Chapter Name

Atomic Structure

NCERT Exercise

Q.1.>

(c) According to Rutherford's α-Particle scattering experiement electron will revolve around the Nucleus but path is not define.

Q.2.>

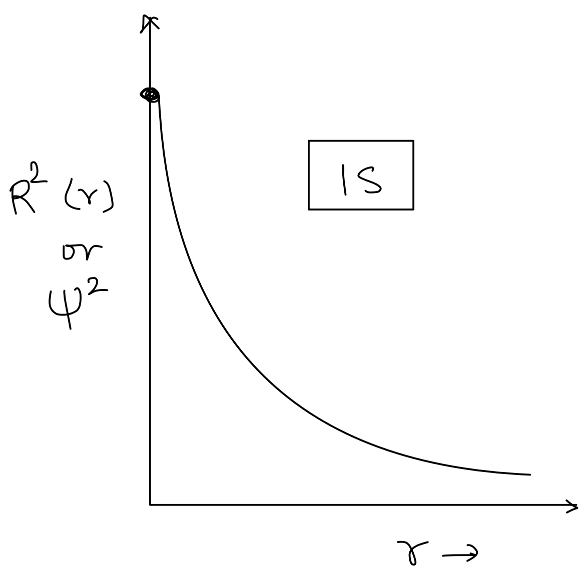
(b) $_{24}Cr \Rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$ ← correct G.S. Configuration

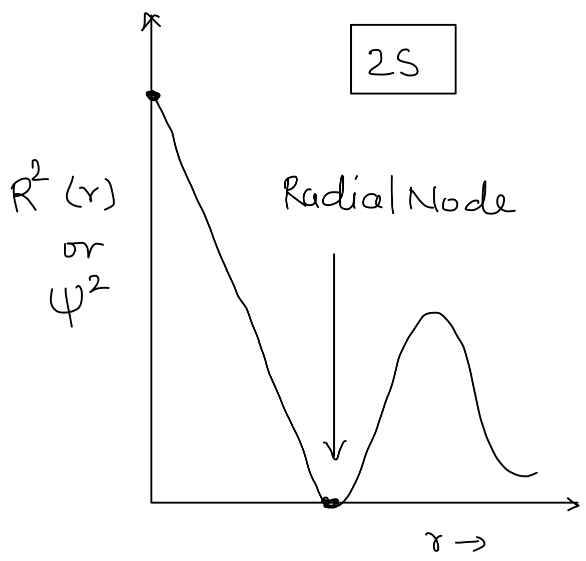
Q. 3.>

(d) Fourth option is incorrect statement

→ Correct statement :→ The probability of having an electron close to the Nucleus is maximum

as the No. of Angular Nodes ⇒ l & Radial Node ⇒ $n-l-1$





Q.4.>

(d) Characteristics of cathode rays & specific charge ratio (e/m) do not depend upon the Nature of gas present in the cathode ray tube.

Q.5.>

(b) The Mass of electron << Mass of Neutron

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Q.6.>

(a) Total Positive Charge = Total Negative charge

i.e. overall Neutrality of atom.

Q.7.>

(d) isobars :→ Same Mass Number (A) = Proton + Neutron but different Atomic Number.

Q.8.>

(d) Radial Node = $n - l - 1$

for 3P-orbital ⇒ $n = 3$, $l = 1$

so, Radial Node ⇒ $3 - 1 - 1$ ⇒ 1

Q.9.>

(c) Angular Node $\Rightarrow l$

for 4d-orbital $\Rightarrow$ $l = 2$, So **Angular Node = 2**

Q.10.>

[b] Heisenberg's Uncertainity Principle (fact)

Q.11.>

(c) Total No. of orbital in shell $\Rightarrow n^2$ { n=3 (Given)

