Some Basic Concepts of Chemistry & Structure of Atom

1. At $300\ K$ and 1 atmospheric pressure, $10\ mL$ of a hydrocarbon required $55\ mL$ of O_2 for complete combustion and $40\ mL$ of CO_2 is formed. The formula of the hydrocarbon is:

   ✗ **A.** C_4H_8

   ✗ **B.** C_4H_7Cl

   ✗ **C.** C_4H_{10}

   ✓ **D.** C_4H_6

General reaction for combustion of hydrocarbons:

$$C_xH_y + \left(x + \frac{y}{4}\right) O_2 \ \rightarrow \ xCO_2 + \frac{y}{2}H_2O$$

$$10\ mL \quad 10\left(x + \frac{y}{4}\right)\ mL \ \ 10x\ mL$$

By given data,

$$10\left(x + \frac{y}{4}\right) = 55$$

and

$10x = 40$

Solving the above two equations:

$x = 4, y = 6 \Rightarrow C_4H_6$

Hence, option D is correct.

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2. What would be the molality of 20% (mass/mass) aqueous solution of KI ?
Molar mass of KI is $166\ g\ mol^{-1}$

A. 1.51 ✓

B. 1.35

C. 1.08

D. 1.48

20% (mass/mass) aqueous solution of KI means $20\ g$ of KI in $100\ g$ of solution.
Mass of solution =100g
Mass of solute=20g
Mass of solvent=mass of solution - mass of solute
$=(100-20)\ g = 80\ g = 0.08\ kg$
Molar mass of KI is $166\ g\ mol^{-1}$

$$\text{Number of moles of solute } (n) = \frac{\text{mass of KI}}{\text{molar mass of KI}} = \frac{20}{166} = 0.121\ mol$$

So, molality of solution $m = \dfrac{\text{number of moles of solute}}{\text{weight of solvent (in kg)}}$

$$\Rightarrow m = \frac{0.121}{0.08} = 1.51\ mol/kg$$

Hence, option (A) is the correct.

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3. Complete combustion of $1.80\ g$ of an oxygen containing compound $(C_xH_yO_z)$ gave $2.64\ g$ of CO_2 and $1.08\ g$ of H_2O. The percentage of oxygen in the organic compound is :

A. 50.33

B. 53.33

C. 51.63

D. 63.53

General reaction:

$$C_xH_yO_z + \left(x + \frac{y}{4} - \frac{z}{2}\right) O_2 \rightarrow xCO_2 + \frac{y}{2} H_2O$$

From the above equation the relation for number of moles is:

$$n_C = n_{CO_2} = \frac{2.64}{44} = 0.06\ mol$$

$$n_H = 2 \times n_{H_2O} = \frac{1.08}{18} \times 2 = 0.12\ mol$$

Mass of carbon, $m_C = \frac{2.64}{44} \times 12 = 0.72\ g$

Mass of hydrogen, $m_H = \frac{1.08}{18} \times 2 = 0.12\ g$

Mass of oxygen,

$m_O = \text{Mass of hydrocarbon} - m_C - m_H$

$= 1.80 - 0.72 - 0.12 = 0.96\ g$

$$\%\ O = \frac{0.96}{1.80} \times 100 = 53.33\%$$

Hence the correct answer is option (b).

4. An unknown chlorohydrocarbon has 3.55% of chlorine. If each molecule of hydrocarbon has one chlorine atom only, then chlorine atoms present in $1\ g$ of chlorohydrocarbon are:
$\text{Atomic weight of } Cl = 35.5\ u$
Avogadro constant, $N_A = 6.023 \times 10^{23}$

A. 6.023×10^{9}

B. 6.023×10^{23}

C. 6.023×10^{21}

D. 6.023×10^{20} ✔

An unknown chlorohydrocarbon has 3.55% of chlorine.
100 g of chlorohydrocarbon has 3.55 g of chlorine.
1 g of chlorohydrocarbon will have $3.55 \times \frac{1}{100} = 0.0355g$ of chlorine.
$\text{Atomic weight of } Cl = 35.5\ u$
$\text{Number of moles of } Cl = \frac{0.0355g}{35.5g/mol} = 0.001mol$
$\text{Number of atoms of} Cl = 0.001mol \times 6.023 \times 10^{23} mol^{-1} = 6.023 \times 10^{20}$
Hence, option D is correct.

