



ATOMIC STRUCTURE – COMPLETE SOLUTIONS

NEET PYQs (1988–2025)

“Solve questions like a learner, understand concepts like a teacher.”

Instructions for Students:

- Solutions are written strictly as per NCERT + NEET logic.
- Focus on **approach and reasoning**, not just final answer.
- Re-solve every question without looking at solution once.
- These PYQs are your **strongest revision weapon**.

Solutions : Topic–1 (Early Atomic Models)

1. Solution

Recall the experimental properties of cathode rays.

Cathode rays are streams of electrons. Hence:

- They possess kinetic energy
- They produce heat
- They exert mechanical pressure
- They are **not electromagnetic waves**

Correct Option: (b)

2. Solution

Identify the scientist who extended Bohr’s model.

Bohr proposed circular orbits. **Sommerfeld** modified Bohr’s theory by introducing

- Elliptical orbits
- Relativistic correction
- Subshell concept

Correct Option: (d)

Solutions : Topic–2 (Discoveries Before Bohr’s Model)

1. Solution

Use relation between wavelength and frequency: $\lambda = \frac{c}{\nu}$

Given,

$$\nu = 1368 \times 10^3 \text{ s}^{-1}$$
$$\lambda = \frac{3.0 \times 10^8}{1.368 \times 10^6} = 2.193 \times 10^2 \text{ m} \approx 219.3 \text{ m}$$

Correct Option: (a)

2. Solution

Use photon relation: $\lambda = \frac{hc}{E}$

$$\lambda = \frac{6.63 \times 10^{-34} \times 3.0 \times 10^8}{8 \times 10^{15}} \approx 2.48 \times 10^{-8} \text{ m} = 24.8 \text{ nm} \approx 25 \text{ nm}$$

Correct Option: (a)

3. Solution

Again use: $\lambda = \frac{c}{\nu}$

$$\lambda = \frac{3 \times 10^{17}}{6 \times 10^{15}} = 50 \text{ nm}$$

Correct Option: (c)

4. Solution

Energy of photon: $E = \frac{hc}{\lambda}$

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{45 \times 10^{-9}} \approx 4.42 \times 10^{-18} \text{ J}$$

Correct Option: (d)

5. **Solution**

$$\text{Use: } \lambda = \frac{hc}{E}$$

$$\lambda = \frac{6.63 \times 10^{-34} \times 3.0 \times 10^8}{3.03 \times 10^{-19}} \approx 6.56 \times 10^{-7} \text{ m} = 656 \text{ nm}$$

Correct Option: (c)

6. **Solution**

$$\text{Law of photochemical equivalence: Energy per mole} = \frac{N_A hc}{\lambda}$$

$$E = \frac{6.02 \times 10^{23} \times 6.62 \times 10^{-27} \times 3 \times 10^{10}}{\lambda} = \frac{1.196 \times 10^{16}}{\lambda}$$

Correct Option: (d)

7. **Solution**

Photon energy is inversely proportional to wavelength: $E \propto \frac{1}{\lambda}$

$$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{25}{50} = \frac{1}{2} \Rightarrow \lambda_1 = 2\lambda_2$$

Correct Option: (a)

8. **Solution**

Photoelectric effect concept: Incident photon energy = work function + KE

Some energy is used to overcome work function, remaining part becomes kinetic energy of electron. Hence emitted electron has **less energy**.

Correct Option: (c)

Solutions : Topic–3 (Bohr's Model & Hydrogen Spectrum)

1. **Solution**

Identify which statement belongs to Quantum Mechanics, not Bohr model.

Uncertainty principle (simultaneous position and velocity cannot be determined) was proposed by Heisenberg, not Bohr.

Correct Option: (d)

2. Solution

Analyse physical meaning of Bohr energy equation.

For smaller n , energy is more negative \rightarrow electron is **more tightly bound**, not loosely bound. Hence statement (b) is incorrect.

