Q1. 21 January Shift 1

Given below are two statements :

Statement I: When an electric discharge is passed through gaseous hydrogen, the hydrogen molecules dissociate and the energetically excited hydrogen atoms produce electromagnetic radiation of discrete frequencies.

Statement II: The frequency of second line of Balmer series obtained from He^+ is equal to that of first line of Lyman series obtained from hydrogen atom.

In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is false but Statement II is true
(2) Both Statement I and Statement II are true
(3) Statement I is true but Statement II is false
(4) Both Statement I and Statement II are false

Q2. 21 January Shift 2

Consider the following spectral lines for atomic hydrogen :

A. First line of Paschen series

B. Second line of Balmer series

C. Third line of Paschen series

D. Fourth line of Bracket series.

The correct arrangement of the above lines in ascending order of energy is :

(1) $D < C < A < B$
(2) $D < A < C < B$
(3) $C < D < B < A$
(4) $A < B < C < D$

Q3. 22 January Shift 1

The energy required by electrons, present in the first Bohr orbit of hydrogen atom to be excited to second Bohr orbit is ____ $Jmol^{-1}$. Given: $R_H = 2.18 \times 10^{-11}$ergs.

(1) 9.835×10^{12}
(2) 1.635×10^{-18}
(3) 1.635×10^{-11}
(4) 9.835×10^{5}

Q4. 22 January Shift 2

The energy of first (lowest) Balmer line of H atom is x J. The energy (in J) of second Balmer line of H atom is :

(1) $1.35x$
(2) x^2
(3) $2x$
(4) $\frac{x}{1.35}$

Q5. 23 January Shift 1

Given,

(A) $n = 5,\ m_l = -1$

(B) $n = 3, l = 2,\ m_l = -1,\ m_s = +\frac{1}{2}$

The maximum number of electron(s) in an atom that can have the quantum numbers as given in (A) and (B) respectively are :

(1) 8 and 1
(2) 2 and 4
(3) 26 and 1
(4) 4 and 1

Q6. 23 January Shift 1

Which of the following statements regarding the energy of the stationary state is true in the following one - electron systems ?

(1) $+2.18 \times 10^{-18}$ J for second orbit of He^{+}ion

(2) -2.18×10^{-18} J for third orbit of Li^{2+} ion

(3) -1.09×10^{-18} J for second orbit of H atom.

(4) $+8.72 \times 10^{-18}$ J for first orbit of He^{+}ion

Q7. 23 January Shift 2

The work functions of two metals (M_A and M_B) are in the 1 : 2 ratio. When these metals are exposed to photons of energy 6 eV, the kinetic energy of liberated electrons of M_A : M_B is in the ratio of 2.642 : 1. The work functions (in eV) of M_A and M_B are respectively.

(1) $1.4, 2.8$ (2) $2.3, 4.6$ (3) $1.5, 3.0$ (4) $3.1, 6.2$

Q8. 23 January Shift 2

Identify the INCORRECT statements from the following:

A. Notation $^{24}_{12}Mg$ represents 24 protons and 12 neutrons.

B. Wavelength of a radiation of frequency 4.5×10^{15} s^{-1} is 6.7×10^{-8} m.

C. One radiation has wavelength $= \lambda_1(900$ nm) and energy $= E_1$. Other radiation has wavelength $= \lambda_2(300$ nm) and energy $= E_2$. $E_1 : E_2 = 3 : 1$.

D. Number of photons of light of wavelength 2000 pm that provides 1 J of energy is 1.006×10^{16}.

Choose the correct answer from the options given below:

(1) B and C Only (2) A and D Only

(3) A and C Only (4) A and B Only

Q9. 24 January Shift 1

The hydrogen spectrum consists of several spectral lines in Lyman series (L_1, L_2, $L_3 \ldots$; L_1 has lowest energy among Lyman series). Similarly it consists of several spectral lines in Balmer series (B_1, B_2, $B_3 \ldots$; B_1 has lowest energy among Balmer lines). The energy of L_1 is x times the energy of B_1. The value of x is ____ $\times 10^{-1}$. (Nearest integer)

Q10. 24 January Shift 2

The wavelength of spectral line obtained in the spectrum of Li^{2+} ion, when the transition takes place between two levels whose sum is 4 and difference is 2, is

(1) 1.14×10^{-7} cm (2) 1.14×10^{-6} cm

(3) 2.28×10^{-7} cm (4) 2.28×10^{-6} cm

Q11. 28 January Shift 1

The wave numbers of three spectral lines of H atom are considered. Identify the set of spectral lines belonging to Balmer series.

(R = Rydberg constant)

(1) $\frac{7R}{144}, \frac{3R}{16}, \frac{16R}{255}$

(2) $\frac{5R}{36}, \frac{8R}{9}, \frac{15R}{16}$

(3) $\frac{3R}{4}, \frac{3R}{16}, \frac{7R}{144}$

(4) $\frac{5R}{36}, \frac{3R}{16}, \frac{21R}{100}$

Q12. 28 January Shift 1

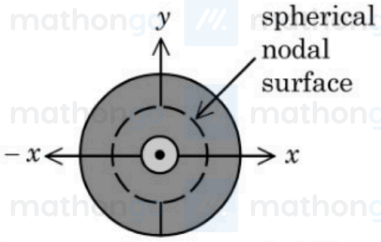


Figure 1. electron probability density for 2s orbital

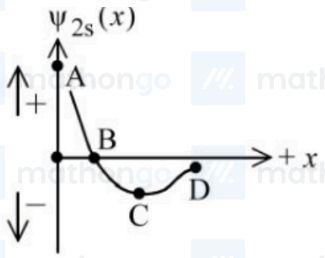


Figure 2. wave function for 2s orbital

Which of the following point in Figure 2 most accurately represents the nodal surface as shown in Figure 1?

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

Q13. 28 January Shift 2

The wavelength of photon ' A ' is 400 nm. The frequency of photon ' B ' is 10^{16} s^{-1}. The wave number of photon ' C' is 10^4 cm^{-1}. The correct order of energy of these photons is :

(1) C > B > A

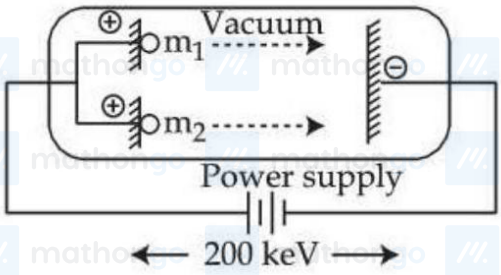
(2) B > A > C

(3) A > B > C

(4) A > C > B

Q14. 28 January Shift 2

Two positively charged particles m_1 and m_2 have been accelerated across the same potential difference of 200 keV as shown below.



[Given mass of $m_1 = 1$ amu and $m_2 = 4$ amu]

The deBroglie wavelength of m_1 will be x times of m_2. The value of x is ____ (nearest integer)

ANSWER KEYS

1. (2)	**2.** (2)	**3.** (4)	**4.** (1)	**5.** (1)	**6.** (1)	**7.** (2)	**8.** (3)
9. 54	**10.** (2)	**11.** (4)	**12.** (4)	**13.** (2)	**14.** 2		