5. On heating, a sample of $NaClO_3$, it gets converted to $NaCl$ with a loss of 0.16 g of oxygen. The residue is dissolved in water and precipitated as $AgCl$. The mass of $AgCl$ (in g) obtained will be :
(Given molar mass of $AgCl = 143.5\ g\ mol^{-1}$)

A. 0.35

B. 0.54

C. 0.41

D. 0.48 ✓

The molar mass of $O_2 = 32g/mol$

$0.16\text{g of oxygen } = \dfrac{0.16g}{32g/mol} = 0.005mol$

$2NaClO_3 \rightarrow 2NaCl + 3O_2$
$NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

3 moles of O_2=2 moles of $NaCl$=2 moles of $AgCl$.

$0.005 \text{ moles of } O_2 = 0.005 \times \dfrac{2}{3}\text{moles of AgCl}$

$\text{Molar mass of } AgCl = 143.5gmol^{-1}$

The mass of $AgCl$ (in g) obtained will be

$143.5\ g/mol^{-1} \times 0.005 \times \dfrac{2}{3}mol = 0.48g$

6. 5 moles of AB_2 weigh $125 \times 10^{-3} kg$ and 10 moles of A_2B_2 weigh $300 \times 10^{-3} kg$ .The molar mass of $A(M_A)$ and molar mass of $B(M_B)$ in kg/mol are :

A. $M_A = 10 \times 10^{-3} and M_B = 5 \times 10^{-3}$

B. $M_A = 25 \times 10^{-3} and M_B = 50 \times 10^{-3}$

C. $M_A = 5 \times 10^{-3} and M_B = 10 \times 10^{-3}$ ✔

D. $M_A = 50 \times 10^{-3} and M_B = 25 \times 10^{-3}$

$\text{Number of moles} = \frac{\text{Given mass}}{\text{Molar mass}}$

For AB_2

$5 = \frac{125}{M_A + 2M_B}$

$M_A + 2M_B = 25$..........(1)

For A_2B_2

$10 = \frac{300}{2M_A + 2M_B}$

$2M_A + 2M_B = 30$..........(2)

Solving 1 and 2 ;

$M_A = 5g/mol = 5 \times 10^{-3}$kg/mol

$M_B = 10g/mol = 10 \times 10^{-3}$kg/mol

7. 100 mL of a water sample contains 0.81g of calcium bicarbonate and 0.73g of magnesium bicarbonate. The hardness of this water sample expressed in terms of ppm of $CaCO_3$ is: (molar mass of calcium bicarbonate is 162 g/mol and magnesium bicarbonate is 146 g/mol.

A. $1000\ ppm$

B. $10000\ ppm$

C. $100\ ppm$

D. $5000\ ppm$

$Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2$
Now, this total amount of calcium carbonate formed is to be measured by taking into consideration both calcium as well as magnesium bicarbonate.
Thus, according to the data given we have to find the total degree of hardness which is given by,
$n_{eq}.\,CaCO_3 = n_{eq}.\,Ca(HCO_3)_2 + n_{eq}.\,Mg(HCO_3)_2$
$\frac{w}{100} \times 2 = \frac{0.81}{162} \times 2 + \frac{0.73}{146} \times 2$
$w = 1g$
Thus, 1 g of calcium carbonate is present in 100 mL and in terms of part per million in 100 mL it is:
$\Rightarrow \frac{1}{100} \times 10^6$
$\Rightarrow 10^4 ppm = 10000 ppm$
Thus, the correct answer is option B) 10000 ppm.

8. 1 gram of a metal carbonate (M_2CO_3) on treatment with excess HCl produces 0.01186 mole of CO_2. The molar mass of (M_2CO_3) in $g mol^{-1}$ is

A. 1186

B. 84.3

C. 118.6

D. 11.86

$M_2CO_3 + 2HCl \rightarrow 2MCl + H_2O + CO_2$
$0.01186 \text{ moles } CO_2 = 0.01186 \text{ moles of } M_2CO_3 = 1\ g\ M_2CO_3$
$$\text{Molar mass of } M_2CO_3 = \frac{\text{Mass of } M_2CO_3}{\text{No. of moles of } M_2CO_3} = \frac{1g}{0.01186 mol} = 84.3 g/mol$$

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9. Find the mole fraction of methanol in its 5.2 molal aqueous solution.

