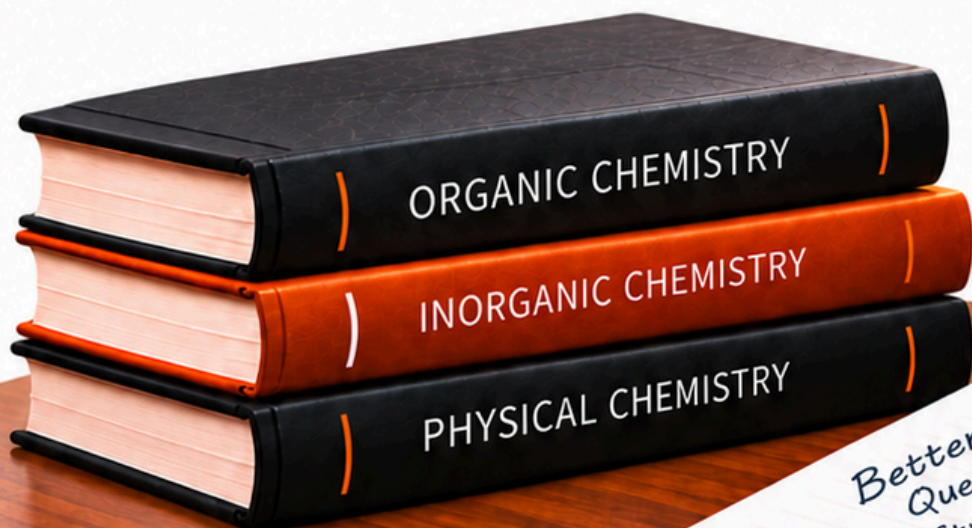
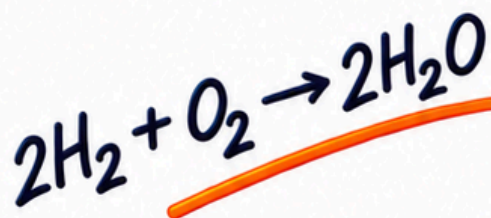
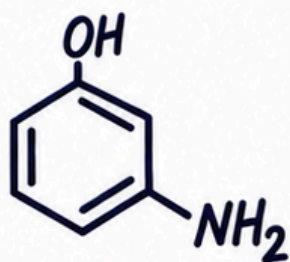


JEE Main Chemistry

Spectrum of the hydrogen atom PYQ

PRACTICE
TODAY
A BRIGHTER
TOMORROWBetter
Questions
Stronger
Concepts
Brighter Future

Subject: Chemistry

Years: 2026-2004

Total Questions: 31

About this PYQ collection

What is inside

A complete topic-wise set of **31 previous year questions** on **Spectrum of the hydrogen atom** from **JEE Main (2026-2013)** and its predecessor **AIEEE (2012-2004)**, across **13 exam years**. **23 questions** are from 2019 onwards, so most of the set reflects the recent NTA pattern.

Questions are arranged to reduce unused page space, with newest-first priority and continuous numbering from 1. Each carries an exam date and shift tag to trace the original paper.

Topic-wise questions

TOPIC	QS	%
Spectrum of the hydrogen atom	31	100%

Question types

TYPE	QS	%
Single-correct MCQ	26	84%
Numerical value	5	16%

Numerical-value questions have no options; all 5 are from 2022 onwards.

How these questions help you

- **Know where the marks are:** spectrum of the hydrogen atom make up **31 of 31 questions (about 100%)**.
- **Build speed and accuracy:** practice the concepts and question styles used in previous papers.
- **Learn the patterns:** the same question styles return year after year.
- **Strengthen other chapters:** these concepts support further study in Chemistry.

Questions – Spectrum of the hydrogen atom

1. If shortest wavelength of hydrogen atom in Lyman series is x , then longest wavelength in Balmer series of He^+ is: (6 Apr 2026 | Shift 1)
- (A) $\frac{9x}{5}$ (B) $\frac{36x}{5}$
(C) $\frac{x}{4}$ (D) $\frac{5x}{9}$
-
2. What is the ratio of wave number of first line (lowest energy line) of Balmer series of H atomic spectrum to first line of its Brackett series? (4 Apr 2026 | Shift 1)
- (A) 5 : 1 (B) 5 : 0.81
(C) 5 : 1.75 (D) 5 : 27
-
3. 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) (28 Jan 2026 | Shift 1)
- (A) $\frac{5R}{36}, \frac{3R}{16}, \frac{21R}{100}$ (B) $\frac{7R}{144}, \frac{3R}{16}, \frac{16R}{255}$
(C) $\frac{3R}{4}, \frac{3R}{16}, \frac{7R}{144}$ (D) $\frac{5R}{36}, \frac{8R}{9}, \frac{15R}{16}$
-
4. The hydrogen spectrum consists of several spectral lines in Lyman series ($L_1, L_2, L_3 \dots$; L_1 has lowest energy among Lyman series). Similarly it consists of several spectral lines in Balmer series ($B_1, B_2, B_3 \dots$; 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) (24 Jan 2026 | Shift 1)
-
5. 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 : (22 Jan 2026 | Shift 2)
- (A) $\frac{x}{1.35}$ (B) $1.35x$
(C) x^2 (D) $2x$
-
6. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H atom is suitable for this?
Given : Rydberg constant $R_H = 10^5 \text{ cm}^{-1}$, $h = 6.6 \times 10^{-34} \text{ J s}$, $c = 3 \times 10^8 \text{ m/s}$ (23 Jan 2025 | Shift 1)
- (A) Lyman series, $\infty \rightarrow 1$ (B) Balmer series, $\infty \rightarrow 2$
(C) Paschen series, $5 \rightarrow 3$ (D) Paschen series, $\infty \rightarrow 3$