Correct Option: (b)

3. Solution

Radius of Bohr orbit $\propto n^2$.

$$r_n = r_1 n^2$$

Correct Option: (a)

4. Solution

For hydrogen-like species: $r \propto \frac{n^2}{Z}$

For Li^{2+} , $Z = 3$:

$$r = \frac{0.53}{3} \approx 0.177 \text{ \AA}$$

Correct Option: (a)

5. Solution

Use $r_n = r_1 n^2$

$$r_2 = 0.53 \times 2^2 = 2.12 \text{ \AA}$$

Correct Option: (d)

6. **Solution**

Energy of n^{th} orbit of H atom is fixed.

$$E_n = -\frac{13.6}{n^2} \text{ eV}$$

Correct Option: (c)

7. **Solution**

Energy $\propto \frac{1}{n^2}$

$$E_4 = \frac{E_2}{4} = \frac{-328}{4} = -82 \text{ kJ mol}^{-1}$$

Correct Option: (d)

8. **Solution**

Electrostatic potential energy of electron around nucleus.

Attractive force \rightarrow potential energy is negative:

$$PE = -\frac{Ze^2}{r}$$

Correct Option: (b)

9. **Solution**

For Bohr orbit: $E = -2(\text{KE})$

$$\text{KE} = +3.4 \text{ eV}$$

Correct Option: (a)

10. **Solution**

Ionisation energy $\propto Z^2$

For He^+ , $Z = 2$:

$$IP = 13.6 \times 2^2 = 54.4 \text{ eV}$$

Correct Option: (a)

11. **Solution**

Spectrum depends on hydrogen-like nature.

He^+ is hydrogen-like (single electron).

Correct Option: (d)

12. **Solution**

Visible region corresponds to Balmer series.

Correct Option: (c)

13. **Solution**

Least energetic photon \rightarrow smallest energy difference.

Closest levels give minimum ΔE :

$$n = 6 \rightarrow 5$$

Correct Option: (c)

14. **Solution**

Longest wavelength \rightarrow smallest energy transition in Balmer series.

Balmer first line ($3 \rightarrow 2$) gives longest wavelength:

$$656 \text{ nm}$$

Correct Option: (b)

15. **Solution**

Use energy difference between $n = 4$ and $n = 1$.

$$\Delta E = 2.18 \times 10^{-18} \left(1 - \frac{1}{16}\right) = 2.04 \times 10^{-18} \text{ J}$$

$$\nu = \frac{\Delta E}{h} = \frac{2.04 \times 10^{-18}}{6.625 \times 10^{-34}} \approx 3.08 \times 10^{15} \text{ s}^{-1}$$

Correct Option: (c)

Solutions : Topic-4 (de-Broglie & Heisenberg Principle)

1. Solution

Use de-Broglie relation: $\lambda = \frac{h}{mv}$

$$m = 1 \text{ g} = 10^{-3} \text{ kg}, \quad v = 100 \text{ m s}^{-1}$$

$$\lambda = \frac{6.63 \times 10^{-34}}{10^{-3} \times 100} = 6.63 \times 10^{-33} \text{ m}$$

Correct Option: (a)

2. Solution

For Bohr orbit: $\lambda = 2\pi r_n$

For $n = 2$:

$$r_2 = n^2 a_0 = 4 \times 52.9 = 211.6 \text{ pm}$$

$$\lambda = 2\pi r_2 = 211.6\pi \text{ pm}$$

Correct Option: (b)

3. Solution

Momentum from de-Broglie relation: $p = \frac{h}{\lambda}$

$$p = \frac{6.625 \times 10^{-34}}{10^{-17}} = 6.625 \times 10^{-17} \text{ kg m s}^{-1}$$

Correct Option: (c)

4. Solution

Experimental proof of wave nature of electron.

Davisson–Germer experiment showed electron diffraction.

