PHYSICS GURUKUL

DPP - Daily Practice Problems

Chapter-wise Sheets

Date : _____ **Start Time :** _____ **End Time :** _____

CHEMISTRY

CC02

SYLLABUS : Structure of Atom

Max. Marks : 74 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 20 Questions divided into 5 sections.
  Section I has **5** MCQs with ONLY 1 Correct Option, **3** marks for each correct answer and **–1** for each incorrect answer.
  Section II has **4** MCQs with ONE or MORE THAN ONE Correct options.
  For each question, marks will be awarded in one of the following categories:
  Full marks: **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  Partial marks: **+1** For darkening a bubble corresponding to each correct option provided NO INCORRECT option is darkened.
  Zero marks: If none of the bubbles is darkened.
  Negative marks: **–2** In all other cases.
  Section III has **5** Single Digit Integer Answer Type Questions, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section IV has Comprehension/Matching Cum-Comprehension Type Questions having **5** MCQs with ONLY ONE correct option, **3** marks for each Correct Answer and 0 marks in all other cases.
  Section V has **1** Matching Type Questions, **2** mark for the correct matching of each row and 0 marks in all other cases.
- You have to evaluate your Response Grids yourself with the help of Solutions.

Section I - Straight Objective Type

This section contains 5 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

1. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become

(a) one fourth (b) half

(c) four times (d) two times

2. An electron, e_1 is moving in the fifth stationary state, and another electron e_2 is moving in the fourth stationary state. The radius of orbit of electron, e_1 is five times the radius of orbit of electron, e_2 calculate the ratio of velocity of electron e_1 (v_1) to the velocity of electron e_2 (v_2).

(a) 5 : 1 (b) 4 : 1 (c) 1 : 5 (d) 1 : 4

3. If the shortest wavelength of the spectral line of H-atom in the Lyman series is X, then the longest wavelength of the line in Balmer series of Li^{2+} is

(a) 9x (b) $\frac{x}{9}$ (c) $\frac{5x}{4}$ (d) $\frac{4x}{5}$

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ

Space for Rough Work

4. If we apply potential difference so that an electron is accelerated continuously in a vacuum tube such that a decrease of 10% occurs in its de-Broglie wave length. In such a case the change observed in kinetic energy of electron will be approximately
   (a) a decrease of 11% (b) an increase of 11.1%
   (c) an increase of 10% (d) an increase of 23.4%

5. The ratio of the frequency corresponding to the third line in Lyman series of hydrogen atomic spectrum to that of the first line in Balmer series of Li^{2+} spectrum is
   (a) $\frac{4}{5}$ (b) $\frac{5}{4}$ (c) $\frac{4}{3}$ (d) $\frac{3}{4}$

Section II - Multiple Correct Answer Type

This section contains 4 multiple correct answer(s) type questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONE OR MORE is/are correct.

6. The energy of an electron in the first Bohr orbit of H-atom is –13.6 eV. Then, which of the following statement(s) is/are correct for He^+?
   (a) The energy of electron in second Bohr orbit is –13.6 eV
   (b) The kinetic energy of electron in the first orbit is 54.46 eV
   (c) The kinetic energy of electron in the second orbit is 13.6 eV
   (d) The speed of electron in the second orbit is $2.19 \times 10^6\ ms^{-1}$

7. Identify the elements of lowest atomic numbers which have the characteristics listed as below
   A. Eleven *p* electrons
   B. one electron with $m_l = 2$
   C. Two electrons with $n = 3, l = 2$
   (a) Cl, Ti, Sc (b) Cl, Sc, Ti
   (c) Cl, V, Cr (d) Cl, Ti, V

8. If the wave number of 1st line of Balmer series of H-atom is '*x*' then
   (a) wave number of 1st line of lyman series of He^+ ion will be $\frac{108x}{5}$
   (b) wave number of 1st line of lyman series of He^+ ion will be $\frac{36x}{5}$
   (c) the wave length of 2nd line of lyman series of H-atom is $\frac{5}{32x}$
   (d) the wave length of 2nd line of lyman series of H-atom is $\frac{32x}{5}$

9. According to Bohr's theory
   (a) when a required amount of energy is supplied to an electron in an atom it jumps from lower orbit to higher orbit and remains there
   (b) when a required amount of energy is supplied to an electron in an atom it jumps from lower orbit to higher orbit and remains there for very short interval of time and returns back to lower orbit, radiating energy
   (c) the angular momentum of an electron is proportional to its quantum number, *n*
   (d) the angular momentum of an electron is independent of its quantum number, *n*

Section III - Integer Type

This section contains 5 questions. The answer to each of the questions is a single digit integer ranging from 0 to 9.

10. Suppose velocity of an α–particle travelling towards the nucleus of a copper atom so as to arrive at a distance 10^{-13} metre from the nucleus of the copper atom is given by $x \times 10^y$. Then what will be the value of y?

11. An electron has a speed of 30,000 cm sec^{-1} accurate upto 0.001%. What is the uncertainty in locating it's position.

12. If the energies of two radiations of wavelength 800 nm and 400 nm are E_1 and E_2 respectively. Then calculate the value of E_2/E_1.

13. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300 nm wavelength falls on the metal is

Metal	Li	Na	k	Mg	Cu	Ag	Fe	Pt	W
ϕ (eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

14. In an atom how many orbital(s) will have the quantum numbers; $n = 3, l = 2$ and $m_l = +2$?

RESPONSE GRID					
	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ
	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓪①②③④⑤⑥⑦⑧⑨		
	11. ⓪①②③④⑤⑥⑦⑧⑨		12. ⓪①②③④⑤⑥⑦⑧⑨		
	13. ⓪①②③④⑤⑥⑦⑧⑨		14. ⓪①②③④⑤⑥⑦⑧⑨		

Space for Rough Work

Section IV - Comprehension Type

Directions (Qs. 15-19) : Based upon the given paragraphs, 5 multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct.