7. 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 :

(21 Jan 2026 | Shift 1)

- | | |
|---|---|
| (A) Both Statement I and Statement II are true | (B) Statement I is true but Statement II is false |
| (C) Statement I is false but Statement II is true | (D) Both Statement I and Statement II are false |

8. 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 :

(21 Jan 2026 | Shift 2)

- | | |
|---------------------|---------------------|
| (A) $D < C < A < B$ | (B) $A < B < C < D$ |
| (C) $D < A < C < B$ | (D) $C < D < B < A$ |

9. Number of spectral lines obtained in He^+ spectra, when an electron makes transition from fifth excited state to first excited state will be

(30 Jan 2024 | Shift 2)

10. The number of following statement/s which is/are incorrect is _____

- (A) Line emission spectra are used to study the electronic structure
- (B) The emission spectra of atoms in the gas phase show a continuous spread of wavelength from red to violet
- (C) An absorption spectrum is like the photographic negative of an emission spectrum
- (D) The element helium was discovered in the sun by spectroscopic method

(8 Apr 2023 | Shift 1)

11. If wavelength of the first line of the Paschen series of hydrogen atom is 720 nm, then the wavelength of the second line of this series is _____ nm. (Nearest integer)

(24 Jan 2023 | Shift 1)

12. Match List I with List II

	List - I (Spectral Series for Hydrogen)		List - II (Spectral Region/Highest Energy State)
(A)	Lyman	(I)	Infrared region
(B)	Balmer	(II)	UV region
(C)	Paschen	(III)	Infrared region
(D)	Pfund	(IV)	Visible region

Choose the correct answer from the options given below:

(29 Jan 2024 | Shift 2)

(A) A-II, B-IV, C-III, D-I

(B) A-I, B-III, C-II, D-IV

(C) A-II, B-III, C-I, D-IV

(D) A-I, B-II, C-III, D-IV

13. Which transition in the hydrogen spectrum would have the same wavelength as the Balmer type transition from $n = 4$ to $n = 2$ of He^+ spectrum

(31 Jan 2023 | Shift 1)

(A) $n = 3$ to $n = 4$

(B) $n = 2$ to $n = 1$

(C) $n = 1$ to $n = 2$

(D) $n = 1$ to $n = 3$

14. The shortest wavelength of hydrogen atom in Lyman series is λ . The longest wavelength is Balmer series of He^+ is

(29 Jan 2023 | Shift 1)

(A) $\frac{36\lambda}{5}$

(B) $\frac{5}{9\lambda}$

(C) $\frac{9\lambda}{5}$

(D) $\frac{5\lambda}{9}$

15. When the excited electron of a H atom from $n = 5$ drops to the ground state, the maximum number of emission lines observed are _____.

(25 Jul 2022 | Shift 2)

16. The region in the electromagnetic spectrum where the Balmar series lines appear is :

(4 Sept 2020 | Shift 1)

(A) Microwave

(B) Ultraviolet

(C) Visible

(D) Infrared

17. The shortest wavelength of H atom in the Lyman series is λ_1 . The longest wavelength in the Balmer series of He^+ is :

(4 Sept 2020 | Shift 2)

- (A) $\frac{5\lambda_1}{9}$ (B) $\frac{36\lambda_1}{5}$
(C) $\frac{27\lambda_1}{5}$ (D) $\frac{9\lambda_1}{5}$
-

18. For the Balmer series in the spectrum of H atom,
 $\bar{\nu} = R_H \left\{ \frac{1}{n_1^2} - \frac{1}{n_2^2} \right\}$, the correct statements among (I) to (IV) are :

(I) As wavelength decreases, the lines in the series converge

(II) The integer n_1 is equal to 2

(III) The lines of longest wavelength corresponds to $n_2 = 3$

(IV) The ionization energy of hydrogen can be calculated from wave number of these lines

(8 Jan 2020 | Shift 1)

- (A) (II), (III), (IV) (B) (I), (II), (III)
(C) (I), (III), (IV) (D) (I), (II), (IV)
-

19. The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are :

(10 Apr 2019 | Shift 2)

- (A) Paschen and Pfund (B) Balmer and Brackett
(C) Lyman and Paschen (D) Brackett and Pfund
-

20. For any given series of spectral lines of atomic hydrogen, let $\Delta \bar{\nu} = \Delta \bar{\nu}_{\max} - \Delta \bar{\nu}_{\min}$ be the difference in maximum and minimum frequencies in cm^{-1} . The ratio $\frac{\Delta \bar{\nu}_{\text{Lyman}}}{\Delta \bar{\nu}_{\text{Balmer}}}$ is :

(9 Apr 2019 | Shift 1)

- (A) 9 : 4 (B) 4 : 1
(C) 27 : 5 (D) 5 : 4
-

21. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H atom is suitable for this purpose?

