictured the atom as:

(A) a tiny positive nucleus with orbiting electrons
(B) a uniform positive sphere with embedded electrons (plum pudding)
(C) a solid indivisible billiard ball
(D) a cloud of neutrons only

Correct Answer: B

Explanation: J.J. Thomson's 1898 model pictured the atom as a uniform positive sphere with embedded electrons (plum pudding).

3. Rutherford, with Geiger, aimed alpha particles from a polonium source at:

(A) a thick lead brick
(B) a glass prism
(C) very thin gold foil
(D) a transformer core

Correct Answer: C

Explanation: Rutherford, with Geiger, aimed alpha particles from a polonium source at very thin gold foil.

4. Flashes on the zinc-sulfide screen showed that most alpha particles:

(A) bounced straight back
(B) were all absorbed in the first atom
(C) became neutrons
(D) went nearly straight through the foil

Correct Answer: D

Explanation: Most of the atom is empty space, so most alphas miss the nucleus.

5. A few alphas scattered through more than 90°, which Thomson's model could not explain because:

(A) positive charge and mass are concentrated in a tiny nucleus
(B) gold atoms have no electrons
(C) alphas have no charge
(D) the foil was a gas

Correct Answer: A

Explanation: Only a dense positive speck can fling a fast alpha backward.

6. About 1 in 20 000 alphas was deflected by more than 90°, showing the nucleus is:

(A) almost as large as the atom
(B) extremely small compared with the atom

(C) negatively charged
(D) made of electrons

Correct Answer: B

Explanation: Close approaches are rare, so the target that scatters them is minute.

7. Rutherford pictured electrons as:

(A) fixed in a positive pudding
(B) inside the nucleus with the protons
(C) light negative particles orbiting a positive nucleus
(D) massless photons

Correct Answer: C

Explanation: Rutherford pictured electrons as light negative particles orbiting a positive nucleus.

8. The nucleus is of order 10 000 times smaller than the atom, like a ping-pong ball in a circle of about:

(A) 2 cm
(B) 2 mm
(C) 2 light years
(D) 2 km

Correct Answer: D

Explanation: The nucleus is of order 10 000 times smaller than the atom, like a ping-pong ball in a circle of about 2 km.

9. Atomic number Z is the number of:

(A) protons in the nucleus
(B) neutrons
(C) nucleons A always
(D) photons emitted

Correct Answer: A

Explanation: Atomic number Z is the number of protons in the nucleus.

10. Mass number A is the number of:

(A) protons only
(B) nucleons (protons plus neutrons)
(C) electrons in all shells always equal to A
(D) gamma photons

Correct Answer: B

Explanation: Mass number A is the number of nucleons (protons plus neutrons).

11. The number of neutrons in a nucleus is:

(A) A + Z
(B) Z − A
(C) A − Z
(D) A × Z

Correct Answer: C

Explanation: The number of neutrons in a nucleus is A − Z.

12. A nuclide is specified by given values of:

(A) only temperature
(B) only frequency of light
(C) only half-life of the Sun
(D) A and Z (and thus a particular nucleus species)

Correct Answer: D

Explanation: A nuclide is specified by given values of A and Z (and thus a particular nucleus species).

13. In the symbol ^{12}□C the 12 is:

(A) the nucleon number A

(B) the proton number
(C) the neutron number only
(D) the atomic number Z

Correct Answer: A

Explanation: Carbon-12 has 12 nucleons; Z = 6 is written as the subscript.

14. Isotopes of an element have the same Z but different:

(A) chemical symbols always
(B) A, because they have different numbers of neutrons
(C) numbers of protons
(D) electron counts in a neutral atom necessarily different

Correct Answer: B

Explanation: Isotopes of an element have the same Z but different A, because they have different numbers of neutrons.

15. Protium, deuterium, and tritium are hydrogen isotopes with neutron numbers:

(A) 1, 1, 1
(B) 1, 2, 3
(C) 0, 1, 2
(D) 6, 7, 8

Correct Answer: C

Explanation: Protium, deuterium, and tritium are hydrogen isotopes with neutron numbers 0, 1, 2.

