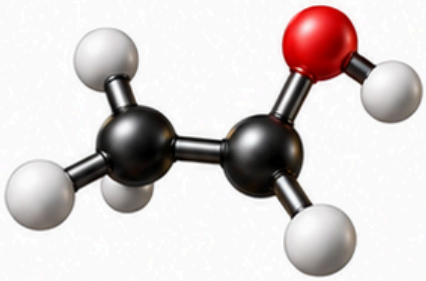
CHEMISTRY

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REACTIONS
CONCEPTS
QUESTIONS
HIGHER GOALS



# JEE Main Chemistry

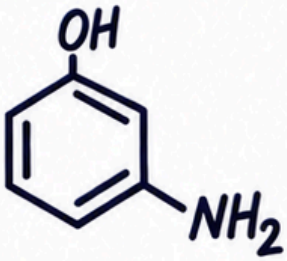
## Dual nature of matter and de Broglie's relationship PYQ






$C_2H_5OH$

$2H_2 + O_2 \rightarrow 2H_2O$



# Dual nature of matter and de Broglie's relationship JEE Main PYQ

Previous Year Questions - Topic-wise Collection

**Subject: Chemistry** **Years: 2026-2003** **Total Questions: 18**

## About this PYQ collection

### What is inside

A complete topic-wise set of **18 previous year questions** on **Dual nature of matter and de Broglie's relationship** from **JEE Main (2026-2013)** and its predecessor **AIEEE (2012-2003)**, across **14 exam years**. **11 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 | % |
|---|---|---|
| Dual nature of matter and de Broglie's relationship | **18** | 100% |

### Question types

| TYPE | QS | % |
|---|---|---|
| Single-correct MCQ | **11** | 61% |
| Numerical value | **7** | 39% |

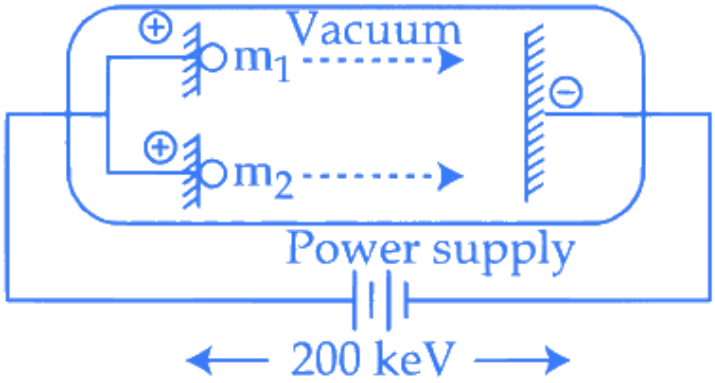
Numerical-value questions have no options; all 7 are from 2021 onwards.

### How these questions help you

- **Know where the marks are:** dual nature of matter and de broglie's relationship make up **18 of 18 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 – Dual nature of matter and de Broglie's relationship

**1.** 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)

(28 Jan 2026 | Shift 2)

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**2.** If $a_0$ is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength ($\lambda$) of the electron present in the second orbit of hydrogen atom? [n : any integer]

(29 Jan 2025 | Shift 1)

(A) $\frac{8\pi a_0}{n}$ (B) $\frac{2a_0}{n\pi}$

(C) $\frac{na_0}{4\pi}$ (D) $\frac{4\pi a_0}{n}$

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**3.** Frequency of the de-Broglie wave of electron in Bohr's first orbit of hydrogen atom is _____ $\times 10^{13}$ Hz (nearest integer).
[Given : $R_H$ (Rydberg constant) $= 2.18 \times 10^{-18}$ J, $h$ (Plank's constant) $= 6.6 \times 10^{-34}$ J.s .]

(6 Apr 2024 | Shift 1)

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**4.** The de-Broglie's wavelength of an electron in the $4^{th}$ orbit is _____ $\pi a_0$. ($a_0$ = Bohr's radius)

(4 Apr 2024 | Shift 1)

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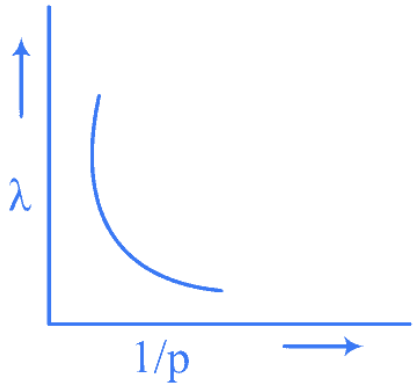
**5.** The wavelength of an electron of kinetic energy $4.50 \times 10^{-29}$ J is _____ $\times 10^{-5}$ m. (Nearest integer)
Given : mass of electron is $9 \times 10^{-31}$ kg, h $= 6.6 \times 10^{-34}$ J s

(6 Apr 2023 | Shift 1)

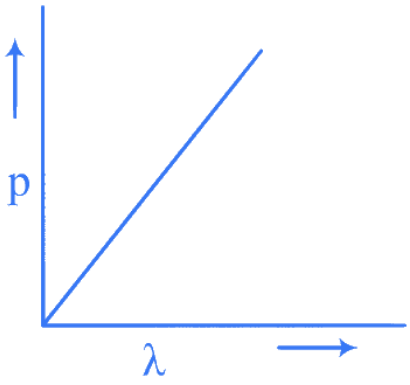
**6.** According to the wave-particle duality of matter by de-Broglie, which of the following graph plot presents most appropriate relationship between wavelength of electron $(\lambda)$ and momentum of electron $(p)$?

