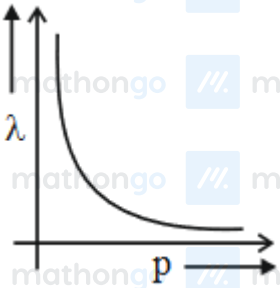
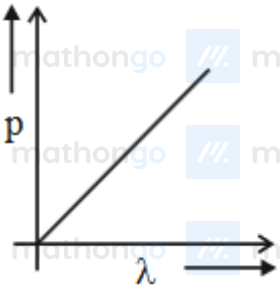
Q1 - 2024 (01 Feb Shift 1)

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 (λ) and momentum of electron (p) ?

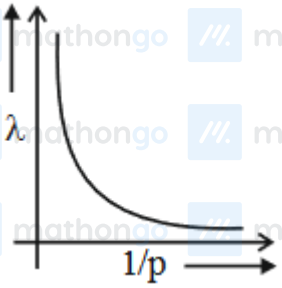
(1)



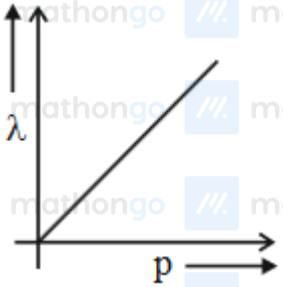
(2)



(3)



(4)



Q2 - 2024 (01 Feb Shift 2)

The number of radial node/s for 3*p* orbital is:

(1) 1

(2) 4

(3) 2

(4) 3

Q3 - 2024 (27 Jan Shift 1)

Which of the following electronic configuration would be associated with the highest magnetic moment?

(1) $[\mathrm{Ar}]3\ \mathrm{d}^7$

(2) $[\mathrm{Ar}]3\ \mathrm{d}^8$

(3) $[\mathrm{Ar}]3\ \mathrm{d}^3$

(4) $[\mathrm{Ar}]3\ \mathrm{d}^6$

Q4 - 2024 (27 Jan Shift 1)

Consider the following complex ions

$\mathrm{P} = [\mathrm{FeF}_6]^{3-}$

$\mathrm{Q} = \left[\mathrm{V}(\mathrm{H_2O})_6\right]^{2+}$

$\mathrm{R} = \left[\mathrm{Fe}(\mathrm{H_2O})_6\right]^{2+}$

The correct order of the complex ions, according to their spin only magnetic moment values (in B.M.) is :

(1) $\mathrm{R} < \mathrm{Q} < \mathrm{P}$

(2) $\mathrm{R} < \mathrm{P} < \mathrm{Q}$

(3) $\mathrm{Q} < \mathrm{R} < \mathrm{P}$

(4) $\mathrm{Q} < \mathrm{P} < \mathrm{R}$

Q5 - 2024 (27 Jan Shift 1)

The electronic configuration for Neodymium is:

[Atomic Number for Neodymium 60]

(1) $[\mathrm{Xe}]4\mathrm{f}^4 6\ \mathrm{s}^2$

(2) $[\mathrm{Xe}]5\mathrm{f}^4 7\ \mathrm{s}^2$

(3) $[\mathrm{Xe}]4\mathrm{f}^6 6\ \mathrm{s}^2$

(4) $[\mathrm{Xe}]4\mathrm{f}^1 5\ \mathrm{d}^1 6\ \mathrm{s}^2$

Q6 - 2024 (27 Jan Shift 1)

The number of electrons present in all the completely filled subshells having $n = 4$ and $s = +\frac{1}{2}$ is

(Where n = principal quantum number and s = spin quantum number)

Q7 - 2024 (27 Jan Shift 2)

Total number of ions from the following with noble gas configuration is _____

$Sr^{2+}(Z = 38), Cs^{+}(Z = 55), La^{2+}(Z = 57) Pb^{2+}$

$(Z = 82), Yb^{2+}(Z = 70)$ and $Fe^{2+}(Z = 26)$

Q8 - 2024 (29 Jan Shift 1)

The correct set of four quantum numbers for the valence electron of rubidium atom $(Z = 37)$ is:

(1) $5, 0, 0, +\frac{1}{2}$

(2) $5, 0, 1, +\frac{1}{2}$

(3) $5, 1, 0, +\frac{1}{2}$

(4) $5, 1, 1, +\frac{1}{2}$

Q9 - 2024 (29 Jan Shift 2)

Match List I with List II

List I (Spectral Series for Hydrogen)		**List II (Spectral Region/Higher 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 :-

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

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

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

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

Q10 - 2024 (30 Jan Shift 1)

Given below are two statements:

Statement-I: The orbitals having same energy are called as degenerate orbitals.

Statement-II: In hydrogen atom, 3p and 3 d orbitals are not degenerate orbitals.

In the light of the above statements, choose the most appropriate answer from the options given

(1) Statement-I is true but Statement-II is false

(2) Both Statement-I and Statement-II are true.

