3. ATOMIC MODELS

SOLUTIONS

TEACHING TASK

1. If two neutrons are added to an element X, then it will get converted to its
   A) isotope B) isotone C) isobar D) None of the above

Answer:A

Solution:Adding neutrons changes the mass number (A) but not the atomic number (Z).

Isotopes are atoms of the same element (same Z) but different mass numbers (A) due to varying neutrons.

Since the element (X) remains the same but its neutron count increases, it becomes an isotope.

2. Two nuclides A and B are isoneutronic. Their mass numbers are 76 and 77 respectively. If atomic number of A is 32, then the atomic number of B will be
   A) 33 B) 34 C) 32 D) 30

Answer:A

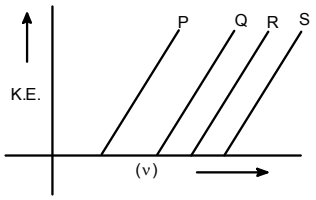
Solution:Isoneutronic means same number of neutrons (N).

For nuclide A (Mass number = 76, Z = 32):

N=A-Z=76-32=44 neutrons

For nuclide B (Mass number = 77, Z = ?):

N=44=77-Z?Z=77-44=33

3. 

   P, Q, R and S are four elements belonging to the same group of the periodic table. Identify the correct sequence with regard to their atomic number with respect to frequency.
   A) P < Q < R < S B) P > Q > R > S
   C) P > Q < R < S D) P < Q > R > S

Answer:A

Solution:In the image:

S has the lowest threshold frequency $\rightarrow$lowest work function

P has the highest threshold frequency $\rightarrow$ highest work function

Trend in a Group:As we go down a group, atomic number increases, and:
Ionization energy and work function decrease
Hence, threshold frequency decreases
So:P has the highest threshold frequency → smallest atomic number
S has the lowest threshold frequency →largest atomic number
Correct Atomic Number Order:P < Q < R < S

4.. The number of neutrons in dipositive zinc ion with mass number 70 is
(A) 34 B) 36 C) 38 D) 40

Answer:D

Solution:Zinc (Zn) has an atomic number (Z) = 30 (this is fixed for all zinc atoms).
The ion is dipositive zinc (Zn^{2+}), meaning it has lost 2 electrons.
However, neutrons and protons are in the nucleus, and electron loss does not affect their count.
Calculate the number of neutrons:Mass number (A) = 70 (given).
Number of neutrons (N) = A - Z = 70 - 30 = 40.

5. The triad of nuclei that is isotonic is:
(A) ${}^{14}_{6}C$, ${}^{15}_{7}N$, ${}^{17}_{9}F$ B) ${}^{12}_{6}C$, ${}^{14}_{7}N$, ${}^{19}_{9}F$ C) ${}^{14}_{6}C$, ${}^{14}_{7}N$, ${}^{17}_{9}F$ D) ${}^{14}_{6}C$, ${}^{14}_{7}C$, ${}^{19}_{9}F$

Answer:A

Solution:Isotonic nuclei have the same number of neutrons (N) but different atomic numbers (Z) and mass numbers (A).
Neutron number (N) = Mass number (A) - Atomic number (Z).
(A) ${}^{14}_{6}C$, ${}^{15}_{7}N$, ${}^{17}_{9}F$
${}^{14}_{6}C$:N=14-6=8
${}^{15}_{7}N$:N=15-7=8
${}^{17}_{9}F$:N=17-9

6. Rutherford's experiment, which estabilished the nuclear model of the atom, used a beam of:
(A) β-particles, which impinged on a metal foil and got absorbed.
(B) γ-rays, which impinged on a metal foil and ejected electrons.
(C) helium atoms, which impinged on a metal foil and got scattered.
(D) helium nuclei, which impinged on a metal foild and got scattered.

Answer:D

Solution:Rutherford's gold foil experiment (1911) led to the discovery of the atomic nucleus.
He used a beam of alpha particles (a-particles), which are helium nuclei (He^{2+})
Option D (Helium nuclei): Correct. Alpha particles are He^{2+} nuclei, which scattered off the gold foil, revealing the nucleus.

