Chemistry

Standard level

Paper 1A

Practice paper

Topic: Electron Configuration (SL)

1. Which of the following is the correct ground-state electron configuration for a neutral copper (Cu) atom?
   A. [Ar] $4s^1$ $3d^{10}$
   B. [Ar] $4s^2$ $3d^9$
   C. [Ar] $4s^2$ $3d^{10}$
   D. [Ar] $4s^2$ $3d^8$

2. Which type of spectrum provides direct evidence for the existence of quantized energy levels within an atom?
   A. A continuous spectrum produced by white light.
   B. A line emission spectrum produced by a gas-filled discharge tube.
   C. A mass spectrum produced by the fragmentation of organic molecules.
   D. An absorption spectrum from a cold solid material.

3. What phenomenon is observed at the high-frequency (short wavelength) end of the hydrogen line emission spectrum?
   A. Convergence of the spectral lines as energy levels become closer.
   B. Divergence of the spectral lines as energy levels become further apart.
   C. The appearance of a continuous black background with no lines.
   D. The lines become wider and less distinct due to doppler broadening.

4. Which of the following electron transitions in a hydrogen atom results in the emission of light in the visible Balmer series?
   A. Transitions dropping down to the n = 1 energy level.
   B. Transitions dropping down to the n = 2 energy level.
   C. Transitions dropping down to the n = 3 energy level.
   D. Transitions dropping down to the n = 4 energy level.

5. Which of the following represents the correct ground-state electron configuration for the iron(II) ion (Fe^{2+})?
   A. [Ar] $4s^2$ $3d^4$
   B. [Ar] $3d^6$
   C. [Ar] $4s^2$ $3d^6$
   D. [Ar] $4s^1$ $3d^5$

6. Which of the following lists the electron sublevels in the correct order of increasing energy according to the Aufbau principle?
   A. 3p < 3d < 4s
   B. 3p < 4s < 3d
   C. 4s < 3d < 4p

D. Both B and C are correct.

7. How many individual orbitals are contained within a single 4f sublevel?
A. 1
B. 3
C. 5
D. 7

8. A neutral atom of an isotope of chlorine has a mass number of 37. How many protons, neutrons, and electrons are present in the Cl^- ion formed from this isotope?
A. 17 protons, 20 neutrons, 17 electrons
B. 17 protons, 20 neutrons, 18 electrons
C. 18 protons, 19 neutrons, 18 electrons
D. 17 protons, 37 neutrons, 18 electrons

9. Which of the following statements about isotopes of the same element is correct?
A. They have the same physical properties but different chemical properties.
B. They have the same chemical properties but different physical properties.
C. They have different atomic numbers but the same mass number.
D. They have the same number of neutrons but different number of protons.

10. An element consists of two isotopes: ^{63}X (abundance 69.1%) and ^{65}X (abundance 30.9%). What is the relative atomic mass of this element to two decimal places?
A. 63.62
B. 64.00
C. 63.50
D. 64.15

11. Which electron transition in a hydrogen atom involves the greatest release of energy?
A. n = 2 to n = 1
B. n = 3 to n = 2
C. n = 4 to n = 3
D. n = 5 to n = 4

12. What is the maximum number of electrons that can occupy the third principal energy level (n = 3)?
A. 8
B. 18
C. 32

D. 2

13. Which of the following best describes the shape of a p_z atomic orbital?
A. Spherical and centered on the nucleus.
B. Dumbbell-shaped and aligned along the z-axis.
C. Clover-shaped with four lobes in the xz plane.
D. Circular ring around the nucleus in the xy plane.

14. Which rule states that electrons fill degenerate orbitals (orbitals with the same energy) singly before pairing up?
A. Aufbau Principle
B. Pauli Exclusion Principle
C. Hund's Rule
D. Heisenberg Uncertainty Principle

15. According to the Pauli Exclusion Principle, what must be true for two electrons occupying the same orbital?
A. They must have the same spin.
B. They must have opposite spins.
C. One must be in a higher energy subshell than the other.
D. They must be in different principal energy levels.

16. What is the correct ground-state electron configuration of a neutral Chromium (Cr) atom?
A. [Ar] $4s^2$ $3d^4$
B. [Ar] $4s^1$ $3d^5$
C. [Ar] $3d^6$
D. [Ar] $4s^2$ $3d^6$

17. How many unpaired electrons are present in a neutral Phosphorus (P) atom in its ground state?
A. 1
B. 2
C. 3
D. 5

18. Which relationship between energy (E), frequency (f), and wavelength (λ) of electromagnetic radiation is correct?
A. E is directly proportional to λ.
B. f is inversely proportional to λ.

C. E is inversely proportional to f.
D. c (speed of light) = E / f.

19. Which of the following species is isoelectronic with a neutral Argon (Ar) atom?
A. Ca^{2+}
B. Mg^{2+}
C. Cl
D. S

20. Which observation provides direct evidence for the existence of discrete main energy levels in an atom?
A. The continuous spectrum from the Sun.
B. The fact that the line emission spectrum of hydrogen converges at high frequencies.
C. The observation of alpha particle scattering in the Gold Foil experiment.
D. The periodic trend in atomic radii down a group.