$\Rightarrow (3)^2 \Rightarrow 9$

Q.12.>

(a) orbital Angular Momentum $= \sqrt{l(l+1)}\ \frac{h}{2\pi}$

Q.13.>

(c) $M_1 \Rightarrow {}^{35}Cl$ $M_2 \Rightarrow {}^{37}Cl$

% abundancy $\Rightarrow x_1 \Rightarrow x\%$ $x_2 \Rightarrow (100-x)\%$

$$\text{Avg. atomic Mass} = \frac{M_1x_1 + M_2x_2}{x_1 + x_2}$$

$$35.5 = \frac{35 \times x + 37(100-x)}{100} \Rightarrow \boxed{x = 25\%}$$

So ${}^{35}Cl$ ${}^{37}Cl$

~~25%~~ ~~75%~~

1 : 3 Ans.

Q.14.>

(b) $_{26}Fe \longrightarrow Fe^{+3} + 3e^{\ominus}$

$e^{\ominus} \Rightarrow 23$

$_{25}Mn \longrightarrow Mn^{+2} + 2e^{\ominus}$

$e^{\ominus} \Rightarrow 23$

Q.15.>

(d) single orbital can accomodate only two electrons but spin must be opposite.

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Q.16.>

(b) According to De-broglie concept

$$\boxed{\lambda = \frac{h}{mv}}$$

h ← Planck's constant

m → Mass of object

v → velocity

As mass ↑es ⇒ λ ↓es

due to Heaviest mass of α-Particle ($_2^4He^{+2}$) ⇒ λ lowest

Q.17.>

(a) A & R correct, Reason is correct explanation (fact)

Q.18.>

(b) A & R both correct but Reason is not correct explanation. (fact)

Q.19.>

(c) According to Heisenberg's uncertainity principle exact position & exact momentum of an electron can not be determine accuratly.

& Path of an electron in an atom is not clearly defined we can give idea about Probability.

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Q.20.>

(a)

(i) ⟶ (c)
(ii) ⟶ (d)
iii> ⟶ (a)
iv> ⟶ (e)

Q.21.>

(b)

(i) ⟶ (b)
(ii) ⟶ (d)
iii> ⟶ (a)
iv> ⟶ (c)

Q. 22.>

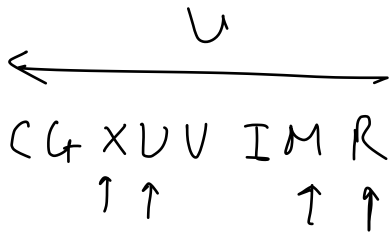
(c)

(i) ⟶ (c)

(ii) ⟶ (e)

iii> ⟶ (a)

iv> ⟶ (d)



Q. 23>

(b)

(i) ⟶ (d)

(ii) ⟶ (c)

iii> ⟶ (a)

iv> ⟶ (b)

Q. 24.>

(d)

(i) ⟶ (d)

(ii) ⟶ (c)

iii> ⟶ (a)

iv> ⟶ (b)

Q. 25.>

(a) Millikan's oil droplet experiment.

Q. 26.>

(c) 3rd option is incorrect

correct statement :→ A very small percentage (1 in 20,000) of the α-Particle were bounced back.

Q.27.>

(a) ∵ 9.1×10^{-28} gram ⇒ 1 electron Mass

∴ 1 gm ⇒ $\frac{1}{9.1 \times 10^{-28}}$ No. of electrons

⇒ 1.098×10^{27} electrons

Q. 28.>

(b) $^{88}_{38}Sr$

Z = Proton No. ⇒ 38

A ⇒ Mass No. ⇒ 88

N = A − P

= 88 − 38 ⇒ 50

Q.29.>

(b) Total No. of emission lines = $\frac{\Delta n(\Delta n+1)}{2}$

⇒ $\frac{5 \times 6}{2}$

⇒ 15

$\Delta n = n_2 - n_1$
$= 6 - 1$
$= 5$

Q.30.>

(d) Maximum No. of sub-shell in orbit ⇒ n

if $n=5$, Possible sub-shell
(s, p, d, f, g)