16. Isotopes of one element have essentially the same chemical properties because they have the same:

(A) mass number A
(B) number of neutrons
(C) half-life
(D) number of electrons (and protons)

Correct Answer: D

Explanation: Chemistry is governed by the electron arrangement, which follows Z.

17. Isotopes cannot be separated by ordinary chemical methods; a mass-based method is:

(A) mass spectrometry
(B) paper chromatography of dyes only
(C) filtering with filter paper only
(D) boiling in an open beaker only

Correct Answer: A

Explanation: Different A means different mass-to-charge behaviour in a spectrometer.

18. A radioisotope is an isotope that is:

(A) always chemically inert like neon
(B) unstable and emits radiation as it becomes more stable
(C) always the most abundant isotope
(D) an isobar with Z = A

Correct Answer: B

Explanation: A radioisotope is an isotope that is unstable and emits radiation as it becomes more stable.

19. Natural neon is mostly ^{20}Ne (about 90.48%), with smaller amounts of ^{21}Ne and ^{22}Ne. These are:

(A) different elements
(B) isobars of carbon
(C) isotopes of neon, all with Z = 10
(D) gamma photons

Correct Answer: C

Explanation: Each has 10 protons; neutron numbers are 10, 11, and 12.

20. Isobars are species with the same A but different:

(A) nucleon number
(B) N only with identical Z and A
(C) photon energy
(D) Z (different elements, same mass number)

Correct Answer: D

Explanation: ^{14}C, ^{14}N, and ^{14}O are a standard isobar set.

21. Isotones have the same number of:

(A) neutrons
(B) protons
(C) electrons in every ion
(D) alpha particles

Correct Answer: A

Explanation: Isotones have the same number of neutrons.

22. Henri Becquerel found in 1896 that uranium salts could:

(A) only heat water
(B) fog a photographic plate with invisible radiation
(C) generate 50 Hz a.c.
(D) scatter blue sky light

Correct Answer: B

Explanation: Henri Becquerel found in 1896 that uranium salts could fog a photographic plate with invisible radiation.

23. Marie Curie coined the word radioactivity for:

(A) the magnetic field of a solenoid
(B) the speed of light in vacuum
(C) natural emission of radiation from unstable nuclei
(D) Rayleigh scattering

Correct Answer: C

Explanation: Marie Curie coined the word radioactivity for natural emission of radiation from unstable nuclei.

24. Radioactive emission is described as spontaneous and:

(A) fully controllable by heating the sample
(B) identical to 50 Hz mains
(C) possible only in stars
(D) random, and not switched by ordinary chemical reactions

Correct Answer: D

Explanation: Radioactive emission is described as spontaneous and random, and not switched by ordinary chemical reactions.

25. An alpha particle is equivalent to a:

(A) helium nucleus (two protons and two neutrons)
(B) high-speed electron from a nuclear neutron
(C) massless gamma photon
(D) single proton

Correct Answer: A

Explanation: An alpha particle is equivalent to a helium nucleus (two protons and two neutrons).

26. A beta particle in the unit's treatment is a:

(A) helium nucleus
(B) fast electron emitted from the nucleus
(C) neutral photon
(D) slow proton

Correct Answer: B

Explanation: It is not an orbital electron; it is created in the nucleus when a neutron changes.

27. Gamma radiation is:

(A) a charged helium nucleus
(B) a beam of neutrons only
(C) short-wavelength electromagnetic radiation from the nucleus
(D) visible red light

Correct Answer: C

Explanation: Gammas are uncharged photons, so fields do not deflect them.

28. In an electric field, alpha particles are attracted toward the:

(A) positive plate
(B) neither plate (they are neutral)
(C) infrared remote
(D) negative plate

Correct Answer: D

Explanation: Alphas are positive, so they move toward the negative electrode.

29. Beta particles in an electric field deflect toward the:

(A) positive plate, and more strongly than alphas because they are lighter
(B) negative plate
(C) same as alphas always
(D) photographic plate without charge

Correct Answer: A

Explanation: Electrons are negative and have a much larger charge-to-mass ratio.

30. Gamma rays in electric or magnetic fields:

(A) curve like alphas
(B) are undeflected because they have no charge
(C) stop at paper
(D) become betas

Correct Answer: B

Explanation: No charge means no electric or magnetic force.

