Atoms

Assertion & Reason Type Questions

Directions: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c. Assertion (A) is true but Reason (R) is false.

d. Both Assertion (A) and Reason (R) are false.

Q1. Assertion (A): The force of repulsion between atomic nucleus and alpha-particle varies with distance according to inverse square law.

Reason (R): Rutherford did alpha-particle scattering experiment.

Answer : (b) Rutherford confirmed the repulsive force on a-particle due to nucleus varies with distance according to inverse square law and that the positive charges are concentrated at the centre and not distributed throughout the atom.

Q2. Assertion (A): The positively charged nucleus of an atom has a radius of atmost 10^{-15} m.

Reason (R): In alpha-particle scattering experiment, the distance of closest approach for alpha-particles $\simeq 10^{-15}$ m.

Answer : (a) Experimentally, it is found that the average radius of a nucleus is given by $R = R_0 A^{1/3}$, where $R_0 = 1.1 \times 10^{-15}$ m = 1.1 fm.

Q3. Assertion (A): For the scattering of alpha-particles at a large angle, only the nucleus of the atom is responsible.

Reason (R): Nucleus is very heavy in comparison to electrons.

Answer : (a) We know that, an electron is very light particle as compared to an α-particle. Hence, electron cannot scatter the α-particle at large angles, according to law of conservation of momentum. On the other hand, mass of nucleus is comparable

with the mass of a-particle, hence only the nucleus of atom is responsible for scattering of a-particles.

Q4. Assertion (A): Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason (R): According to classical Physics, all moving electrons radiate.

Answer : (b) Bohr postulated that electrons in stationary orbits around the nucleus do not radiate. This is one of the Bohr's postulate. According to this, the moving electrons radiate only when they go from one orbit to the next lower orbit.

Q5. Assertion (A): Electrons in the atom are held due to coulomb forces.

Reason (R): The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

Answer : (c) According to postulates of Bohr's atomic model, the electron revolve round the nucleus in fixed orbit of definite radii. As long as the electron is in a certain orbit, it does not radiate any energy.

Q6. Assertion (A): The whole mass of the atom is considered in the nucleus.

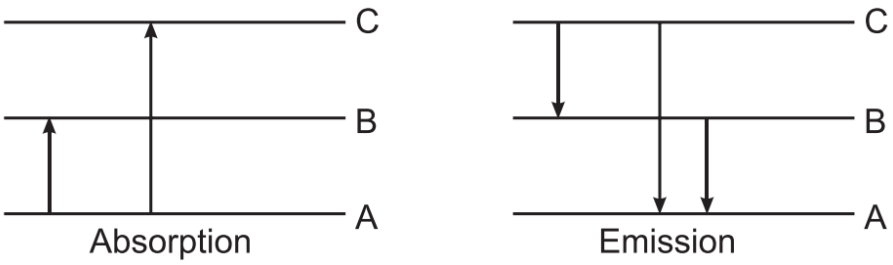
Reason (R): The mass of a nucleus can be either less than or more than the sum of the masses of nucleons present in it.

Answer : (c) The whole mass of the atom is concentrated at nucleus and $M_{nucleus} <$ (Sum of the masses of nucleons) because, when nucleons combines, some energy is wasted.

Q7. Assertion (A): It is essential that all the lines available in the emission spectrum will also be available in the absorption spectrum.

Reason (R): The spectrum of hydrogen atom is only absorption spectrum.

Answer : (d) Emission transition can take place between any higher energy level and any energy level below it while absorption transitions start from the lowest energy level only and may end at any higher energy level. Hence, number of absorptions transition between two given energy levels is always less than the number of emission transition between same two levels.



Q8. Assertion: The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.

Reason: Rutherford did α-particle scattering experiment.

Q9. Assertion: According to classical theory the proposed path of an electron in Rutherford atom model will be parabolic.

Reason: According to electromagnetic theory an accelerated particle continuously emits radiation.

Q10. Assertion: Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason: According to classical physics all moving electrons radiate.

Q11. Assertion: Electrons in the atom are held due to coulomb forces.

Reason: The atom is stable only because the centripetal force due to Coulomb's law is balanced by the centrifugal force.

Q12. Assertion: Hydrogen atom consists of only one electron but its emission spectrum has many lines.

Reason: Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.

Q13. Assertion: Between any two given energy levels, the number of absorption transitions is always less than the number of emission transitions.

Reason: Absorption transitions start from the lowest energy level only and may end at any higher energy level. But emission transitions may start from any higher energy level and end at any energy level below it.

Q14. Assertion: In Lyman series, the ratio of minimum and maximum wavelength is 3/4

Reason: Lyman series constitute spectral lines corresponding to transition from higher energy to ground state of hydrogen atom.

ANSWER KEY 8 to 14

Q8 : (b) Rutherford confirmed that the repulsive force of α- particle due to nucleus varies with distance according to inverse square law and that the positive charges are concentrated at the centre and not distributed throughout the atom.

Q9 : (d) According to classical electromagnetic theory, an accelerated charged particle continuously emits radiation. As electrons revolving in circular paths are constantly experiencing centripetal acceleration, hence they will be losing their energy continuously and the orbital radius will go on decreasing, form spiral and finally the electron will fall in the nucleus.

Q10 : (b) Bohr postulated that electrons in stationary orbits around the nucleus do not radiate. This is the one of Bohr's postulate, According to this the moving electrons radiates only when they go from one orbit to the next lower orbit.

Q11 : (c) According to postulates of Bohr's atom model the electron revolves around the nucleus in fixed orbit of definite radii. As long as the electron is in a certain orbit it does not radiate any energy.

Q12 : (b) When the atom gets appropriate energy from outside, then this electron rises to some higher energy level. Now it can return either directly to the lower energy level or come to the lowest energy level after passing through other lower energy levels hence all possible transitions take place in the source and many lines are seen in the spectrum.

Q13 : (a) **Q14 :** (b)