2. ATOMIC STRUCTURE

1. A hydrogen atom in an excited state emits a photon which has the longest wavelength of the Paschen series. Further emissions from the atom cannot include the

(1) longest wavelength of the Lyman series

(2) second longest wavelength of the Lyman series

(3) longest wavelength of the Balmer series

(4) second longest wavelength of the Balmer series

2. Whenever a hydrogen atom emits a photon in the Balmer series

(A) it may emit another photon in the Balmer series

(B) it may emit another photon in the Lyman series

(C) the second photon, if emitted will have a wavelength of about 122 nm

(D) it may emit a second photon, but the wavelength of this photon cannot be predicted

(1) A, D (2) A, B, C (3) B, C (4) B, D

3. If the radius of first Bohr's orbit of H-atom is x, which of the following is the correct conclusion -

(A) The de-Broglie wavelength in the third Bohr orbit of H-atom = $6\pi x$

(B) The fourth Bohr's radius of He^+ ion = 8x

(C) The de-Brglie wavelength in third Bohr's orbit of Li^{2+} = 2x

(D) The second Bohr's radius of Be^{2+} = x

(1) B, C, D (2) A, B, C (3) A, B, D (4) C, D

4. The ratio of the wavelength of a proton & α-particle will be 1 : 2 if their

(A) Velocity of proton to velocity of α particle is in the ratio 1 : 8

(B) Velocity of proton to velocity of α particle is in the ratio 8 : 1

(C) Kinetic energy of proton to Kinetic energy of α particle is in the ratio 64 : 1

(D) Kinetic energy of proton to Kinetic energy of α particle is in the ratio 16 : 1

(1) A, C (2) B, C (3) B, D (4) A, B

5. According to Bohr's atomic model, choose the correct statement among -

(1) The shortest wavelength in brackett series of He^+ ion is $R_H/4$

(2) The radius of 3^{rd} orbit of Li^{2+} is equal to radius of 1^{st} orbit of H-atom

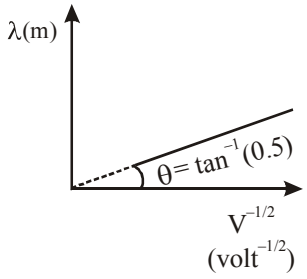
(3) The velocity of electron in 3^{rd} orbit of Li^{2+} is equal to velocity of electron in 1^{st} orbit of H-atom

(4) The frequency of revolution of an electron in n^{th} orbit of H-like species is directly proportional to n^3

6. In a sample of a hydrogen atoms, all the atoms are in 5th excited state. If they de-excite to the ground state, the ratio of longest and shortest wavelengths of emitted photons is

(1) 6 : 1 (2) 875 : 11 (3) 384 : 9 (4) 35 : 1

7. Observe the following graph for the de-Broglie wavelength of a hypothetical charged particle (q = 1.6×10^{-19}C). Find the mass of the particle



(h = 6.0×10^{-34} J-s)

(1) 45×10^{-49} kg (2) 45×10^{-45} kg (3) 4.5×10^{-45} kg (4) 4.5×10^{-49} gm

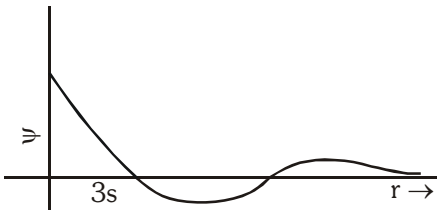
8. A green bulb and a red bulb are emitting the radiations with equal power. The correct relation between numbers of photons emitted by the bulbs per second is

(1) $n_g = n_r$ (2) $n_g < n_r$ (3) $n_g > n_r$ (4) unpredictable

9. In an excited state, a calcium atom has the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4d^1$. What is the orbital angular momentum for d electron :- $\left(\hbar = \frac{h}{2\pi}\right)$

(1) $\sqrt{4}\hbar$ (2) $\sqrt{16}\hbar$ (3) $\sqrt{6}\hbar$ (4) $\sqrt{10}\hbar$

10. The wave function (ψ) verses radial distance (r) curve for certain orbital is given. Predict the shape of $\psi^2.4\pi r^2$ (radial probability distribution function) verses r graph.



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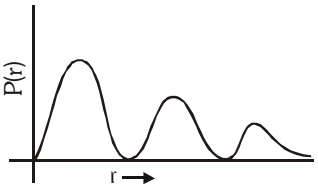

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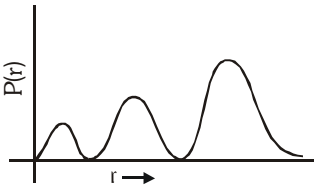

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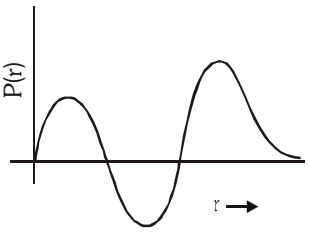

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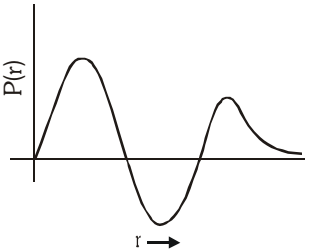


11. In a hydrogen like sample electron is in 2nd excited state, the energy of 4th state of this sample is – 13.6 eV, then incorrect statement is :

(1) Atomic number of element is 4.