Q.31.>

(b) $n=4$ (Given)

Max. No. of orbitals in orbit ⇒ n^2
⇒ 16

Max. No. of electrons in orbit ⇒ $2n^2$
⇒ 32

Q.32.>

(d) A. ⟶ (iv)
B ⟶ (i)
C ⟶ (ii)
D ⟶ (iii)

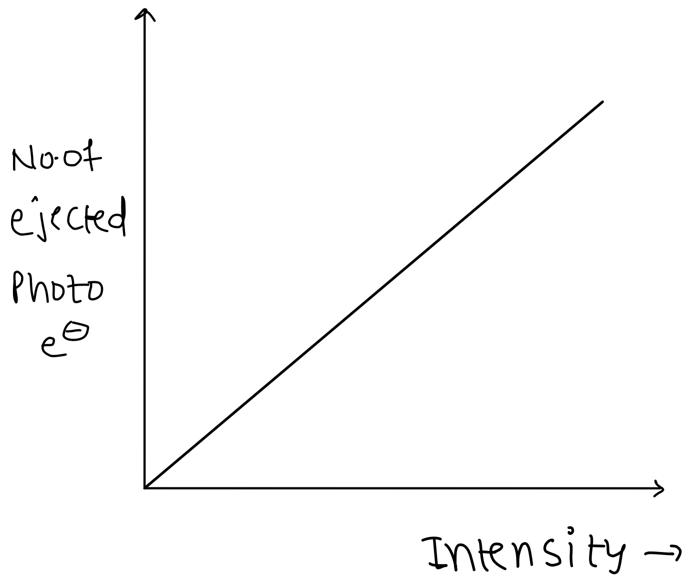
Q.33.>

(b) Wave Number $(\bar{\nu}) = \frac{1}{\lambda} = \frac{1}{240 \times 10^{-9} m}$

$= 4.16 \times 10^{6} m^{-1}$

Q.34.>

(b)



Q.35.>

(b)

$E = h\nu$

$E = 6.626\times10^{-34}\times5\times10^{14}$ J

$\boxed{E = 3.3\times10^{-19}\text{ J}}$

$h = 6.626\times10^{-34}$ J-sec

ν = frequency

$= 5\times10^{14}$ Hz (sec^{-1})

Q.36.>

(c)

V	I	B	G	Y	O	R

Q.37.>

(b)

Visible Region ⇒ Balmer series

↳ starts from n = 2

Q. 38.>

(a) $r_n = 52.9 \times \frac{n^2}{Z}$ pm $= a_0 n^2$ (Given) $\{ Z = 1$

so, $\boxed{a_0 = 52.9\,pm}$

Q. 39.>

(d) Bohr's theory applicable for H-like species (single electron system)

Q. 40>

(c) $E = \frac{hc}{\lambda} \Rightarrow E \propto \frac{1}{\lambda}$

$\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{400}{800}$ $\left\{ \begin{array}{l} \lambda_1 = 800\,nm \\ \lambda_2 = 400\,nm \\ \text{(Given)} \end{array} \right.$

$\boxed{E_2 = 2E_1}$

Q. 41.>

(a) Time Period (T) of Revolution :→ Time required to complete one revolution around the Nucleus in any orbit is known as time period of revolution of that orbit.

Distance travelled in one revolution ⇒ $2\pi r_n$

Velocity ⇒ v_n

$$v = \frac{d}{t} \Rightarrow T = \frac{d}{v}$$

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$$T = \frac{2\pi r_n}{v_n}$$