(3) Both Statement-I and Statement-II are false

(4) Statement-I is false but Statement-II is true

Q11 - 2024 (30 Jan Shift 2)

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

Q12 - 2024 (31 Jan Shift 1)

The ionization energy of sodium in $kJmol^{-1}$. If electromagnetic radiation of wavelength 242 nm is just sufficient to ionize sodium atom is _____

Q13 - 2024 (31 Jan Shift 2)

The four quantum numbers for the electron in the outer most orbital of potassium (atomic no. 19) are

(1) $n = 4, l = 2, m = -1, s = +\frac{1}{2}$

(2) $n = 4, l = 0, m = 0, s = +\frac{1}{2}$

(3) $n = 3, l = 0, m = 1, s = +\frac{1}{2}$

(4) $\mathrm{n}=2, l=0, \mathrm{~m}=0, s=+\frac{1}{2}$

Answer Key

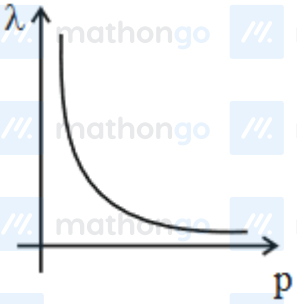
Q1 (1)	**Q2** (1)	**Q3** (4)	**Q4** (3)
Q5 (1)	**Q6** (16)	**Q7** (3)	**Q8** (1)
Q9 (3)	**Q10** (1)	**Q11** (10)	**Q12** (494)
Q13 (2)			

Q1

$\lambda = \frac{h}{p}\left[\lambda \propto \frac{1}{p}\right]$

$\Rightarrow \lambda p = h$ (constant)

So, the plot is a rectangular hyperbola.



Q2

For 3p : $n = 3, \ell = 1$

Number of radial node $= n - \ell - 1$

$= 3 - 1 - 1 = 1$

Q3

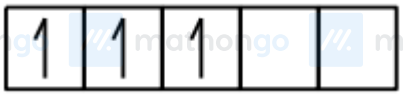
	$3d^7$	$3d^8$	$3d^3$	$3\,d^6$
No.of. unpaired e	3	2	3	4
Spin only Magnetic moment	$\sqrt{15}$ BM	$\sqrt{8}$ BM	$\sqrt{15}$ BM	$\sqrt{24}$ BM

Q4

$[FeF_6]^{3-}$: Fe^{+3} : $[Ar]3\,d^5$

F : Weak field Ligand

No. of unpaired electron's $= 5$



$\mu = \sqrt{5(5+2)}$

$\mu = \sqrt{35}\text{BM}$

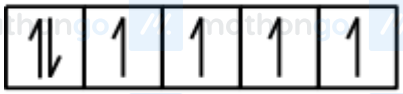
$\left[\text{V}(\text{H}_2\text{O})_6\right]^{+2} : \text{V}^{+2} : 3\ \text{d}^3$

No. of unpaired electron's $= 3$

$\mu = \sqrt{3(3+2)}$

$\mu = \sqrt{15}\text{BM}$

$\left[\text{Fe}(\text{H}_2\text{O})_6\right]^{+2} : \text{Fe}^{+2} : 3\ \text{d}^6$



H_2O : Weak field Ligand

No. of unpaired electron's $= 4$

$\mu = \sqrt{4(4+2)}$

$\mu = \sqrt{24}\text{BM}$

Q5

Electronic configuration of $\text{Nd}(\text{Z} = 60)$ is; $[\text{Xe}]\ 4\text{f}^4 6\ \text{s}^2$

Q6

$\text{n} = 4$ can have,

	4s	4p	4d	4f
Total e	2	6	10	14
Total e- with S $= +\frac{1}{2}$	1	3	5	7

So, Ans. 16

Q7

Noble gas configuration $=ns^2np^6$

$\left[\mathrm{Sr}^{2+}\right]=[\mathrm{Kr}]$

$\left[\mathrm{Cs}^{+}\right]=[\mathrm{Xe}]$

$\left[\mathrm{Yb}^{2+}\right]=[\mathrm{Kr}]4\ \mathrm{d}^{10}4\mathrm{f}^{14}5\ \mathrm{s}^2 5\mathrm{p}^6$

$\left[\mathrm{La}^{2+}\right]=[\mathrm{Xe}]5\ \mathrm{d}^1$

$\left[\ \mathrm{Pb}^{2+}\right]=[\mathrm{Xe}]4\mathrm{f}^{14}5\ \mathrm{d}^{10}6\ \mathrm{s}^2$

$\left[\mathrm{Fe}^{2+}\right]=[\mathrm{Ar}]3\ \mathrm{d}^6$

Q8

$\mathrm{Rb}=[\mathrm{Kr}]5\ \mathrm{s}^1$

$\mathrm{n}=5$

$l=0$

$\mathrm{m}=0$

$\mathrm{s}=+1/2 \text{ or } -1/2$

Q9

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

Fact based.

Q10

For single electron species the energy depends upon principal quantum number ' n ' only. So, statement II is false.

Statement I is correct definition of degenerate orbitals.

Q11

5^{th} excited state $\Rightarrow \mathrm{n}_1=6$

1^{st} excited state $\Rightarrow \mathrm{n}_2=2$

$\Delta \mathrm{n}=\mathrm{n}_1-\mathrm{n}_2=6-2=4$

Maximum number of spectral lines

$=\frac{\Delta \mathrm{n}(\Delta \mathrm{n}+1)}{2}=\frac{4(4+1)}{2}=10$

Q12

$$\begin{aligned}
&\mathrm{E}=\frac{1240}{\lambda(\mathrm{nm})} \mathrm{eV} \\
&=\frac{1240}{242} \mathrm{eV} \\
&=5.12 \mathrm{eV} \\
&=5.12 \times 1.6 \times 10^{-19} \\
&=8.198 \times 10^{-19} \mathrm{~J} / \text { atom } \\
&=494 \mathrm{~kJ} / \mathrm{mol}
\end{aligned}$$

Q13

$_{19} \mathrm{K} 1 \mathrm{~s}^2, 2 \mathrm{~s}^2, 2 \mathrm{p}^6, 3 \mathrm{~s}^2, 3 \mathrm{p}^6, 4 \mathrm{~s}^1$.

Outermost orbital of potassium is 4 s orbital

$\mathrm{n}=4,1=0, \mathrm{~m}_1=0, \mathrm{~s}=\pm \frac{1}{2}$.