31. Relative ionizing ability is highest for:

(A) gamma rays
(B) infrared photons
(C) alpha particles
(D) radio waves

Correct Answer: C

Explanation: Heavy, +2 charge alphas rip electrons from atoms densely along a short track.

32. Relative penetrating power is highest for:

(A) alpha particles
(B) beta particles compared with gamma
(C) a sheet of paper
(D) gamma radiation

Correct Answer: D

Explanation: Relative penetrating power is highest for gamma radiation.

33. A typical shielding comparison is: paper stops alphas, millimetres of aluminium stop betas, and gammas need:

(A) centimetres of lead (or thick concrete)
(B) another sheet of paper
(C) a thin aluminium foil only
(D) nothing, because they are charged

Correct Answer: A

Explanation: Ionizing densely means stopping quickly; ionizing sparsely means penetrating far.

34. In alpha decay, A decreases by 4 and Z decreases by:

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

Correct Answer: B

Explanation: In alpha decay, A decreases by 4 and Z decreases by 2.

35. The general alpha-decay scheme is ᴬ_Z X →:

(A) ᴬ_{Z+1} Y + β
(B) ᴬ_Z X + γ only with no particle
(C) ᴬ□⁴_{Z−2} Y + α
(D) ᴬ□⁴_{Z+2} Y

Correct Answer: C

Explanation: Parent loses an alpha, so both A and Z drop as shown.

36. In beta-minus decay a nuclear neutron transforms into a proton and:

(A) an alpha particle
(B) a helium nucleus
(C) a photon of visible light only
(D) an electron that is emitted

Correct Answer: D

Explanation: In beta-minus decay a nuclear neutron transforms into a proton and an electron that is emitted.

37. The general beta-minus scheme is ᴬ_Z X →:

(A) ᴬ_{Z+1} Y + ⁰□□β
(B) ᴬ□⁴_{Z−2} Y + α
(C) ᴬ_Z Y + neutron
(D) ᴬ_{Z−1} Y + proton

Correct Answer: A

Explanation: Mass number is conserved; charge number rises by one.

38. Gamma emission typically occurs when a nucleus has:

(A) too few electrons in K shell only
(B) excess energy after a decay, without changing Z or A
(C) too many protons only as alpha
(D) zero nucleons

Correct Answer: B

Explanation: Gamma emission typically occurs when a nucleus has excess energy after a decay, without changing Z or A.

39. Activity is the number of decays per unit time. The SI unit is the:

(A) curie only, with no SI name
(B) gray
(C) becquerel (1 Bq = 1 decay per second)
(D) sievert

Correct Answer: C

Explanation: Activity is the number of decays per unit time. The SI unit is the becquerel (1 Bq = 1 decay per second).

40. One curie is defined as about:

(A) 1 decay/s
(B) 13.6 eV
(C) 5730 years

(D) 3.70 × 10^{10} Bq, historically the activity of 1 g of radium

Correct Answer: D

Explanation: The curie is a large traditional unit equal to 3.70 × 10^{10} decays per second.

41. Half-life is the time for:

(A) half of the original radioactive nuclei in a sample to decay
(B) all nuclei to decay
(C) activity to become infinite
(D) Z to become zero

Correct Answer: A

Explanation: Half-life is the time for half of the original radioactive nuclei in a sample to decay.

42. Radioactive decay of a sample follows:

(A) linear decrease of N with time
(B) exponential decay, because the rate depends on how many nuclei remain
(C) a sine wave like a.c.
(D) a step that finishes in one second always

Correct Answer: B

Explanation: Radioactive decay of a sample follows exponential decay, because the rate depends on how many nuclei remain.

43. If a sample has N□ nuclei, after three half-lives the number remaining is:

(A) N□ / 3
(B) N□ / 2
(C) N□ / 8
(D) zero

Correct Answer: C

Explanation: If a sample has N□ nuclei, after three half-lives the number remaining is N□ / 8.