$$mvr = \frac{nh}{2\pi}$$

$$v = \frac{nh}{2\pi mr}$$

$$T = \frac{2\pi r}{\left(\frac{nh}{2\pi mr}\right)}$$

$$\boxed{T = \frac{4\pi^2 mr^2}{nh}}$$

Q.42.>

(d) Angular momentum (mvr) $= n\frac{h}{2\pi}$ { n=5 (Given

$= 2.5\,\frac{h}{\pi}$

Q.43.>

(b) $\boxed{\lambda = \frac{h}{mv}}$

Here $h = 6.626 \times 10^{-34}$ J-sec

$m = 10 \times 10^{-3}$ kg

$V = 100$ m/sec

so, $\lambda = \frac{6.626 \times 10^{-34}}{10 \times 10^{-3} \times 100}$ m

$\boxed{\lambda = 6.626 \times 10^{-34}\ \text{m}}$

Q.44.>

(c) 3d-orbitals

$n = 3$, $l = 2$, $m = -l$ to $+l \Rightarrow -2, -1, 0, +1, +2$

Q.45.>

(d) 3d & 4f respectively

Q.46.>

(b) Net Attraction

⇓

It represents net attraction on outermost $e^{\ominus}$

Net attraction = Attraction − repulsion force

⇓ Effective Nuclear Charge (Z_{eff})

⇓ Nuclear charge (Z)

↓ (σ) screening constant (Shielding / Screening Effect)

$$Z_{eff} = Z - \sigma$$

Q.47.>

(d) If two orbital have same value of (n+l), the orbital with higher value of n have higher energy

2p < 3s (Energy order)

$$n + l = 3$$

Q.48.>

(a) Square of the orbital wave function i.e. ψ^2

Q.49.>

(d)

Total No. of electrons in shell $\Rightarrow 2n^2$

$\Rightarrow 2(4)^2$

$\Rightarrow$ (32)

16 electrons — 16 electrons

spin Quantum No. $\Rightarrow$ $m_s = +1/2$ — $m_s \Rightarrow -1/2$

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Q.50.>

(a)

- As $(n+l)$ value ↑es $\Rightarrow$ Energy also ↑es
- If two orbital have same value of $(n+l)$, the orbital with higher value of n have higher energy

(iv) < (ii) < (iii) < (i)

Q.51.>

(b)

$$KE_1 = h\nu_1 - h\nu_0 \quad \text{——— (1)}$$

$$KE_2 = h\nu_2 - h\nu_0 \quad \text{——— (2)}$$

$$(KE_1) = 2\,(KE_2) \quad (\text{Given})$$

$$\Rightarrow h\nu_1 - h\nu_0 = 2\,(h\nu_2 - h\nu_0)$$

$$\Rightarrow h\nu_0 = 2h\nu_2 - h\nu_1$$

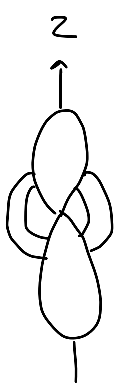
$$\Rightarrow \nu_0 = 2\nu_2 - \nu_1$$

$$= 2\,(2\times10^{16}) - 3.2\times10^{16}$$

$$\boxed{\nu_0 = 8\times10^{15}\ Hz}$$ Ans.

Q.52.>

(b) $d_{z^2} \Rightarrow$



Q.53.>

(c) • As $(n+l)$ value ↑es ⇒ Energy also ↑es

• If two orbital have same value of $(n+l)$, the orbital with higher value of n have higher energy

so,

$3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p$

Energy order

Q.54.>

(b) $^{81}_{35}Br$

No. of Protons ⇒ 35

No. of Neutrons ⇒ 46

31.7 % more

Q.55.>

(b)

A. ⟶ (ii)

B ⟶ (i)

C ⟶ (iv)

D ⟶ (iii)