7. The sum of the number of neutrons and protons in the isotope of hydrogen is:
A) 6 B) 5 C) 4 D) 3

Answer:D

Solution:Hydrogen has three main isotopes:
Protium (${}^{1}H_{1}$) → 1 proton, 0 neutrons → sum = 1
Deuterium (${}^{2}H_{1)}$ → 1 proton, 1 neutron → sum = 2
Tritium (${}^{3}H_{1}$) → 1 proton, 2 neutrons → sum = 3

So, the maximum sum of protons and neutrons in a naturally occurring isotope of hydrogen is: 3 (in Tritium)

8. An atom contains electrons, protons and neutrons. If the mass of each neutrons is halved, and each electron is doubled, then the atomic mass of $_{12}Mg^{24}$

A) Gets doubled B) Approximately remain same

C) Approximately get reduced by 5% D) Approximately get reduced by 25%

Answer:D

Solution:Standard Composition of $_{12}Mg^{24}$

Protons = 12

Neutrons = 12

Electrons = 12 (if neutral)

Neutron mass halved: N=12/2=6

Total atomic mass A=Z+N=12+6=18

Original atomic mass=24

Reduction in mass =24-18=6

Percentage reduction: $\frac{6}{24}\times 100 = 25\%$

9. The e/m ratio of cathode rays is x unit, when hydrogen is filled in the discharge tube. What will be its value when deuterium (D_2) is filled in it?

A) x unit B) x/2 unit C) 2x unit D) x/4 unit

Answer:A

Solution:The e/m ratio remains x regardless of the gas (hydrogen or deuterium).

10. α–particles are projected towards the following metals, with the same kinetic energy. Towards which metal, the distance of closest approach is minimum?

A) $Cu(Z=29)$ B) $Ag(Z=47)$ C) $Au(Z=79)$ D) $Ca(Z=20)$

Answer:C

Solution:Formula for Distance of Closest Approach: $r_{\min} = \frac{1}{4\pi \in_0}\frac{2Ze^2}{K}$

$r_{\min}\alpha\frac{Z}{K}$

Since K is constant, $r_{\min}\alpha Z$

Higher Z $\rightarrow$Smaller $r_{\min}$ (because Coulomb repulsion increases, stopping the alpha particle sooner).

Gold (Au) has the highest Z (79), so it will have the smallest $r_{\min}$

STATEMENT TYPE

(A) Both statement-1 and statement-2 are correct, and statement-2 is the correct explanation of the statement-1.

(B) Both statement-1and statement-2 are correct, and statement-2 is the notcorrect explanation of the statement-1.

(C) statement-1 is correct, but statement-2 is incorrect.

(D) statement-1 is incorrect, but statement-2 is correct.

11. **STATEMENT-1:** Nuclide $^{30}_{13}Al$ is less stable than $^{40}_{20}Ca$.
STATEMENT-2: Nuclides having odd number of protons and neutrons are generally unstable.

Answer:A

Solution:

$^{30}_{13}Al$:Protons (Z) = 13 (odd)

Neutrons (N) = 30 - 13 = 17 (odd)

Odd-odd nuclei are typically unstable.

$^{40}_{20}Ca$:Protons (Z) = 20 (even)

Neutrons (N) = 40 - 20 = 20 (even)

Even-even nuclei are highly stable.

12. **STATEMENT-1** : The frequency of ultraviolet radiation is greater than the frequency of infrared radiation
STATEMENT-2 : The velocity of ultraviolet radiation is greater than the velocity of infrared radiation.

Answer:C

Solution:In the electromagnetic spectrum:“ Ultraviolet (UV) has shorter wavelength than infrared (IR).

Since: $Frequency(\upsilon) = \frac{C}{\lambda}$

Shorter wavelength means higher frequency.

So, UV has greater frequency than IR.

In vacuum (or air), all electromagnetic waves travel at the same speed, i.e.,c = 3×10^8 m/s

So, UV and IR have the same velocity in vacuum.

COMPREHENSION TYPE

Comprehension - I

Atomic number of an element is characterised by Mosely's law & is given as $\sqrt{\vartheta} = a(z-b)$, where ϑ is frequency of x-rays, a & b are constants.

13. Which of the following represents Mosley's law

A) $\sqrt{\vartheta} \propto \frac{1}{z}$ B) $\sqrt{\lambda} \propto z$ C) $\sqrt{\frac{\lambda_1}{\lambda_2}} = \frac{z_2}{z_1}$ D) $\sqrt{\lambda} \propto \frac{1}{z}$

Answer:D

Solution:

$$Frequency(\upsilon) = \frac{C}{\lambda}$$

$$\sqrt{\upsilon} \alpha \frac{1}{\sqrt{\lambda}}$$

$$\frac{1}{\sqrt{\lambda}} \alpha Z$$

$$\sqrt{\lambda} \alpha \frac{1}{Z}$$

14. In the graph between $\sqrt{\vartheta}$ & z (Moseley's equation), if a straight line is at angle of 45^0 with intercept 1 on $\sqrt{\vartheta}$ axis. Then constant 'a' is

A) $\frac{1}{2}$ B) 1 C) $\sqrt{2}$ D) $\sqrt{3}$

Answer:B

Solution:Moseley's equation is: $\sqrt{\upsilon} = a(Z-b)$

$\sqrt{\upsilon}$ =Square root of the X-ray frequency.