(2) 3 different types of spectral line will be observed if electrons make transition upto ground state from the 2nd excited state.

(3) A 25 eV photon can set free the electron from the 2nd excited state of this sample

(4) 2nd line of Balmer series of this sample has same energy value as 1st excitation energy of H-atoms.

12. An electron in a hydrogen atom in its ground state absorbs energy equal to the ionisation energy of Li^{+2}. The wavelength of the emitted electron is:

(1) 3.32×10^{-10} m (2) 1.17 Å (3) 2.32×10^{-9} nm (4) 3.33 pm

13. Given ΔH for the process $Li(g) \longrightarrow Li^{+3}(g) + 3e^-$ is 19800 kJ/mole & IE_1 for Li is 520 then IE_2 & IE_3 of Li are respectively (approx, value)

(1) 7505 , 11775 (2) 520 , 19280 (3) 11775 , 19280 (4) Data insufficient

14. Which of the following could be derived from Rutherford's α-particle scattering experiment-

(A) Most of the space in the atom is empty

(B) The radius of the atom is about 10^{-10} m while that of nucleus is 10^{-15}m

(C) Electrons move in a circular path of fixed energy called orbits

(D) Electrons and the nucleus are held together by electrostatic forces of attraction.

(1) A, B, D (2) B, C, D (3) A, B, C (4) All of these

15. In a H-like sample electrons make transition from 5^{th} excited state to 2^{nd} excited state

(A) 10 different spectral lines will be emiited

(B) 6 different spectral lines will be emiited

(C) Number of lines belonging to Balmer series will be 4

(D) Number of lines belonging to paschen series will be 3

(1) A, C (2) B, C (3) A, D (4) B, D

16. Select the correct statement(s):

(A) All electromagnetic radiation travel with speed of light in vaccum.

(B) Energy of photon of UV light is lower than that of yellow light.

(C) He^+ and H have similar spectrum.

(D) The total energy of an electron in unielectronic species is greater than zero

(1) A, B, C, D (2) B, C, D (3) A, C (4) C only

17. Choose the incorrect statement(s):

(A) Increasing order of wavelength is

Micro waves > Radio waves > IR waves > visible waves > UV waves

(B) The order of Bohr radius is (r_n : where n is orbit number for a given atom) $r_1 < r_2 < r_3 < r_4$

(C) The order of total energy is (E_n : where n is orbit number for a given atom) $E_1 > E_2 > E_3 > E_4$

(D) The order of velocity of electron in H, He^+, Li^+, Be^{3+} species in second Bohr orbit is

$Be^{3+} > Li^{+2} > He^+ > H$

(1) A, C (2) B, C (3) A, B, C (4) B, C, D

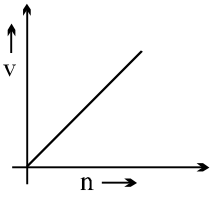
18. Select the incorrect curve(s):

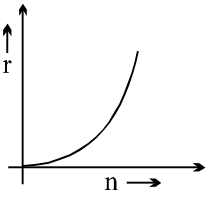
If v = velocity of electron in Bohr's orbit

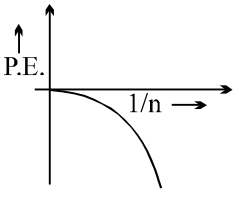
r = Radius of electron in Bohr's orbit

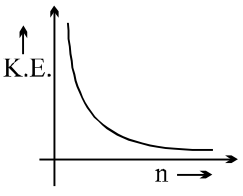
P.E. = Potential energy of electron in Bohr's orbit

K.E. = Kinetic energy of electron in Bohr's orbit.

(1) 

(2) 

(3) 

(4) 

19. Which is / are correct statement.

(A) The difference in angular momentum associated with the electron present in consecutive orbits of H-atom is $(n-1)\frac{h}{2\pi}$

(B) Energy difference between energy levels will be changed if, P.E. at infinity assigned value other than zero.

(C) Frequency of spectral line in a H-atom is in the order of $(2 \to 1) < (3 \to 1) < (4 \to 1)$

(D) On moving away from the nucleus, kinetic energy of electron decreases.

(1) A, B (2) B, C (3) C, D (4) A, D

20. If the shortest wavelength in Lyman series of hydrogen atom is A, then the longest wavelength in Paschen series of He^+ is :

(1) $\frac{36A}{5}$ (2) $\frac{9A}{5}$ (3) $\frac{36A}{7}$ (4) $\frac{5A}{9}$

21. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with :-

(1) Brackett series (2) Balmer series (3) Lyman series (4) Paschen series

22. The de-Broglie's wavelength of electron present in first Bohr orbit of 'H' atom is :-

(1) $\frac{0.529}{2\pi}$Å (2) $2\pi \times 0.529$Å (3) 0.529Å (4) 4×0.529Å

ANSWER KEY															
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	**4**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**4**	**2**	**1**	**1**	**4**
Que.	16	17	18	19	20	21	22								
Ans.	**3**	**1**	**1**	**3**	**3**	**2**	**2**								