Q.56.>

(c)

$$\lambda = \frac{h}{mv}$$

$$\lambda = \frac{6.626 \times 10^{-31} \text{ J-sec}}{9.1 \times 10^{-31} \text{ kg} \times 2.19 \times 10^{6} \text{ m sec}^{-1}}$$

$$\boxed{\lambda = 3.32 \times 10^{-10} \text{ m}}$$

Q. 57.>

(d)

$$r = 0.529 \times \frac{n^2}{z} \text{ Å}$$

$$r_1 = 0.529 \times \frac{(1)^2}{1} \Rightarrow 0.529 \quad \text{—— (1)}$$

$$r_3 = 0.529 \times \frac{(3)^2}{1} \Rightarrow 0.529 \times \frac{9}{1} \quad \text{—— (2)}$$

eq. (1) ÷ eq (2)

$$\frac{r_1}{r_3} = \frac{1}{9} \qquad \left\{ r_1 = x \text{ pm (Given)} \right.$$

So, $\boxed{r_3 = 9x \text{ pm}}$

Q.58.>

(b)

$$\Delta E = 13.6 \times Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) eV$$

$n_1 = 1$, $n_2 = 2$

$$\Delta E = 13.6 \times \left[\frac{1}{(1)^2} - \frac{1}{(2)^2} \right] eV$$

$$\Delta E = 13.6 \times \frac{3}{4} \Rightarrow 10.2\, eV$$

Q.59.>

(b) Zeeman effect.

Q.60.>

(b) spectrum of atoms or ions containing one electron only

eg. H, He^+, Li^{+2}, Be^{+3} etc.

Q.61.>

(a) Cr ⇒ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$

K ($1s^2$), L ($2s^2\ 2p^6$), M ($3s^2\ 3p^6\ 3d^5$), N ($4s^1$)

Q.62.>

(b) 4f

$n = 4$, $l = 3$, $m = -l$ to $+l$

$\Rightarrow -3, -2, -1, 0, +1, +2, +3$

Q.63.>

(b)

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

or

$$E_n = -13.6 \times \frac{Z^2}{n^2} \times 1.6 \times 10^{-19} \text{ J}$$

$$E_n = -2.179 \times 10^{-18} \times \frac{Z^2}{n^2} \text{ J}$$

Q.64.>

(d)

$$\Delta E = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{\Delta E}$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J-sec} \times 3 \times 10^{8} \text{ m sec}^{-1}}{3 \times 10^{-19} \text{ J}}$$

$$\boxed{\lambda = 6.6 \times 10^{-7} \text{ m}}$$

Q.65.>

(a) $$E_n = -13.6 \times \frac{z^2}{n^2} \text{ eV}$$

or

$$E_n = -13.6 \times \frac{z^2}{n^2} \times 1.6 \times 10^{-19} \text{ J}$$

Q.66.>

(b) Two quantum mechanic spin states which refers to the orientation of spin of the electron.

Q.67.>

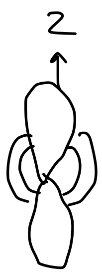
(d) All statements are correct.

Q.68.>

(d) have different spin Quantum No.

Q.69.>

(b)



d_{z^2}

Q.70.>

(a) $n=2$, Balmer series (visible Region)

Q.71.>

(c) $E = 400\ W \Rightarrow 400\ J\ sec^{-1}$

$\lambda = 400 \times 10^{-9} m$

$$E = n \times \frac{hc}{\lambda}$$

$$400 = n \times \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{400 \times 10^{-9}}$$

$$\boxed{n = 2 \times 10^{20}}$$

Q.72.>

(a) Orbital Angular momentum $= \sqrt{l(l+1)}\ \frac{h}{2\pi}$

for 2s $\Rightarrow l = 0$

so,

Orbital Angular momentum $= 0$

Q.73.>

(b) $_{11}Na \Rightarrow 1s^2\,2s^2\,2p^6\,\boxed{3s^1}$

$n = 3$, $l = 0$, $m = 0$, $s = -\frac{1}{2}$

Q.74.>

(a) $\Delta x \cdot \Delta v \geq \frac{h}{4\pi m}$

$10^{-8}\,m \times 5.26 \times 10^{-25}\,m s^{-1} = \frac{6.6 \times 10^{-34}\,J\text{-}sec}{4 \times \pi \times m}$