- ✗ **A.** 0.190
- ✓ **B.** 0.086
- ✗ **C.** 0.050
- ✗ **D.** 0.100

Mole fraction of solute (χ_{solute}) in aqueous solution = $\dfrac{molality}{molality + \dfrac{1000}{18}}$.

$$= \frac{5.2}{5.2 + \dfrac{1000}{18}} = 0.086$$

10. The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 g/mol) in 1000 g of water is 1.15 g/mL. The molarity of this solution is

- ✗ **A.** 1.78 M
- ✗ **B.** 1.02 M
- ✓ **C.** 2.05 M
- ✗ **D.** 0.50M

Total weight of solution = 1000 + 120 =1120g

Molarity $= \dfrac{120}{60} \times \dfrac{1000 \times 1.15}{1120} = 2.05\ M$

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11. The ground state energy of hydrogen atom is -13.6 eV. The energy of second excited state of He^+ ion in eV is

- ✔ **A.** -6.04
- ✖ **B.** -27.2
- ✖ **C.** -54.4
- ✖ **D.** -3.4

For hydrogen like species, energy of n^{th} shell is given by

$$(E)_{n^{th}} = (E_{GND})_H X \frac{Z^2}{n^2}$$

where,

$(E)_{n^{th}}$ is the energy of n^{th} state of hydrogen like species

$(E_{GND})_H$ is the ground state energy of hydrogen atom

Z is the atomic number

Thus,

$$E_{3^{rd}}(He^+) = (-13.6\ eV)X\frac{2^2}{3^2} = -6.04\ eV$$

Hence, correct option is (a).

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12. The de Broglie wavelength (λ) associated with a photoelectron varies with the frequency (v) of the incident radiation as, $[v_0$ is threshold frequency]:

A. $\lambda \propto \frac{1}{(v-v_0)^{\frac{3}{2}}}$

B. $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{2}}}$

C. $\lambda \propto \frac{1}{(v-v_0)^{\frac{1}{4}}}$

D. $\lambda \propto \frac{1}{(v-v_0)}$

In photoelectric effect, incident energy = thershold energy + KE
$hv = hv_0 + \mathrm{KE}$
$\mathrm{KE} = hv - hv_0$
KE = $\frac{mv^2}{2} = h(v-v_0)$
v = $\sqrt{\frac{2h(v-v_0)}{m}}$
de broglie wavelength λ = $\frac{h}{mv}$
v = $\frac{h}{m\lambda}$. Substituting v,
v = $\frac{h}{m\lambda}$.= $\sqrt{\frac{2h(v-v_0)}{m}}$
or λ = $\frac{h}{m} X \sqrt{\frac{m}{2h(v-v_0)}}$
λ = $\sqrt{\frac{h}{2m(v-v_0)}}$
λ = $(\frac{h}{2m(v-v_0)})^{1/2}$
Since h and m are constants,
$\lambda \propto (\frac{1}{(v-v_0)})^{1/2}$
Hence, the correct option is option (b).

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13. What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity $6 \times 10^5\ ms^{-1}$ form it?
(Mass of electron $= 9 \times 10^{-31} kg$
Velocity of light $= 3 \times 10^8 ms^{-1}$
Planck's constant $= 6.626 \times 10^{-34} Js$
Charge of electron $= 1.6 \times 10^{-19} JeV^{-1}$)

A. 0.9 eV

B. 4.0 eV

C. 2.1 eV

D. 3.1 eV

$h\nu = \phi + \frac{1}{2}mv^2$
where,
h is Planck's constant
ν is frequency of light
ϕ is work function
m is mass of electron
v is velocity of light
$\phi = h\nu - \frac{1}{2}mv^2$

$$\phi = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{4000 \times 10^{-10}} - \frac{1}{2} \times 9 \times 10^{-31} \times (6 \times 10^5)^2$$

$\phi = 3.35 \times 10^{-19}\ J$
1 eV = 1.6×10^{-19} J
~⇒ $\phi \simeq 2.1\ eV$
Option C is the correct answer

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14. The number of subshells associated with n = 4 and m = -2 quantum numbers is:

A. 4

B. 8

C. 2

D. 16

n = 4
For n=4, the possible 'l' values are 0,1,2,3.
l = 0 m = 0
l = 1 m = -1, 0, +1
l = 2 m = -2, +2, -1, +1, 0
l = 3 m = $\pm3, \pm2, \pm1, 0$

Answer: '2' Subshells

15. The region in the electromagnetic spectrum where the Balmer series lines appear is:

A. Microwave

B. Infrared

C. Visible

D. None of the above

The question should be a bonus as lines of the Balmer series belong to both UV as well as visible regions of the EM spectrum. Hence, correct answer should be option (c).