$[R_H = 1 \times 10^5 \text{ cm}^{-1}, h = 6.6 \times 10^{-34} \text{ Js}, c = 3 \times 10^8 \text{ ms}^{-1}]$

(11 Jan 2019 | Shift 1)

- (A) Balmer, $\infty \rightarrow 2$ (B) Paschen, $5 \rightarrow 3$
(C) Paschen, $\infty \rightarrow 3$ (D) Lyman, $\infty \rightarrow 1$
-

22. The ground state energy of hydrogen atom is -13.6 eV. The energy of second excited state of He^+ ion in eV is : (10 Jan 2019 | Shift 2)
- (A) -6.04 (B) -54.4
(C) -27.2 (D) -3.4
-
23. For emission line of atomic hydrogen from $n_i = 8$ to $n_f = n$, the plot of wave number ($\bar{\nu}$) against $\left(\frac{1}{n^2}\right)$ will be (The Rydberg constant, R_H is in wave number unit) (9 Jan 2019 | Shift 1)
- (A) Linear with intercept $-R_H$ (B) Non linear
(C) Linear with slope R_H (D) Linear with slope $-R_H$
-
24. The electron in the hydrogen atom undergoes transition from higher orbitals to orbital of radius 211.6 pm. This transition is associated with : (9 Apr 2017 | Shift 1)
- (A) Lyman series (B) Balmer series
(C) Paschen series (D) Brackett series
-
25. If the shortest wavelength in Lyman series of hydrogen atom is A , then the longest wavelength in Paschen series of He^+ is : (8 Apr 2017 | Shift 1)
- (A) $\frac{5A}{9}$ (B) $\frac{9A}{5}$
(C) $\frac{36A}{5}$ (D) $\frac{36A}{7}$
-
26. Based on the equation: $\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right) \Delta E = -2.0 \times 10^{-18} \text{ J}$ – the wavelength of the light that must be absorbed to excite hydrogen electron from level $n = 1$ to level $n = 2$ will be: ($h = 6.625 \times 10^{-34} \text{ Js}$, $c = 3 \times 10^8 \text{ ms}^{-1}$) (11 Apr 2014 | Single slot)
- (A) $1.325 \times 10^{-7} \text{ m}$ (B) $1.325 \times 10^{-10} \text{ m}$
(C) $2.650 \times 10^{-7} \text{ m}$ (D) $5.300 \times 10^{-10} \text{ m}$
-
27. The wave number of the first emission line in the Balmer series of H -Spectrum is : (R = Rydberg constant :) (22 Apr 2013 | Single slot)
- (A) $(5)/(36R)$ (B) $(9)/(400R)$
(C) $(7)/(6)$ (D) $(3)/(4)$

28. Energy of an electron is given by $E = -2.178 \times 10^{-18} J \left(\frac{Z^2}{n^2} \right)$. Wavelength of light required to excite an electron in an hydrogen atom from level $n = 1$ to $n = 2$ will be ($h = 6.62 \times 10^{-34} \text{ Js}$ and $c = 3.0 \times 10^8 \text{ ms}^{-1}$) (7 Apr 2013 | Single sitting)
- (A) $2.816 \times 10^{-7} \text{ m}$ (B) $6.500 \times 10^{-7} \text{ m}$
(C) $8.500 \times 10^{-7} \text{ m}$ (D) $1.214 \times 10^{-7} \text{ m}$
-
29. The limiting line in Balmer series will have a frequency of (Rydberg constant, $R_\infty = 3.29 \times 10^{15} \text{ cycles/s}$) (7 May 2012 | Single slot)
- (A) $8.22 \times 10^{14} \text{ s}^{-1}$ (B) $3.29 \times 10^{15} \text{ s}^{-1}$
(C) $3.65 \times 10^{14} \text{ s}^{-1}$ (D) $5.26 \times 10^{13} \text{ s}^{-1}$
-
30. The ionization enthalpy of hydrogen atom is $1.312 \times 10^6 \text{ J mol}^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is (27 Apr 2008 | Single sitting)
- (A) $8.51 \times 10^5 \text{ J mol}^{-1}$ (B) $6.56 \times 10^5 \text{ J mol}^{-1}$
(C) $7.56 \times 10^5 \text{ J mol}^{-1}$ (D) $9.84 \times 10^5 \text{ J mol}^{-1}$
-
31. The wavelength of the radiation emitted when in a hydrogen atom electron falls from infinity to stationary state 1, would be (Rydberg constant = $1.097 \times 10^7 \text{ m}^{-1}$) (23 May 2004 | Single sitting)
- (A) 406 nm (B) 192 nm
(C) 91 nm (D) $9.1 \times 10^{-8} \text{ nm}$