44. Carbon-14 used in dating has a half-life of about:

(A) 8.02 days
(B) 4.5 billion years
(C) 12.3 years
(D) 5730 years

Correct Answer: D

Explanation: Carbon-14 used in dating has a half-life of about 5730 years.

45. ^{14}C is formed in the atmosphere when cosmic-ray neutrons strike:

(A) nitrogen-14
(B) oxygen-16 exclusively
(C) uranium-238 in soil only
(D) helium-4

Correct Answer: A

Explanation: A neutron is absorbed and a proton ejected, turning ^{14}N into ^{14}C.

46. Living plants take in ^{14}C as radioactive CO□ during:

(A) radioactive decay of radon in basements
(B) photosynthesis
(C) alpha decay of americium
(D) fusion in the Sun’s core only

Correct Answer: B

Explanation: Living plants take in ^{14}C as radioactive CO□ during photosynthesis.

47. After death the ^{14}C fraction falls because:

(A) the organism takes in extra ^{14}C
(B) nitrogen becomes oxygen

(C) intake stops while ^{14}C continues to decay
(D) half-life becomes zero

Correct Answer: C

Explanation: Comparing remaining ^{14}C with the living ratio gives an age.

48. A fossil with $N/N_0 = 1/4$ for ^{14}C ($T_{1/2} = 5730$ y) has age about:

(A) 5730 years
(B) 17 190 years
(C) 2865 years
(D) 11 460 years

Correct Answer: D

Explanation: A fossil with $N/N_0 = 1/4$ for ^{14}C ($T_{1/2} = 5730$ y) has age about 11 460 years.

49. Ionizing radiation in the unit is radiation with energy above about:

(A) 13.6 eV, enough to eject hydrogen's K-electron
(B) 0 eV
(C) 13.6 MeV only
(D) 3×10^8 eV

Correct Answer: A

Explanation: 13.6 eV is hydrogen's ionization energy, used as a school threshold.

50. Visible light and radio waves are generally non-ionizing because they:

(A) travel faster than gamma rays
(B) have photon energies too low to eject electrons
(C) cannot travel in vacuum
(D) are not electromagnetic

Correct Answer: B

Explanation: Visible light and radio waves are generally non-ionizing because they have photon energies too low to eject electrons.

51. Biological damage from ionizing radiation includes ionization, excitation, and:

(A) conversion of the person into a radioisotope instantly always
(B) only a change of eye colour
(C) creation of free radicals that can alter DNA
(D) a decrease of c

Correct Answer: C

Explanation: Chemical follow-up of ionization can kill cells or cause mutations and cancer.

52. Safe practice is summarised as time, distance, and:

(A) increasing dose for curiosity
(B) removing all warning symbols
(C) storing sources in clothing pockets
(D) shielding (for example lead or concrete)

Correct Answer: D

Explanation: Safe practice is summarised as time, distance, and shielding (for example lead or concrete).

53. Absorbed dose is energy deposited in tissue, measured in:

(A) gray (Gy)
(B) becquerel
(C) hertz
(D) tesla

Correct Answer: A

Explanation: The gray is joules per kilogram absorbed.

54. Equivalent and effective dose, which include radiation type and tissue sensitivity, are measured in:

(A) becquerel

(B) sievert (Sv) or millisievert
(C) metre
(D) ampere

Correct Answer: B

Explanation: The sievert is the protection quantity used in the dose-limit.

55. The annual dose limit quoted for the general public is about:

(A) 20 mSv
(B) 100 mSv per hour
(C) 1 mSv per year
(D) 1 Gy per second

Correct Answer: C

Explanation: Radiation workers have a higher annual limit (20 mSv) because they are monitored.

56. A common ionization smoke alarm uses americium-241, which emits:

(A) only infrared
(B) only visible photons
(C) 50 Hz a.c.
(D) alpha particles that ionize air so a small current flows

Correct Answer: D

Explanation: Smoke disrupts that ion current and the alarm sounds.

57. Iodine-131 is useful against thyroid disease because it is:

(A) chemically identical to stable iodine and concentrates in the thyroid
(B) an alpha emitter used only in smoke alarms
(C) not radioactive
(D) a form of carbon-14

Correct Answer: A

Explanation: The gland takes up iodine, so the radioisotope delivers a local dose.