Correct Option: (c)

5. **Solution**

$$\Delta p = m \Delta v$$

$$\Delta v = \frac{1 \times 10^{-18}}{9 \times 10^{-28}} = 1.11 \times 10^9 \text{ cm s}^{-1}$$

Correct Option: (a)

6. **Solution**

Heisenberg uncertainty principle: $\Delta x \Delta p \geq \frac{h}{4\pi}$

$$\Delta x = \frac{6.62 \times 10^{-34}}{4\pi \times 10^{-5}} \approx 5.27 \times 10^{-30} \text{ m}$$

Correct Option: (c)

7. **Solution**

Given $\Delta x = \Delta p$

$$\Delta x \Delta p = \frac{h}{4\pi} \Rightarrow \Delta p = \sqrt{\frac{h}{4\pi}}$$
$$\Delta v = \frac{\Delta p}{m} = \frac{h}{2\pi m}$$

Correct Option: (a)

8. **Solution**

$$\Delta v = \frac{h}{4\pi m \Delta x}$$

$$\Delta x = 0.1 \text{ \AA} = 10^{-11} \text{ m}$$

$$\Delta v = \frac{6.626 \times 10^{-34}}{4\pi \times 9.11 \times 10^{-31} \times 10^{-11}} \approx 5.79 \times 10^6 \text{ m s}^{-1}$$

Correct Option: (a)

9. **Solution**

Uncertainty depends only on position accuracy.

Same Δx implies same minimum Δp for both electron and helium atom.

Correct Option: (d)

10. **Solution**

Accuracy given \rightarrow find uncertainty in velocity.

$$\Delta v = 0.001\% \times 3 \times 10^4 = 0.3 \text{ cm s}^{-1}$$

$$\Delta x = \frac{6.626 \times 10^{-27}}{4\pi \times 9.1 \times 10^{-28} \times 0.3} \approx 5.76 \text{ cm}$$

Correct Option: (c)

11. **Solution**

Check which statement is incorrect.

In hydrogen-like atoms, all orbitals of same n have equal energy. Hence $2s$ and $2p$ have same energy — not different.

Correct Option: (d)

Solutions : Topic–5 (Quantum Numbers)

1. **Solution** For $n = 3$, $l = 1$ (3p-subshell): No. of orbitals = $2l + 1 = 3$ Electrons = $3 \times 2 = 6$

Correct Option: (b)

2. **Solution** $l = 3$ corresponds to f -subshell Max electrons = $2(2l + 1) = 14$

Correct Option: (a)

3. **Solution** $n = 2, l = 1 \rightarrow 2p$ subshell $\rightarrow 3$ orbitals Electrons = 6

Correct Option: (c)

4. **Solution** For $l = 3$ (f -subshell), electrons = 14

Correct Option: (d)

5. **Solution** Given one orbital ($m = -1$) \rightarrow max electrons = 2

Correct Option: (d)

6. **Solution** Fixed n, l, m gives exactly ****one orbital****

Correct Option: (a)

7. **Solution** $m = -1$ possible only if $l \geq 1$ s -orbital has $l = 0 \rightarrow$ not possible

Correct Option: (d)

8. **Solution** Orientation of orbital depends on magnetic quantum number m

Correct Option: (c)

9. **Solution** Two electrons in same orbital differ by spin

Correct Option: (c)

10. **Solution** Max electrons in subshell = $2(2l + 1) = 4l + 2$

Correct Option: (a)

11. **Solution** Same expression: $4l + 2$

Correct Option: (b)

12. **Solution** For $l = 2, m = -2, -1, 0, +1, +2$ $m = -3$ is invalid

Correct Option: (c)

13. **Solution** Invalid sets: (ii) $l = 2$ not possible for $n = 2$, (iv) $m = -1$ not possible for $l = 0$, (v) $m = 3$ invalid for $l = 2$

Correct Option: (c)

14. **Solution** Angular momentum = $\sqrt{l(l+1)} \frac{h}{2\pi}$ For d ($l = 2$): $\sqrt{6} \frac{h}{2\pi} = 2\sqrt{3} h$

