Q1 - 2024 (04 Apr Shift 1)

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

Q2 - 2024 (04 Apr Shift 2)

Choose the Incorrect Statement about Dalton's Atomic Theory

(1) chemical reactions involve reorganization of atoms

(2) Matter consists of indivisible atoms.

(3) Compounds are formed when atoms of different elements combine in any ratio.

(4) Compounds are formed when atoms of different elements combine in any ratio. All the atoms of a given element have identical properties including identical

mass.

Q3 - 2024 (04 Apr Shift 2)

The maximum number of orbitals which can be identified with $n = 4$ and $m_l = 0$ is ______

Q4 - 2024 (05 Apr Shift 1)

The incorrect postulates of the Dalton's atomic theory are :

(A) Atoms of different elements differ in mass.

(B) Matter consists of divisible atoms.

(C) Compounds are formed when atoms of different element combine in a fixed ratio.

(D) All the atoms of given element have different properties including mass.

(E) Chemical reactions involve reorganisation of atoms.

Choose the correct answer from the options given below :

(1) (C), (D), (E) only

(2) (B), (D) only

(3) (A), (B), (D) only

(4) (B), (D), (E) only

Q5 - 2024 (05 Apr Shift 1)

The value of Rydberg constant (R_H) is 2.18×10^{-18} J. The velocity of electron having mass 9.1×10^{-31} kg in Bohr's first orbit of hydrogen atom = _______ $\times 10^5$ ms^{-1} (nearest integer).

Q6 - 2024 (05 Apr Shift 2)

In an atom, total number of electrons having quantum numbers $\mathrm{n} = 4, |\mathrm{m}_l| = 1$ and $\mathrm{m_s} = -\frac{1}{2}$ is _______

Q7 - 2024 (06 Apr Shift 1)

Frequency of the de-Broglie wave of electron in Bohr's first orbit of hydrogen atom is _______ $\times 10^{13}$ Hz (nearest integer).

[Given : $\mathrm{R_H}$(Rydberg constant) $= 2.18 \times 10^{-18}$ J, h (Plank's constant)$= 6.6 \times 10^{-34}$ J.s.]

Q8 - 2024 (06 Apr Shift 2)

Consider the following reactions

$$\mathrm{NiS + HNO_3 + HCl \rightarrow A + NO + S + H_2O}$$

$$\begin{array}{l} \mathrm{A + NH_4OH + H_3C - C = N - OH} \\ \qquad\qquad\qquad\quad | \qquad\qquad\qquad\quad \rightarrow \mathrm{B + NH_4Cl + H_2O} \\ \qquad\qquad\quad \mathrm{H_3C - C = N - OH} \end{array}$$

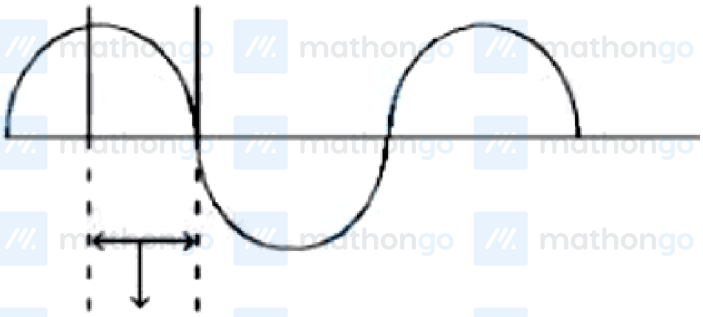
The number of protons that do not involve in hydrogen bonding in the product B is ______.

Q9 - 2024 (06 Apr Shift 2)

For hydrogen atom, energy of an electron in first excited state is $-3.4\mathrm{eV}$, K. E. of the same electron of hydrogen atom is xeV. Value of x is ______ $\times 10^{-1}$eV. (Nearest integer)

Q10 - 2024 (08 Apr Shift 1)

A hypothetical electromagnetic wave is show below.



The frequency of the wave is $x \times 10^{19}$ Hz.