(1 Feb 2024 | Shift 1)

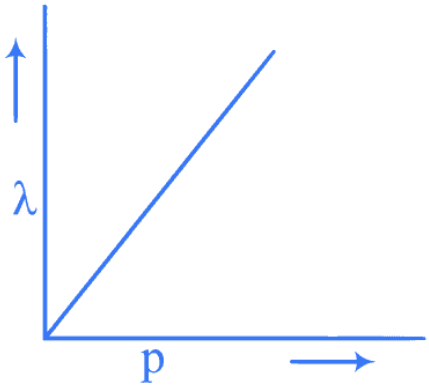
(A)



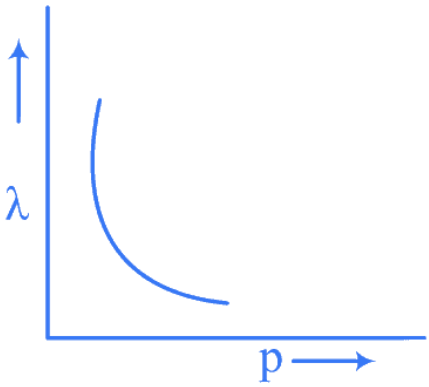

(B)




(C)




(D)




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**7.** If the radius of the first orbit of hydrogen atom is $\alpha_0$, then de Broglie's wavelength of electron in $3^{rd}$ orbit is :

(6 Apr 2023 | Shift 2)

(A) $\frac{\pi\alpha^3}{6}$

(B) $3\pi\alpha_0$

(C) $6\pi\alpha_0$

(D) $\frac{\pi\alpha^3}{3}$

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**8.** The wavelength of an electron and a neutron will become equal when the velocity of the electron is $x$ times the velocity of neutron. The value of $x$ is _____. (Nearest Integer)

(Mass of electron is $9.1 \times 10^{-31}$ kg and mass of neutron is $1.6 \times 10^{-27}$ kg )

(26 Jul 2022 | Shift 1)

**9.** Electrons in a cathode ray tube have been emitted with a velocity of 1000 m $s^{-1}$. The number of following statements which is/are <u>true</u> about the emitted radiation is _____.

Given : $h = 6 \times 10^{-34}$ J s, $m_e = 9 \times 10^{-31}$ kg.

(A) The de-Broglie wavelength of the electron emitted is 666.67 nm.

(B) The characteristic of electrons emitted depend upon the material of the electrodes of the cathode ray tube.

(C) The cathode rays start from cathode and move towards anode.

(D) The nature of the emitted electrons depends on the nature of the gas present in cathode ray tube.

(1 Feb 2023 | Shift 1)

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**10.** The wavelength of electrons accelerated from rest through a potential difference of 40 kV is x $\times 10^{-12}$ m. The value of x is _____. (Nearest integer)

Give : Mass of electron $= 9.1 \times 10^{-31}$ kg

Charge on an electron $= 1.6 \times 10^{-19}$ C

Planck's constant $= 6.63 \times 10^{-34}$ Js

(20 Jul 2021 | Shift 2)

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**11.** If the de Broglie wavelength of the electron in $n^{th}$ Bohr orbit in a hydrogenic atom is equal to 1.5 $\pi a_0$ ($a_0$ is Bohr radius), then the value of n/z is - (12 Jan 2019 | Shift 2)

(A) 0.75

(B) 0.40

(C) 1.50

(D) 1.0

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**12.** A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V esu. If e and m are charge and mass of an electron, respectively, then the value of h / $\lambda$ (where $\lambda$ is wavelength associated with electron wave) is given by : (3 Apr 2016 | Single sitting)

(A) 2meV

(B) $\sqrt{meV}$

(C) $\sqrt{2meV}$

(D) meV

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**13.** At temperature , the average kinetic energy of any particle is T(3)/(2)kT. The de Broglie wavelength follows the order (11 Apr 2015 | Single slot)

(A) Visible photon > thermal electron > thermal

(B) Thermal neutron > visible photon > thermal neutron.electron

(C) Thermal neutron > thermal electron > visible

(D) Visible photon > thermal neutron > thermal photon.electron

**14.** The de-Broglie wavelength of a particle of mass 6.63 g moving with a velocity of 100 ms − 1 is (12 Apr 2014 | Single slot)

(A) 10 − 33 m

(B) 10 − 35 m

(C) 10 − 31 m

(D) 10 − 25 m

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**15.** The de Broglie wavelength of a car of mass 1000 kg and velocity 36 km/hr is (23 Apr 2013 | Single slot)

(A) 6.626 × 10 − 34 m

(B) 6.626 × 10 − 38 m

(C) 6.626 × 10 − 31 m

(D) 6.626 × 10 − 30 m

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**16.** If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become (19 May 2012 | Single slot)

(A) one fourth

(B) half

(C) four times

(D) two times

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**17.** Calculate the wavelength (in nanometer) associated with a proton moving at 1.0 x $10^3$ $ms^{-1}$ (Mass of proton = 1.67 × $10^{-27}$ kg and h = 6.63 × $10^{-34}$ Js) : (26 Apr 2009 | Single sitting)

(A) 0.40 nm

(B) 2.5 nm

(C) 14.0 nm

(D) 0.32 nm

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**18.** The de Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 meters per second is approximately (26 Apr 2003 | Single sitting)

(A) $10^{-31}$ meters

(B) $10^{-16}$ meters

(C) $10^{-25}$ meters

(D) $10^{-33}$ meters