Correct Option: (c)

15. **Solution** For p ($l = 1$): $\sqrt{2} \frac{h}{2\pi}$

Correct Option: (a)

Solutions : Topic-6 (Shape and Nodes)

1. **Solution** Electron density along axes: d_{z^2} and $d_{x^2-y^2}$

Correct Option: (c)

2. **Solution** Radial nodes = $n - l - 1 = 3 - 1 - 1 = 1$

Correct Option: (a)

3. **Solution** Angular nodes = $l = 0$ Radial nodes = $3 - 0 - 1 = 2$

Correct Option: (a)

4. **Solution** Angular nodes = 3 $l = 3$ Total nodes = $n - 1 = 3$ $n = 4$ Orbital = $4f$

Correct Option: (c)

Solutions : Topic-7 (Electronic Configuration)

1. **Solution** No two electrons can have same 4 quantum numbers \rightarrow Pauli principle

Correct Option: (d)

2. **Solution** Degenerate orbitals \rightarrow same energy, different wavefunctions

Correct Option: (d)

3. **Solution** Highest energy depends on $(n + l)$ rule \rightarrow option (d)

Correct Option: (d)

4. **Solution** Correct filling order: $4s \rightarrow 3d \rightarrow 4p \rightarrow 5s$

Correct Option: (b)

5. **Solution** Energy order: $5f > 6p > 5p > 4d$

Correct Option: (d)

6. **Solution** Correct order: $ns \rightarrow np \rightarrow nd \rightarrow nf$

Correct Option: (c)

7. **Solution** Increasing energy: $3s < 3p < 4s < 3d$

Correct Option: (d)

8. **Solution** Cu shows exception: $4s^1 3d^{10}$

Correct Option: (b)

9. **Solution** Calcium: $[Ar] 4s^2$

Correct Option: (b)

10. **Solution** $N^{2+} \rightarrow 1s^2 2s^2 2p^1 \rightarrow$ one unpaired

Correct Option: (c)

11. **Solution** Fe^{2+} has d^6 ; unequal with p -electrons of Ne (6) is false

Correct Option: (d)

12. **Solution** Correct Fe configuration: $[Ar] 4s^2 3d^6$

Correct Option: (d)

13. **Solution** Rb valence electron: $5s^1 \Rightarrow (5, 0, 0, +\frac{1}{2})$

Correct Option: (c)

14. **Solution** Wrong statement: shown N configuration image is incorrect

Correct Option: (a)

15. **Solution** 18 electrons in outer shell \rightarrow noble gas core $\rightarrow Cu^+$

Correct Option: (a)

16. **Solution** Gd configuration: $[Xe] 4f^7 5d^1 6s^2$

Correct Option: (b)

Solutions : Topic-8 (NEET 2025-2022)

1. **Solution**

For hydrogen-like species:

$$E_n = -R_H \frac{Z^2}{n^2}, \quad r_n = \frac{a_0 n^2}{Z}$$

For He^+ ($Z = 2, n = 1$):

$$E = -2.18 \times 10^{-18} \times 4 = -8.72 \times 10^{-18} \text{ J}$$

$$r = \frac{52.9}{2} = 26.4 \text{ pm}$$

For Li^{2+} ($Z = 3, n = 1$):

$$E = -2.18 \times 10^{-18} \times 9 = -19.62 \times 10^{-18} \text{ J}$$

$$r = \frac{52.9}{3} = 17.6 \text{ pm}$$

Correct Option: (c)

2. **Solution**

Use Rydberg relation:

$$\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

For $2 \rightarrow 3$:

$$\frac{1}{\lambda_1} = R_H \left(\frac{1}{4} - \frac{1}{9} \right) = \frac{5R_H}{36}$$

For $4 \rightarrow 6$:

$$\frac{1}{\lambda_2} = R_H \left(\frac{1}{16} - \frac{1}{36} \right) = \frac{5R_H}{144}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{1/\lambda_2}{1/\lambda_1} = \frac{5/144}{5/36} = \frac{1}{4}$$

Correct Option: (b)

3. **Solution**

Energy order depends on $(n + l)$ rule. Higher $(n + l)$ higher energy.