58. Background radiation is ionizing radiation that is:

(A) only from hospital X-ray machines you just used
(B) always present from natural and widespread artificial sources
(C) zero at sea level
(D) identical to Earth's magnetic field

Correct Answer: B

Explanation: Background radiation is ionizing radiation that is always present from natural and widespread artificial sources.

59. Cosmic-ray dose is typically higher:

(A) in deep mines always
(B) only at the equator indoors
(C) at higher altitude and where Earth's magnetic shield is weaker
(D) inside thick lead rooms

Correct Answer: C

Explanation: Cosmic-ray dose is typically higher at higher altitude and where Earth's magnetic shield is weaker.

60. Radon from uranium and thorium in the crust is a major indoor hazard because it is a:

(A) solid that stays in bedrock forever
(B) form of infrared heat
(C) stable isotope of neon
(D) radioactive gas that can collect in basements and raise lung-cancer risk

Correct Answer: D

Explanation: Inhaled decay products irradiate lung tissue; it is a leading cause of lung cancer in non-smokers.

61. Nuclear fission is a reaction in which a:

(A) heavy nucleus splits into lighter nuclei and energy is released
(B) light nucleus joins another light nucleus
(C) photon becomes an electron in a wire
(D) molecule vibrates in a microwave oven

Correct Answer: A

Explanation: Splitting a heavy nucleus such as uranium-235 can release about 200 MeV per event.

62. A typical energy release quoted per fission is about:

(A) 13.6 eV
(B) 200 MeV
(C) 26.3 eV
(D) 1 Bq

Correct Answer: B

Explanation: That is millions of times a chemical bond, which is why a little fuel stores so much energy.

63. In a fission chain reaction, neutrons from one split can:

(A) only escape to infinity always
(B) turn into infrared photons only
(C) be absorbed by other fissile nuclei and cause further fission
(D) increase Z of helium to 92

Correct Answer: C

Explanation: In a fission chain reaction, neutrons from one split can be absorbed by other fissile nuclei and cause further fission.

64. In a nuclear power reactor the chain reaction is:

(A) left completely uncontrolled
(B) used to date fossils with carbon-14
(C) identical to Rayleigh scattering
(D) kept controlled so heat is released steadily to make electricity

Correct Answer: D

Explanation: Control systems keep the neutron multiplication near one for a steady energy supply.

65. Nuclear fusion is a reaction in which:

(A) light nuclei combine to form a heavier nucleus and release energy
(B) a heavy nucleus splits
(C) an electron leaves a metal in a CRO
(D) a transformer steps voltage down

Correct Answer: A

Explanation: Stars fuse hydrogen toward helium; the Sun's output is fusion energy.

66. The proton–proton chain in the Sun starts with two protons forming:

(A) uranium-238
(B) deuterium, with a positron (anti-electron) among the products
(C) a carbon-14 nucleus
(D) an alpha particle in one step only

Correct Answer: B

Explanation: The proton–proton chain in the Sun starts with two protons forming deuterium, with a positron (anti-electron) among the products.

67. Energy released in fusion and fission ultimately comes from:

(A) chemical rearrangement of electron shells only
(B) Earth's molten iron dynamo
(C) conversion of a small amount of mass to energy, $E = mc^2$
(D) 50 Hz rotation of a generator coil only

Correct Answer: C

Explanation: A mass defect appears as kinetic energy, gamma rays, and heat, while total mass-energy is conserved.

68. A complete proton–proton cycle in the unit releases about:

(A) 200 MeV
(B) 13.6 eV
(C) 5730 years of power
(D) 26.3 MeV

Correct Answer: D

Explanation: Four protons effectively become one helium-4 with that energy release.

69. The nature of the Sun in this unit is that it is powered by:

(A) fusion of hydrogen nuclei into helium
(B) burning coal in a furnace
(C) radioactive decay of carbon-14 only
(D) tidal friction alone

Correct Answer: A

Explanation: The nature of the Sun in this unit is that it is powered by fusion of hydrogen nuclei into helium.