$x =$ ______ (nearest integer)

Q11 - 2024 (08 Apr Shift 2)

Wavenumber for a radiation having 5800Ã . . . wavelength is $x \times 10\ cm^{-1}$. The value of x is ________ (Integer answer)

Q12 - 2024 (09 Apr Shift 1)

Compare the energies of following sets of quantum numbers for multielectron system.

(A) $n = 4, 1 = 1$

(B) $n = 4, l = 2$

(C) $n = 3, 1 = 1$

(D) $n = 3, 1 = 2$

(E) $n = 4, 1 = 0$

Choose the correct answer from the options given below :

(1) (B) $>$ (A) $>$ (C) $>$ (E) $>$ (D)

(2) (E) $<$ (C) $<$ (D) $<$ (A) $<$ (B)

(3) (E) $>$ (C) $>$ (A) $>$ (D) $>$ (B)

(4) (C) $<$ (E) $<$ (D) $<$ (A) $<$ (B)

Q13 - 2024 (09 Apr Shift 2)

The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency ' A ' $\times 10^{12}$ hertz and that has a radiant intensity in that direction of $\frac{1}{'B'}$ watt per steradian.

'A' and 'B' are respectively

(1) 540 and 683

(2) 450 and 683

(3) 450 and $\frac{1}{683}$

(4) 540 and $\frac{1}{683}$

Q14 - 2024 (09 Apr Shift 2)

The electronic configuration of Einsteinium is :

(Given atomic number of Einsteinium = 99)

(1) $[Rn]5f^{10}6d^{\circ}7s^2$

(2) $[Rn]5f^{13}6d^{\circ}7s^2$

(3) $[Rn]5f^{11}6d^{\circ}7s^2$

(4) $[Rn]5f^{12}6d^{\circ}7s^2$

Q15 - 2024 (09 Apr Shift 2)

Match List I with List II

	List - I (Element)		List - II (Electronic configuration)
A.	N	I.	$[Ar]3d^{10}4s^2 4p^5$ AR
B.	S	II.	$[Ne]3s^2 3p^4$
C.	Br	III.	$[He]2s^2 2p^3$
D.	Kr	IV.	$[Ar]3d^{10}4s^2 4p^6$

Choose the correct answer from the options given below:

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

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

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

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

Q16 - 2024 (09 Apr Shift 2)

Based on Heisenberg's uncertainty principle, the uncertainty in the velocity of the electron to be found within an atomic nucleus of diameter 10^{-15} m is ________. 10^{9} ms^{-1} (nearest integer)

[Given : mass of electron $= 9.1 \times 10^{-31}$ kg, Plank's constant $(h) = 6.626 \times 10^{-34}$Js] (Value of $\pi = 3.14$)

Answer Key

Q1 (8)	**Q2** (3)	**Q3** (4)	**Q4** (2)
Q5 (22)	**Q6** (6)	**Q7** (661)	**Q8** (12)
Q9 (34)	**Q10** (5)	**Q11** (1724)	**Q12** (4)
Q13 (1)	**Q14** (3)	**Q15** (1)	**Q16** (58)

Q1

$$2\pi r_n = n\lambda_d$$

$$2\pi a_0 \frac{n^2}{Z} = n\lambda_d$$

$$2\pi a_0 \frac{4^2}{1} = 4\lambda_d$$

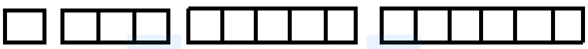
$$\lambda_d = 8\pi a_0$$

Q2

In compound atoms of different elements combine in fixed ratio by mass.

Q3

$n = 4$,



4s 4p 4d 4f

$m_\ell \Rightarrow$ 1 1 1 1

So answer is 4 .