16. The shortest wavelength of H atom in the Lyman series is λ_1. The longest wavelength in the Balmer series of He^+ is

A. $\frac{5\lambda_1}{9}$

B. $\frac{36\lambda_1}{5}$

C. $\frac{27\lambda_1}{5}$

D. $\frac{9\lambda_1}{5}$ ✔

Shortest wavelength $\rightarrow$ Max energy$(\infty \rightarrow 1)$ (Lyman series)

$$\frac{1}{\lambda_1} = R_H(1)^2\left[\frac{1}{1} - 0\right]$$

$$\frac{1}{\lambda_1} = R_H \Rightarrow R_H = \frac{1}{\lambda_1}$$

For Balmer series,

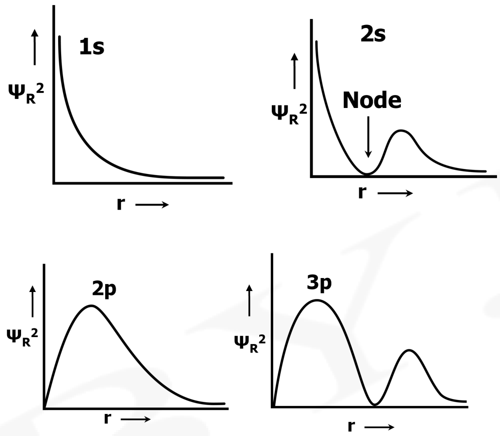
$$\frac{1}{\lambda} = R_H(2)^2\left[\frac{1}{2^2} - \frac{1}{3^2}\right] \Rightarrow R_H(4)\left(\frac{9-4}{36}\right)$$

$$\frac{1}{\lambda} = \frac{5R_H}{9} \Rightarrow \lambda = \frac{9}{5R_H} = \frac{9\lambda_1}{5}$$

Hence the correct answer is option (d).

17. The correct statement about probability density (except at infinite distance from nucleus) is

- ✗ **A.** It can never be zero for 2s orbital
- ✓ **B.** It can be zero for 3p orbital
- ✗ **C.** It can be zero for 1s orbital
- ✗ **D.** It can be negative for 2p orbital



Probability density is the square of wave function and hence is always positive .
So, option d is wrong.
Probality density changes with distance (radius) from nucleus. It becomes zero at radial nodes.

In 1s graph, the probability density curve does not become zero at any distance hence, option (c) is wrong.

In 2s graph, the probability density curve becomes zero at a point which is know as node. Hence, potion (a) is wrong.

In 3p graph, we have a minimum curve which denotes the node where probability density is zero.
Hence, option (b) is the correct statement.

18. The difference between radii of 3rd and 4th orbits of Li^{2+} is ΔR_1. The difference between the radii of 3rd and 4th orbits of He^{+} is ΔR_2. Ratio $\Delta R_1 : \Delta R_2$ is

A. 3 : 2

B. 8 : 3

C. 2 : 3 ✔

D. 3 : 8

$$r_n = a_0 \frac{n^2}{Z}$$

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

$$r_3(Li^{2+}) \propto \frac{3^2}{Z_{Li^{2+}}}$$

$$r_4(Li^{2+}) \propto \frac{4^2}{Z_{Li^{2+}}}$$

$$\Delta R_1 = r_4 - r_3 \propto \frac{4^2 - 3^2}{Z_{Li^{2+}}}$$

Similarly for He^{+}

$$\Delta R_2 = r_4 - r_3 \propto \frac{4^2 - 3^2}{Z_{He^{+}}}$$

$$\therefore \quad \frac{\Delta R_1}{\Delta R_2} = \frac{Z_{HE^{+}}}{Z_{Li^{2+}}} = \frac{2}{3}$$

Hence, (c) is the correct option

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19. The number of electron associated with quantum numbers $n = 5,\ m_s = +\frac{1}{2}$ is

A. 15

B. 50

C. 25

D. 11

The number of orbitals possible in a shell with principal quantum number 'n' is 'n^2'.
Each orbital can have one electron each of + and - spin.

Number of electrons with $m_s = +\frac{1}{2}$ is also 25

Hence, the correct answer is option (c).