70. Dark matter is inferred because:

(A) it emits bright visible light from every galaxy centre
(B) visible matter's gravity is not enough to explain galaxy rotation and clustering
(C) it ionizes air in smoke alarms
(D) it is identical to ozone

Correct Answer: B

Explanation: Dark matter is inferred because visible matter's gravity is not enough to explain galaxy rotation and clustering.

71. Dark matter interacts gravitationally but does not:

(A) occupy space or have mass
(B) affect galaxy clusters at all
(C) emit, absorb, or reflect light (no electromagnetic interaction of that kind)
(D) exist according to the unit

Correct Answer: C

Explanation: It is invisible to telescopes yet reveals itself by gravity.

72. The unit states dark matter is about five times as abundant as ordinary matter and roughly:

(A) 1% of the universe
(B) 99% visible stars
(C) equal to the speed of light
(D) 27% of the universe

Correct Answer: D

Explanation: Ordinary atoms are the smaller share; most matter is this unseen component.

73. Observed galactic rotation curves stay high at large radius, whereas without extra mass they should:

(A) fall off with distance from the centre
(B) rise without limit
(C) become exactly zero at 1 kpc
(D) match a sine wave like a.c.

Correct Answer: A

Explanation: The flat curve is the classic evidence plotted in the unit.

74. Falsifiability means a scientific theory must make claims that could in principle be:

(A) believed forever without test
(B) shown false by observation or experiment

(C) hidden from all measurement
(D) true only if nobody looks

Correct Answer: B

Explanation: If nothing could ever contradict an idea, it is not an empirical scientific theory.

75. Falsifiability helps separate science from:

(A) engineering only
(B) mathematics only
(C) pseudoscience that cannot be empirically tested
(D) school examinations

Correct Answer: C

Explanation: Falsifiability helps separate science from pseudoscience that cannot be empirically tested.

76. Conservation in nuclear decay includes charge, momentum, mass-energy, and:

(A) the number of electrons in the laboratory always
(B) the colour of the sample
(C) Earth's magnetic tilt of 11°
(D) nucleon number A in the usual decay equations of the unit

Correct Answer: D

Explanation: Alphas and betas are written so A and charge add up on both sides.

77. Molybdenum-99 decaying to technetium-99 is an example of:

(A) beta decay (A unchanged, Z increases by 1)
(B) alpha decay (A drops by 4)
(C) gamma-only with no transmutation
(D) fusion of two hydrogens

Correct Answer: A

Explanation: ^{99}□□Mo → ^{99}□□Tc + β is the medical-isotope route described in the unit.

78. Artificial radioisotopes can be made in a reactor by adding extra neutrons, for example:

(A) fluorine-18 in every PET scan only
(B) molybdenum-99 for medical imaging
(C) stable neon-20
(D) photons of red light

Correct Answer: B

Explanation: Artificial radioisotopes can be made in a reactor by adding extra neutrons, for example molybdenum-99 for medical imaging.

79. Particle accelerators (cyclotrons) tend to make radioisotopes that are:

(A) always neutron-rich like reactor products
(B) stable lead only
(C) neutron-poor, such as fluorine-18 for PET
(D) identical to carbon-12

Correct Answer: C

Explanation: Particle accelerators (cyclotrons) tend to make radioisotopes that are neutron-poor, such as fluorine-18 for PET.

80. For a tracer to be useful, its radiation type and half-life must:

(A) both be infinite
(B) be identical to uranium-238 always
(C) produce no ionizing radiation of any kind
(D) match the job: long enough to measure, short enough to limit dose, with a detectable emission

Correct Answer: D

Explanation: For a tracer to be useful, its radiation type and half-life must match the job: long enough to measure, short enough to limit dose, with a detectable emission.

B. Less Important / Secondary Topics

81. Thomson showed in 1897 that atoms contain:

(A) smaller charged pieces (electrons)
(B) only nuclei of gold
(C) only neutrons
(D) only photons

Correct Answer: A

Explanation: Thomson showed in 1897 that atoms contain smaller charged pieces (electrons).

82. Rutherford compared a backward-scattered alpha to a 15-inch shell bouncing from:

(A) a steel plate
(B) tissue paper
(C) a neutron star
(D) a transformer

Correct Answer: B

Explanation: Rutherford compared a backward-scattered alpha to a 15-inch shell bouncing from tissue paper.

