MISCELLANEOUS EXERCISE

Choose the correct options for each of the following questions. Questions marked with * may have more than one correct options.

1. If a certain metal was irradiated by using two different light radiations of frequency 'x' and '$2x$', the maximum kinetic energy of the ejected electrons are 'y' and '3y' respectively. The threshold frequency of the metal is :
(A) $x/3$ **(B)** $x/2$ **(C)** $3x/2$ **(D)** $2x/3$

2. A hydrogen atom in a state having a binding energy of 0.85 eV makes a transition to a state with excitation energy 10.2 eV. The energy in (eV) of the emitted photon is :
(A) 2.55 **(B)** 5.1 **(C)** 3.85 **(D)** 12.75

***3.** The energy of an electron in the Bohr's first orbit of H-atom is –13.6 eV. The possible energy values in (eV) of the excited states for electron in Bohr's orbits of hydrogen is(are) :
(A) –3.4 **(B)** –4.2 **(C)** –6.8 **(D)** +6.8

4. Ratio of frequency of revolution of electron in the 2nd excited state of He^+ and 2nd state of hydrogen is :
(A) 32/27 **(B)** 27/32
(C) 1/54 **(D)** 27/2

5. The wavelength of the first line of Lyman series for hydrogen is identical to that of the second line of Balmer series for some hydrogen like ion 'X'. The E_2 for 'X' is :
(A) –54.4 eV **(B)** –32.8 eV
(C) –13.6 eV **(D)** –3.8 eV

6. If each hydrogen atom in the ground state of 1.0 mol of H-atoms is excited by absorbing photons of energy 8.4eV, 12.09eV and 15.0eV of energy, then the number of spectral lines emitted is equal to :
(A) None **(B)** Two
(C) Three **(D)** Four

***7.** When an electron of H-atom jumps from a higher to lower energy state, then :
(A) its potential energy decreases
(B) its kinetic energy increases
(C) its angular momentum remains unchanged
(D) wavelength of de Broglie wave associated with the electron decreases

For Q. 8 - 10

In a mixture of H – He^+ gas (He^+ is singly ionized He atom), H atoms and He^+ ions are excited to their respective first excited states. Subsequently, H atoms transfer their total excitation energy to He^+ ions (by collisions). Assuming that the Bohr model of atom is applicable, answer the following questions.

8. The quantum number n of the state finally populated in He^+ ions is :
(A) 2 **(B)** 3 **(C)** 4 **(D)** 5

9. The wavelength of light emitted in the visible region by He^+ ions after collisions with H atoms is :
(A) 6.5×10^{-7} m **(B)** 5.6×10^{-7} m
(C) 4.8×10^{-7} m **(D)** 4.0×10^{-7} m

10. The ratio of the potential energy of the n = 2 electron for the H atom to that of He^+ ion is :
(A) 1/4 **(B)** 1/2 **(C)** 1 **(D)** 2

***11.** In a hydrogen like species, electron is in 2nd excited state. The Binding energy of 4th state of this species is 13.6 eV, then :
(A) A 25 eV photon can set free the electron from the second excited state of this sample
(B) 3 different types of photon will be observed if electron make transition up to ground state from the second excited state
(C) If 23 eV photon is used for electron in 2nd excited state then K.E. of the ejected electron is 1 eV
(D) 2nd line of Balmer series of this sample has same energy value as 1st excitation energy of H-atoms

***12.** The ratio of the de Broglie wavelength of a proton and α-particles will be 1 : 2 if their :
(A) velocity are in the ratio 1 : 8
(B) velocity are in the ratio 8 : 1
(C) kinetic energy are in the ratio 1 : 64
(D) kinetic energy are in the ratio 1 : 256

13. Which of the following has the maximum number of unpaired electrons ?

(A) Mg^{2+} **(B)** Ti^{3+} **(C)** V^{3+} **(D)** Fe^{2+}

***14.** Which of the following statements is (are) incorrect for an electron of quantum numbers $n = 4$ and $m = 2$?

(A) The value of ℓ may be 2

(B) The value of ℓ may be 3

(C) The value of s may be + 1/2

(D) The value of ℓ may be 0, 1, 2, 3.

***15.** Pick out the orbitals with the maximum number of nodal planes ?

(A) $3d_{xy}$ **(B)** $4d_{z^2}$ **(C)** $4d_{xy}$ **(D)** $2p_x$

16. Which of the following orbitals will have the maximum number of radial nodes ?

(A) 3s **(B)** $4d_{z^2}$ **(C)** $4d_{xy}$ **(D)** $2p_x$

For Q. 17 - 18

It is impossible to determine simultaneously the position of velocity of small microscopic particle like, electron, proton or neutron with accuracy. This is called Heisenberg's uncertainty principle. Mathematically it is represented as $\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$

Δx is uncertainty in position, Δp is uncertainty in momentum.

17. If uncertainty in the measurement of position and momentum of an electron are equal then uncertainly in the measurement of its velocity is approximately :

(A) 8×10^{12} m/s **(B)** 6×10^{12} m/s

(C) 4×10^{12} m/s **(D)** 2×10^{12} m/s

18. If a 1.0 g body is travelling along X-axis at 100 cm s^{-1} with an uncertainty in velocity as 2 cms^{-1}. The uncertainty in its position is :

(A) 5.28×10^{-30} m **(B)** 2.64×10^{-30} m

(C) 1.30×10^{-30} m **(D)** 0.66×10^{-30} m

19. A mono chromatic source of light rated at 200 W emits 4×10^{20} photons per second. Find the wavelength of light.

(A) 400 nm **(B)** 800 nm

(C) 1200 nm **(D)** None of these

20. Three photons coming from excited atomic-hydrogen sample are picked up. Their energies are 12.1 eV, 10.2 eV and 1.9 eV. These photons must come from :

(A) a single atom **(B)** two atoms

(C) three atoms

(D) either two atoms or three atoms

21. In which of the following transitions will the wavelength be minimum ?

(A) n = 5 to n = 4 **(B)** n = 4 to n = 3

(C) n = 3 to n = 2 **(D)** n = 2 to n = 1

22. If the shortest wavelength of H-atom in Lyman series is x, then longest wavelength in Balmer series of He^+ is :

(A) $\frac{9x}{5}$ **(B)** $\frac{36x}{5}$ **(C)** $\frac{x}{4}$ **(D)** $\frac{5x}{9}$

***23.** Which of the following ralate to light as wave motion ?

(A) diffraction **(B)** interference

(C) photoelectric effect **(D)** $E = mc^2$

24. Match the entries in Column I with the correctly related quantities in Column II.

Column - I (Electronic transition)		Column - II (Characteristics of radiation concerned)
(A)	$n_1 \rightarrow n_\infty$ in H-atoms	**1.** Visible radiations
(B)	$n_4 \rightarrow n_2$ in He^+ ion	**2.** Energy numerically equal to Rydberg energy
(C)	$n_\infty \rightarrow n_1$ in He^+ ion	**3.** Energy numerically equal to Ionization Energy
(D)	$n_4 \rightarrow n_2$ in H-atom	**4.** Ultraviolet radiations

25. Match the entries in Column I with the correctly related quantities in Column II.

Column - I		Column - II
(A)	Angular momentum	**1.** Increases by increasing n
(B)	Kinetic energy	**2.** Decreases by decreasing Z
(C)	Potential energy	**3.** Increases by decreasing Z
(D)	Velocity	**4.** Decreases by decreasing n