I: $n + l = 6$ II: $n + l = 5$ III: $n + l = 5$ IV: $n + l = 4$

For equal $(n + l)$, higher n higher energy.

Order: $I > III > II > IV$

Correct Option: (b)

4. **Solution**

Check both statements independently.

Lowest-energy Balmer line is $3 \rightarrow 2$:

$$\bar{\nu} = R_H \left(\frac{1}{2^2} - \frac{1}{3^2} \right) = \frac{5}{36} R_H \Rightarrow \text{Statement I true}$$

By Wien's law, higher temperature shorter $\lambda_{\max} \Rightarrow$ Statement II true

Correct Option: (c)

5. **Solution**

$$\text{Energy} \propto \frac{Z^2}{n^2}$$

He⁺ ground state:

$$E = -x = -R_H(2^2)$$

For Be³⁺ ($Z = 4, n = 2$):

$$E = -R_H \frac{16}{4} = -4R_H = -4x$$

Correct Option: (c)

6. **Solution**

Match each quantum number with its physical meaning.

$m_l \rightarrow$ orientation of orbital (III)
 $m_s \rightarrow$ orientation of spin (IV)
 $l \rightarrow$ shape of orbital (I)
 $n \rightarrow$ size of orbital (II)

Correct Option: (b)

7. **Solution**

Evaluate each statement.

- A (atoms have 3 fundamental particles)
- B correct value
- C same chemical properties
- D nucleons = protons + neutrons
- E Dalton's view

Correct Option: (c)

8. **Solution**

Magnetic quantum number values = $-l$ to $+l$

Total values:

$$n_m = 2l + 1$$

Correct Option: (b)

9. **Solution**

Check allowed m_l values for given l .

For $l = 3$, allowed $m_l = -3$ to $+3$

For $l = 2$, allowed $m_l = -2$ to $+2$

Option (a) lists multiple m_l values simultaneously \rightarrow invalid

Correct Option: (a)

10. **Solution**

Wave function interpretation.

Ψ depends on coordinates
Probability $\propto |\Psi|^2$, not Ψ

Correct Option: (a)

11. **Solution**

Identify subshell from (n, l) .

$$n = 2, l = 1 \rightarrow 2p$$

$$n = 3, l = 2 \rightarrow 3d$$

$$n = 3, l = 0 \rightarrow 3s$$

$$n = 2, l = 0 \rightarrow 2s$$

Correct Option: (a)

12. **Solution**

Use photoelectric equation: $E = h\nu = \phi + KE$

Photon energy per mole:

$$E = \frac{hcN_A}{\lambda} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8 \times 6.022 \times 10^{23}}{300 \times 10^{-9}} \approx 3.99 \times 10^5$$

$$\phi = E - KE = (3.99 - 1.68) \times 10^5 = 2.31 \times 10^5 \text{ J mol}^{-1}$$

Correct Option: (a)

13. **Solution**

Compare size, shape and energy.

5d orbitals are **larger** than 4d, not different among themselves. Hence statement (a) is incorrect.

Correct Option: (a)

14. **Solution**

$$r_n \propto \frac{n^2}{Z}$$

For He^+ :

$$r_2 = \frac{4a_0}{2} = 2a_0 = 105.8 \text{ pm} \Rightarrow a_0 = 52.9 \text{ pm}$$

For Li^{2+} :

$$r_3 = \frac{9a_0}{3} = 3a_0 = 158.7 \text{ pm}$$

Correct Option: (a)

FINAL WORD

NEET is not about studying everything — it is about mastering the **right things**. *If you have solved these questions honestly, you are already ahead of thousands of aspirants.*
*NEET is not about studying everything — it is about mastering the **right things**.*

— Weird Chemist