83. Electrons in the modern picture occupy:

(A) fixed clockwork orbits with known exact position always
(B) the nucleus with the protons
(C) energy levels, with only a probability cloud for position
(D) photons of the Sun

Correct Answer: C

Explanation: The hydrogen ground-state cloud is densest near the nucleus.

84. An electron jumps to a higher level by:

(A) emitting a photon always
(B) becoming a proton
(C) increasing A
(D) absorbing energy (heat, light, or electricity)

Correct Answer: D

Explanation: An electron jumps to a higher level by absorbing energy (heat, light, or electricity).

85. Relative abundance of an isotope is the:

(A) percentage of atoms of that mass in a natural sample
(B) half-life in years
(C) activity in Bq only
(D) Z number

Correct Answer: A

Explanation: Relative abundance of an isotope is the percentage of atoms of that mass in a natural sample.

86. Natural uranium is mostly ^{238}U, with ^{235}U a little under 1%. ^{235}U is noted as:

(A) the only isotope of hydrogen
(B) a fuel used in nuclear reactors (an energy application)
(C) a stable form of carbon
(D) a microwave frequency

Correct Answer: B

Explanation: Natural uranium is mostly ^{238}U, with ^{235}U a little under 1%. ^{235}U is noted as a fuel used in nuclear reactors (an energy application).

87. There are roughly 257 stable isotopes in nature; the rest of the thousands of known species are:

(A) all visible light photons
(B) all isobars of neon
(C) radioisotopes
(D) magnetic field lines

Correct Answer: C

Explanation: There are roughly 257 stable isotopes in nature; the rest of the thousands of known species are radioisotopes.

88. Radioactivity is unaffected by:

(A) the identity of the element
(B) the value of Z
(C) whether the nucleus is unstable
(D) ordinary heating, cooling, or chemical reactions

Correct Answer: D

Explanation: It is a nuclear process, not a chemical one.

89. Fleming's left-hand rule appears for charged nuclear radiation in a magnetic field because:

(A) moving charges (alphas and betas) experience a magnetic force
(B) gammas have charge +2
(C) photons have rest mass
(D) half-life depends on B

Correct Answer: A

Explanation: Fleming's left-hand rule appears for charged nuclear radiation in a magnetic field because moving charges (alphas and betas) experience a magnetic force.

90. Beta particles differ from orbital electrons because they:

(A) have opposite charge
(B) originate in the nucleus, not in electron shells
(C) are helium nuclei
(D) cannot ionize

Correct Answer: B

Explanation: Beta particles differ from orbital electrons because they originate in the nucleus, not in electron shells.

91. A survey meter (Geiger-type instrument) is used to:

(A) step down 220 V
(B) fuse hydrogen in the lab
(C) measure radiation levels so workers can stay within safe limits
(D) scatter blue light

Correct Answer: C

Explanation: It is a practical detector, not a source.

92. The 2007 IAEA supplementary warning symbol adds a skull and a running figure to mean:

(A) safe to touch
(B) this is only infrared
(C) this is a transformer
(D) danger — stay away, even if you cannot read the word radioactivity

Correct Answer: D

Explanation: The 2007 IAEA supplementary warning symbol adds a skull and a running figure to mean danger — stay away, even if you cannot read the word radioactivity.

93. PPE for radioactive work includes lab coats, suitable shoes, and:

(A) safety glasses, plus tracking and proper storage of sources
(B) no labelling of sources
(C) keeping sources in pockets
(D) removing all shields

Correct Answer: A

Explanation: PPE for radioactive work includes lab coats, suitable shoes, and safety glasses, plus tracking and proper storage of sources.

94. Potassium-40 and carbon-14 in food cause:

(A) zero internal dose
(B) internal exposure, a part of natural background
(C) only external X-ray beams
(D) fusion in the stomach

Correct Answer: B

Explanation: Potassium-40 and carbon-14 in food cause internal exposure, a part of natural background.