Q4

B, D

Q5

$$V = 2.18 \times 10^6 \times \frac{Z}{n}$$

$$= 21.8 \times 10^5 \times \frac{1}{1} \approx 22 \times 10^5 \text{ (nearest)}$$

Q6

$n = 4$

ℓ	m_ℓ
0	0
1	$-1, 0, +1$
2	$-2, -1, 0, +1, +2, +3$

So number of orbital associated with

$n = 4, |m_\ell| = 1$ are 6

Now each orbital contain one e^- with $m_s = -\frac{1}{2}$

Q7

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

$$\lambda = \frac{hv}{mv^2}$$

$$\frac{mv^2}{h} = \frac{v}{\lambda} = v \text{ (frequency)}$$

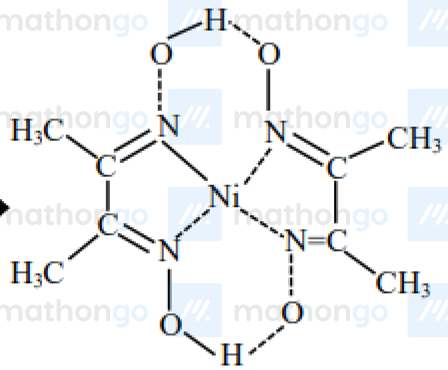
Given $\frac{1}{2}mv^2 = 2.18 \times 10^{-18}$ J

$h = 6.6 \times 10^{-34}$

$$v = \frac{4.36 \times 10^{-18}}{6.6 \times 10^{-34}} = 660.60 \times 10^{13} \text{ Hz}$$

$\approx 661 \times 10^{13}$ Hz

Q8

B → 

$3NiS + 2HNO_3 + 6HCl$

$\longrightarrow 3NiCl_2 + 2NO + 3S + 4H_2O$

$NiCl_2 + 2NH_4OH +$ $H_3C - C = N - OH$ | $H_3C - C = N - OH$

$\rightarrow NH_4Cl + H_2O + (B)$

Q9

Kinetic energy of electron is,

$KE = \frac{13 \cdot 6 Z^2}{n^2} eV$

For the first excited state of the hydrogen atom,

$n = 2$ and $Z = 1 \therefore KE = \frac{13.6}{2^2} = 3.4 eV$

Q10

$\lambda = 1.5 \times 4 pm$
$= 6 \times 10^{-12}$ meter
$\lambda v = C$
$6 \times 10^{-12} \times v = 3 \times 10^8$
$v = 5 \times 10^{19}$ Hz

Q11

$\bar{v}(\text{ wave no. }) = \frac{1}{\lambda} = \frac{1}{5800 \times 10^{-8} \text{ cm}} = 17241$

OR

$1724 \times 10 \text{ cm}^{-1} \Rightarrow x = 1724$

Q12

Energy level can be determined by comparing $(n + \ell)$ values

(A) $n = 4, \ell = 1 \Rightarrow (n + \ell) = 5$

(B) $n = 4, \ell = 2 \Rightarrow (n + \ell) = 6$

(C) $n = 3, \ell = 1 \Rightarrow (n + \ell) = 4$

(D) $n = 3, \ell = 2 \Rightarrow (n + \ell) = 5$

(E) $n = 4, \ell = 0 \Rightarrow (n + \ell) = 4$

For same value of $(n + \ell)$, orbital having higher value of n, will have more energy.

(B) > (A) > (D) > (E) > (C)

Q13

The candela is the luminous intensity of a source that emits monochromatic radiation of frequency radiation of frequency 540×10^{12} Hz and has a radiant intensity in that direction of $\frac{1}{683}$ w/sr. It is unit of Candela.

Q14

Einsteinium (atomic No = 99) : $[Rn]5f^{11}6\,d^{0}7\,s^{2}$

Q15

(A) $_7\,N : [He]2\,s^{2}2p^{3}$

(B) $_{16}\,S : [Ne]2\,s^{2}3p^{4}$

(C) $_{35}Br : [Ar]3\,d^{10}4\,s^{2}4p^{5}$

(D) $_{36}Kr : [Ar]3\,d^{10}4\,s^{2}4p^{6}$

Q16

$$m\Delta V.\,\Delta x = \frac{h}{4\pi}$$

$$\Delta V = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 10^{-15} \times 4 \times 3.14}$$
$$= 57.97 \times 10^{+9}\ \mathrm{m/sec}$$