$\boxed{m = 0.01\ kg}$

Q.75.>

(b)
A. ⟶ (iii)
B ⟶ (i)
C ⟶ (ii)
D ⟶ (iv)

Q.76.>

(b) $\boxed{n_1 = 2}$ ↑ fixed for Balmer series

$n_2 = n_1 + 3$

$\boxed{n_2 = 2 + 3 \Rightarrow 5}$

Q.77>

(a)

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

$$(1000 \times 10^{-10} m) \times \Delta v = \frac{6.6 \times 10^{-34}\ J\text{-}sec}{4\pi \times 9.1 \times 10^{-31}\ kg}$$

$$\boxed{\Delta v = 5.79 \times 10^{2}\ m\,sec^{-1}}$$

Q.78>

(c)

K, L, M

$_{18}X \Rightarrow 2, 8, 8$

$_{19}Y \Rightarrow 2, 8, 8, 1$

$_{20}Z \Rightarrow 2, 8, 8, 2$

Q.79>

(c) visible light $\lambda \Rightarrow$ 380 nm – 760 nm

Q.80:>

(c) AUFBAU's PRINCIPLE :→

- According to this principle filling of $e^{\ominus}$ in an orbital of a sub-shell takes place from lower energy to higher energy level & energy level of orbital of a sub-shell is determined by $(n+l)$ rule.
- $(n+l)$ rule :→ According to this rule $e^{\ominus}$ enters to that orbital of sub-shell whose $(n+l)$ value is minimum. When $(n+l)$ value becomes equal for two sub-shell then $e^{\ominus}$ first enter to that sub-shell of which n value is minimum.

1S < 2S < 2P < 3S < 3P < 4S < 3d < 4P < 5S < 4d < 5P < 6S < 4f < 5d < 6P < 7S < 5f < 6d < 7P < 8S

Energy level of sub-shell to write electronic configuration of element.

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Q.81.>

(a) Exchange Energy (E) :→ Amount of energy released in one exchange of unpaired electron of degenerated atomic orbital is called exchange Energy. [Carries –ive sign]
↓
Released.

As Exchange Energy ↑es ⇒ Stability ↑es

Q.82.>

(c) Na^+, Al^{+3}, Ne

No. of electrons ⇒ 10

Q.83.>

(c) $$\Delta x \cdot \Delta v \geq \frac{h}{4\pi m}$$

$$\Delta v = 3\times10^4 \times \frac{0.001}{100}$$

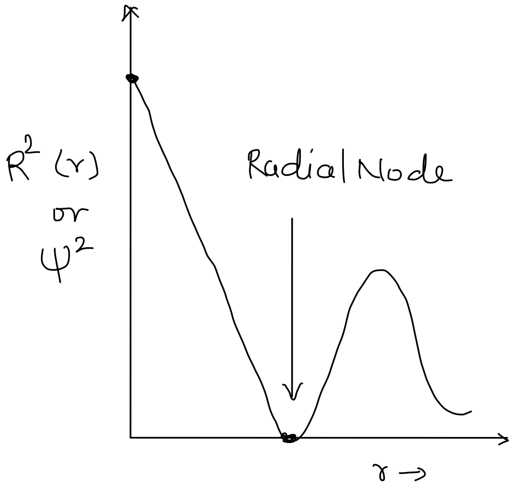
$$\Delta v = 3\times10^{-1}\ \text{cm/sec}$$

$$\Delta x \cdot 3\times10^{-1} = \frac{6.6\times10^{-27}\ \text{erg-sec}}{4\pi \times 9.1\times10^{-31}\ \text{kg}}$$