PARAGRAPH-1

Directions (Qs. 15-17): By appropriately matching the information given in the three columns of the following table, give the answer of the questions that follows.

Bohr's theory successfully explains the hydrogen spectrum. It also explains the spectrum of some other one-electron system (H-like system) such as He^{+}, Li^{2+}, Be^{3+} etc. With the help of Bohr's theory we find out, Radius of the orbit in which the electron is revolving around the nucleus, Energy of electron in an orbits, velocity and wavelength.

Column I	Column II	Column III
(I) Radius	(i) $\frac{2\pi Ze^2}{nh}$	(P) $-\frac{Z^2}{n^2}\times 313.6$
(II) Velocity	(ii) $\frac{n^2h^2}{4\pi^2 mZe^2}$	(Q) $R\times Z^2\left[\frac{1}{n_1^2}-\frac{1}{n_2^2}\right]$
(III) Energy	(iii) $\frac{2\pi^2 me^4}{ch^2}$	(R) $\left(\frac{Ze^2}{rm}\right)^{1/2}$
(IV) Wavelength	(iv) $-\frac{2\pi^2\ mZ^2e^4}{n^2\ h^2}$	(S) $\frac{n^2}{Z}\times 0.0529$

15. The only correct combination of formula for the radius give in column I is

(a) (I) (ii) (P) (b) (I) (iii) (R)

(c) (I) (ii) (S) (d) (I) (iv) (Q)

16. The only correct combination of formula for the velocity given in column I is

(a) (II) (iii) (P) (b) (II) (i) (R)

(c) (II) (ii) (S) (d) (II) (iv) (Q)

17. The only correct combination of formula for the energy given in column I is

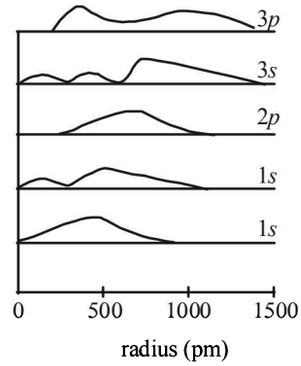
(a) (III) (i) (Q) (b) (III) (ii) (R)

(c) (III) (iv) (S) (d) (III) (iv) (P)

PARAGRAPH-2

Radial wave function depends on n and l but not on m. Thus each of the three p-orbitals have the same radial form. The wave functions may have positive or negative regions but their radial probability distributions (figure below) show the following features.

- Radial distributions may have several peaks, the number being equal to $(n-1)$.
- The outermost peak is by far the largest, showing where the electron is most likely to be found. The distance of this peak from the nucleus is a measure of the radius of the orbital and is roughly proportional to n^2 (although it slightly depends on l also)



RESPONSE GRID 15. ⓐⓑⓒⓓ 16. ⓐⓑⓒⓓ 17. ⓐⓑⓒⓓ

Space for Rough Work

Radial distributions determine the energy of an electron in an atom. The subsidiary maxima at smaller distances are not significant in hydrogen, but are useful in understanding the energies in many electron atoms.

The energies of atomic orbitals in hydrogen atom are given by the formula $E_n = -\frac{R}{n^2}$

This shows that the energy depends only on the principal quantum number, n.

All orbitals with finite n represent bound electrons with lower energy. Energies of individual atoms or molecules are expressed in **electron volts** (eV) equal to about 1.602×10^{-19} J.

For many electron atoms

The orbital sizes and energies depend on the atomic number 'Z'

Average radius of an orbital $\simeq \frac{n^2 a_0}{Z}$

Where a_0 = Bohr's radius (59 pm)

i.e., radius of 1s orbital of hydrogen atom

Also $E_n = -\frac{Z^2 R}{n^2}$

18. If the subsidiary quantum number of a sub-energy level is 4, the maximum and minimum values of the spin multiplicities are given by

(a) 4, –4 (b) 9, 1 (c) 10, 1 (d) 10, 2

19. The number of d-electrons in Fe^{2+} is **not** equal to that of

(a) d-electrons in Iron

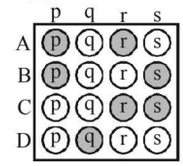
(b) p-electrons in Neon

(c) p-electrons in Chlorine

(d) s-electrons in Magnesium

Section V - Matrix-Match Type

This section contains 1 questions. It contains statements given in two columns, which have to be matched. Statements in column I are labelled as A, B, C and D whereas statements in column II are labelled as p, q, r and s. The answers to these questions have to be appropriately bubbled as illustrated in the following example. If the correct matches are A-p, A-r, B-p, B-s, C-r, C-s and D-q, then the correctly bubbled matrix will look like the following:



20. If the shortest wavelength of spectral line of H-atom in Lyman series is x, then match the following for Li^{2+}

	Column I		Column II
(A)	Shortest wavelength in Lyman series	p.	$\frac{4x}{5}$
(B)	Longest wavelength in Lyman series	q.	$\frac{4x}{9}$
(C)	Shortest wavelength in Balmer series	r.	$\frac{x}{9}$
(D)	Longest wavelength in Balmer series	s.	$\frac{4x}{27}$

RESPONSE GRID	18. ⓐⓑⓒⓓ 19. ⓐⓑⓒⓓ 20. A - ⓟⓠⓡⓢ; B - ⓟⓠⓡⓢ; C - ⓟⓠⓡⓢ; D - ⓟⓠⓡⓢ

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 2 - CHEMISTRY			
Total Questions	20	Total Marks	74
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	26	Qualifying Score	38
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work