95. A rotating cobalt therapy unit aims to:

(A) irradiate the whole body equally always
(B) date the patient with C-14
(C) concentrate dose in a tumour from several angles while sparing more healthy tissue
(D) produce microwaves at 2.45 GHz

Correct Answer: C

Explanation: A rotating cobalt therapy unit aims to concentrate dose in a tumour from several angles while sparing more healthy tissue.

96. Buildings can add terrestrial dose because construction materials may contain:

(A) only plastic with Z = 0
(B) only hydrogen-1
(C) only photons of radio
(D) uranium, thorium, and potassium-40

Correct Answer: D

Explanation: Rocks and bricks are mildly radioactive.

97. Parker Solar Probe can survive near the Sun partly because space has:

(A) almost no air, so heat transfer by convection/conduction is inefficient, plus a carbon-composite shield
(B) very dense air for convection
(C) a lead castle like a gamma lab
(D) liquid water cooling from Earth

Correct Answer: A

Explanation: The unit-opener point is thermal physics, not nuclear fuel.

98. 1 kiloparsec is about:

(A) 1 metre
(B) 3262 light years
(C) 3×10^8 m/s
(D) 5730 years

Correct Answer: B

Explanation: 1 kiloparsec is about 3262 light years.

99. Dark matter is said to form a web-like gravitational:

(A) electromagnetic spectrum
(B) set of radio stations
(C) framework on which ordinary matter gathers
(D) transformer core

Correct Answer: C

Explanation: It is the scaffolding of large-scale structure in the account given.

100. A theory that cannot be tested against any possible observation is, by the unit's standard:

(A) the most scientific
(B) automatically true
(C) a form of carbon dating
(D) not scientific in the falsifiability sense

Correct Answer: D

Explanation: Empirical risk of failure is required.

101. Iodine-131's half-life in the table is about:

(A) 8 days, suitable for a medical course of treatment
(B) 4.5 billion years
(C) 5730 years
(D) 24 110 years

Correct Answer: A

Explanation: Iodine-131's half-life in the table is about 8 days, suitable for a medical course of treatment.

102. Uranium-238's half-life of 4.5 billion years makes it useful for:

(A) a one-week hospital scan
(B) dating very old rocks, not short medical traces
(C) smoke alarms in kitchens
(D) Bluetooth links

Correct Answer: B

Explanation: The clock must match the age of the sample.

103. Tritium (hydrogen-3) has a half-life of about:

(A) 8 days
(B) 5730 years
(C) 12.3 years
(D) 4.5 billion years

Correct Answer: C

Explanation: It is another tabulated radioisotope, distinct from C-14.

104. Radon-222's half-life of a few days means that indoor levels:

(A) are frozen forever at Earth's formation
(B) are identical to C-14 in bones
(C) measure 50 Hz
(D) can change with ventilation, because the gas keeps being produced from the crust and then decays

Correct Answer: D

Explanation: A short half-life plus continuous production from uranium chains sets the indoor problem.

105. 1 kg of uranium is compared energetically with about:

(A) 3000 tons of coal, illustrating how large fission energy is per mass
(B) 1 kg of coal
(C) 1 g of radium activity only
(D) a 12.2 cm microwave

Correct Answer: A

Explanation: The comparison is about energy density, not about building devices.

106. Excitation differs from ionization because the electron:

(A) leaves the atom
(B) is raised to a higher level but remains bound
(C) becomes a neutron
(D) changes Z of the nucleus

Correct Answer: B

Explanation: Excitation differs from ionization because the electron is raised to a higher level but remains bound.

107. Nucleons are:

(A) only electrons
(B) only photons
(C) protons and neutrons in the nucleus
(D) only neutrinos in stars

Correct Answer: C

Explanation: Nucleons are protons and neutrons in the nucleus.

108. The unit’s big idea is that tiny nuclei store huge energy, emit ionizing radiation with measurable half-lives, and that ideas such as dark matter remain scientific only if they stay:

(A) untestable slogans
(B) secret from all observers
(C) identical to astrology
(D) open to being tested and possibly falsified

Correct Answer: D

Explanation: The unit’s big idea is that tiny nuclei store huge energy, emit ionizing radiation with measurable half-lives, and that ideas such as dark matter remain scientific only if they stay open to being tested and possibly falsified.