$$\boxed{\Delta x = 1.93\text{cm}}$$

Q. 84.>

(d) 2S



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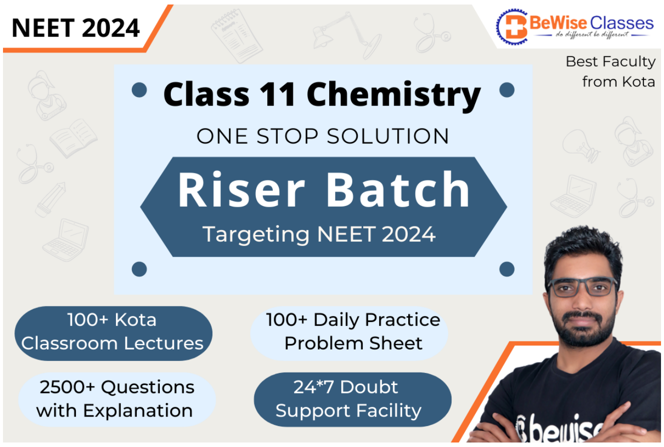
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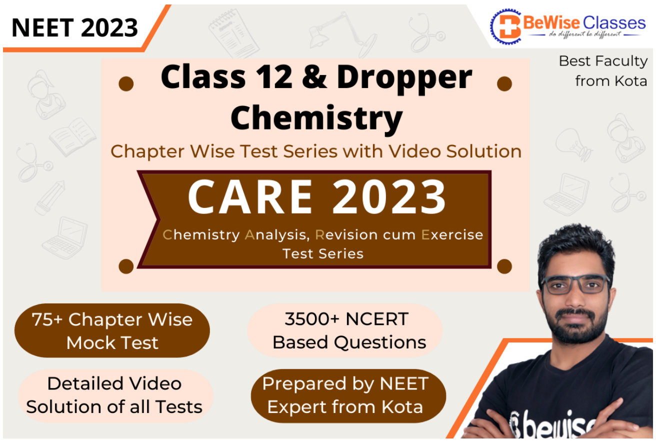
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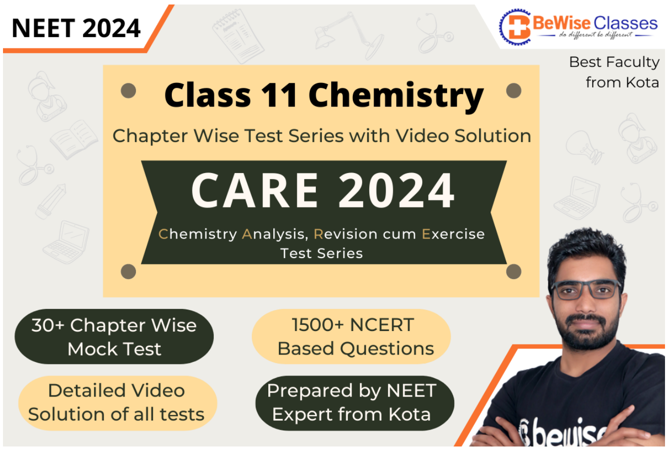
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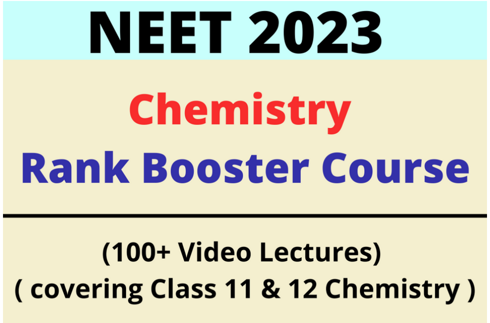
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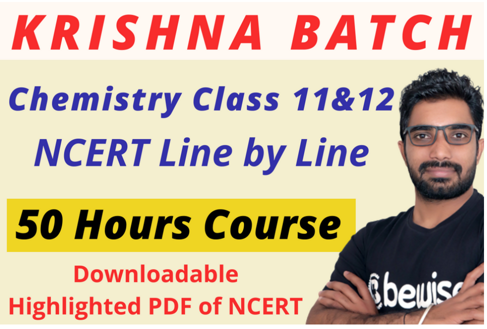
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