20. The radius of the second Bohr orbit, in terms of the Bohr radius, $a_0,\ \text{in}\ Li^{2+}$ is:

A. $\frac{2a_0}{3}$

B. $\frac{2a_0}{9}$

C. $\frac{4a_0}{9}$

D. $\frac{4a_0}{3}$

$r = a_0 \frac{n^2}{Z}$Å

Bohr's radius of Li^{2+} ion for n = 2

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

$= \frac{4a_0}{3}$

Hence, option (d) is the correct answer.

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21. The ratio of the mass percentages of 'C and H' and C &O of a saturated acyclic organic compound 'X' are 4:1 and 3:4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is

Accepted Answers

5 5.0 5.00

Solution:

$C : H = 4 : 1$
$C : O = 3 : 4$
Mass ratio
$C : H : O$
$12 : 3 : 16$

Mole ratio:
$C : \ H : \ O$
$\frac{12}{12} : \frac{3}{1} : \frac{16}{16}$
$1 : \ 3 : \ 1$
Empirical formula $= CH_3O$
Molecular formula $= C_2H_6O_2$
(saturated acyclic organic compound)
General reaction:

$$C_xH_yO_z + \left(x + \frac{y}{4} - \frac{z}{2}\right) O_2 \rightarrow xCO_2 + \frac{y}{2} H_2O$$

$$C_2H_6O_2 + \frac{5}{2} O_2 \rightarrow 2CO_2 + 3H_2O$$

1 mol of organic compound reacts with 2.5 mol of oxygen
So,
2 moles of organic compound reacts with 5 moles of oxygen.

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22. Ferrous sulphate heptahydrate is used to fortify foods with iron.The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat (Rounded-off to the nearest integer) is
[Atomic weight : Fe=55.85 S=32.00 O=16.00]

Accepted Answers

5 5.0 5.00

Solution:

$10\ ppm = \frac{\text{Mass of Fe(in g)}}{100 \times 1000} \times 10^6$
Mass of $Fe = 1g$
Molar mass of $FeSO_4.7H_2O = 278\ g\ mol^{-1}$
Mass of Fe is 56 g in 1 mol
i.e.
$1g$ in $\frac{1}{56} mol.$
The amount (in grams) of the salt required to achieve 10 ppm of iron in 100 kg of wheat
$\Rightarrow \frac{1}{56} \times 278 = 4.96g \approx 5g$

23. The number of atoms of Na in 8 g of its sample is $x \times 10^{23}$.The value of x(rounded off to the nearest integer) is

[Given : $N_A = 6.02 \times 10^{23} mol^{-1}$
and Atomic mass of Na=23.0u]

Accepted Answers

2 2.0 2.00

Solution:

1 mol of Na or 23 g of Na has 6.02×10^{23} atoms.
8 g of Na has:
$\frac{8}{23} \times 6.02 \times 10^{23}$ atoms
$\Rightarrow 2.09 \times 10^{23}$ atoms
$\approx 2 \times 10^{23}$ atoms
The value of x is 2

24. 100 g of propane is completely reacted with 1000g of oxygen.The mole fraction of carbon dioxide in the resulting mixture is $x \times 10^{-2}$.The value of 'x' is (Rounded off to the nearest integer) is
[Atomic weight :H=1.008;C=12.00;O=16.00]

Accepted Answers

19 19.0 19.00

Solution:

100 g of propane = 2.27mol
1000g oxygen= 31.25 mol
$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$
From the equation 1 mol of propane reacts with 5 mol of oxygen to give 3 moles of carbon dioxide and 4 moles of water
So, by stoichiometric calculations:
2.27 mol of propane will react with 11.35 mol oxygen to give 6.81 mol carbon dioxide and 9.08 mol water

	$C_3H_8(g)$	$+5O_2(g)$	$\rightarrow 3CO_2(g)$	$+4H_2O(l)$
$t=0$	2.27	31.25	0	0
$t=\infty$	0	19.9	6.81	9.08

mole fraction of CO_2 in the final reaction mixture (heterogenous)
$$X_{CO_2} = \frac{6.81}{19.9 + 6.81 + 9.08}$$
$= 0.1902 = 19.02 \times 10^{-2}$
Value of x is 19

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25. $NaClO_3$ is used even in spacecrafts to produce O_2. The daily consumption of pure O_2 by a person is 492 L at $1\ atm$ and $300\ K$. How much amount of $NaClO_3$ in
grams, is required to produce O_2 for the daily consumption of a person at STP?
$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaC1(s) + FeO(s)$

Accepted Answers

21302130.02130.00

Solution:

$NaClO_3(s) + Fe(s) \rightarrow O_2(g) + NaC1(s) + FeO(s)$
Moles of $NaClO_3$ required = moles of O_2 produced
Moles of O_2 required
$n = \frac{PV}{RT} = \frac{1 \times 492}{0.082 \times 300} = 20\ mol$
Molar mass of $NaC1O_3 = 23 + 35.5 + (3 \times 16) = 106.5\ g\ mol^{-1}$
$\therefore$ Mass of $NaClO_3$ required $= 20 \times 106.5 = 2130\ g$

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26. A metal surface is exposed to 500 nm radiation. The threshold frequency of the metal for photoelectric current is $4.3 \times 10^{14} Hz$. The velocity of ejected electron is $\times 10^{5}\ ms^{-1}$. (Nearest integer)
[Use : $h = 6.63 \times 10^{-34} Js,\ m_e = 9.0 \times 10^{-31}\ kg$]

Accepted Answers

5 5.0 5.00

Solution:

$$h\nu = h\nu_0 + \frac{1}{2} m_e v^2$$
$$\frac{hc}{\lambda} = h\nu_0 + \frac{1}{2} m_e v^2$$

Here,
$\nu_0 =$ threshold frequency of the metal
h is planck's constant
m_e is mass of electron
v is velocity of ejected electron
Putting values:

$$\frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{500 \times 10^{-9}} = 6.63 \times 10^{-34} \times 4.3 \times 10^{14} + \frac{1}{2} \times 9 \times 10^{-31} \times v^2$$

$$v = 5 \times 10^{5}\ ms^{-1}$$

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27. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is equal to $\frac{h^2}{xma_0^2}$. The value of 10x is .

(a_0 is radius of Bohr's orbit) (Nearest integer)

[Given: $\pi = 3.14$]

Accepted Answers

31553155.03155.00

Solution:

Kinetic energy of an electron in nth orbit of Bohr atom :

$\frac{1}{2}mv^2 = \frac{(mv)^2}{2m}$

In Bohr's model,

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

$mv = \frac{nh}{2\pi r}$

$KE = \frac{n^2h^2}{8\pi^2mr^2}$

For 2nd orbit of H-atom

$n = 2$ and $r = 4a_0$

$\therefore \quad KE = \frac{4h^2}{8\pi^2m \times 16a_0^2} = \frac{h^2}{315.5\ ma_0^2}$

$\therefore \quad x = 315.5;\ 10x = 3155$

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28. The number of photons emitted by a monochromatic (single frequency) infrared range finder of power 1 mW and wavelength of 1000 nm, in 0.1 second is $x \times 10^{13}$. The value of x is . (Nearest integer)
$(h = 6.63 \times 10^{-34}\ Js,\ c = 3.00 \times 10^{8}\ ms^{-1})$

Accepted Answers

50 50.0 50.00

Solution:

Power $= 1\ mW$
$= 10^{-3}\ J$ in 1 sec.
$= 10^{-4}\ J$ in 0.1 sec.
$\therefore$ Energy $= \frac{nhc}{\lambda}$

$$10^{-4} = \frac{n \times 6.63 \times 10^{-34} \times 3 \times 10^{8}}{1000 \times 10^{-9}}$$

$n = 50.2 \times 10^{13}$
$\therefore\ x = 50$

29. The value of magnetic quantum number of the outermost electron of Zn^{+} ion is . (Integer answer)

Accepted Answers

0 0.0

Solution:

$Zn(30) = [Ar]4s^{2}3d^{10}$

$Zn^{+} = [Ar]4s^{1}3d^{10}$

Outermost electron is present in 4s
n = 4 l = 0 $m_1 = 0$

30. A 50 watt bulb emits monochromatic red light of wavelength of 795 nm. The number of photons emitted per second by the bulb is $x \times 10^{20}$. The value of x is . (Nearest integer)
[Given: $h = 6.63 \times 10^{-34}\ Js$ and $c = 3.0 \times 10^{8}\ ms^{-1}$]

Accepted Answers

2 2.0 2.00

Solution:

$$E = nh\nu = \frac{nhc}{\lambda}$$

50 watt bulb emits 50 J energy per second.

$$50 = \frac{n \times 6.63 \times 10^{-34} \times 3 \times 10^{8}}{795 \times 10^{-9}}$$

$$n = \frac{50 \times 795 \times 10^{-9}}{6.63 \times 10^{-34} \times 3 \times 10^{8}}$$

$n = 2 \times 10^{20}$
Value of x =2