Z = Atomic number.

a,b = Constants

Slope of the line (a):The line makes a 45° angle with the Z-axis.

Slope (a) = tan(45°)=1

Comprehension - II

Electron, proton & neutron are said to be fundamental particles the charge of fundamental particles calculated by mullikan oil drop experiment.

15. An oil drop has -6.39×10^{-19} coulomb change. The number of electrons in this oil drop is

A) 4 B) 3 C) 2 D) 1

Answer:A

Solution:The charge of a single electron is -1.6 × 10^{-19} C.

Given charge on the oil drop = -6.39 × 10^{-19} C.

Number of electrons = Total charge / Charge of one electron

$$n = \frac{\text{-}6.39 \times 10^{-19}}{\text{-}1.6 \times 10^{-19}} = \frac{6.39}{1.6} \approx 3.99 \approx 4$$

INTEGER TYPE

16. The no . of electrons in 8 gm of O^{-2} ion is $x \times 10^{24}$ then x is _____

Answer:3

Solution:Molar mass of O=16 g/mol.

Moles of O^{2-} in 8 g: $\frac{8g}{16g/mol} = 0.5 moles$

Each O^{2-} ion has: 8 protons + 2 extra electrons = 10 electrons.
Total electrons:0.5 x 10 x 6.022 x10 ^{23}=3.011 x 10^{24}
xx10^{24} =3.011 x 10^{24}
x=3.011

17. How many grams of nitrogen (N^{14}) contains same number of neutrons as 6 gm of C^{12}

Answer:6

Solution:Carbon-12 (^{12}C):Atomic number = 6 $\rightarrow$ protons = 6
Neutrons = 12 – 6 = 6 neutrons per atom
Nitrogen-14 (^{1}4N):Atomic number = 7 $\rightarrow$protons = 7
Neutrons = 14 – 7 = 7 neutrons per atom
Number of neutrons in 3gms Carbon
6gms$\rightarrow$6 neutrons
3gms $\rightarrow$xneutrons
x=3neutrons
Weight of nitogen for 3 neutrons
14gms $\rightarrow$7 neutrons
xgms$\rightarrow$3 neutrons
x=14(3)/7=6gms

18. Though Moseley's equation $\sqrt{\vartheta}$ on y-axis & z on x-axis, if a straight line is at angle of 45^0 and y intercept equal to 1 & is obtained when the frequency is 25 sec^{-1} then, atomic number of the element is

Answer:4

Solution: Moseley's Equation
Moseley's law relates the frequency (υ) of characteristic X-rays to the atomic number (Z) as: $\sqrt{\upsilon} = a(Z-b)$

$\sqrt{\upsilon}$: Square root of the X-ray frequency (plotted on the y-axis).
Z: Atomic number (plotted on the x-axis).
a: Slope of the line.
b: Shielding constant (y-intercept correction).
The line makes a 45° angle with the x-axis, so its slope is : a=tan(45°)=1
The y-intercept occurs when Z=0: $\sqrt{\upsilon} = a(0-b) \Rightarrow Y-\text{int}ercept = -ab$
Given the y-intercept is 1, we solve for b:
1=-1·b $\Rightarrow$ b=-1
Substitute υ=25, a=1, and b=-1 into Moseley's equation:

$$\sqrt{25} = 1(Z-(-1)) \Rightarrow 5 = Z+1$$
$$Z = 5-1 = 4$$

19. The atomic mass of an element is 19. The second shell of its atom contains 7 electrons. The number of neutrons in its nucleus is 2x. The value of x is _____

Answer:5

Solution:Given that the second shell has 7 electrons, the total number of electrons (and thus protons, in a neutral atom) is:

First shell: 2 electrons

Second shell: 7 electrons

Total electrons = 2 + 7 = 9

Therefore, the atomic number (Z) is 9. This corresponds to the element Fluorine (F).

The atomic mass is the sum of protons and neutrons:

A=Number of protons+Number of neutrons

19=9+Number of neutrons

Number of neutrons=19-9=10

It is given that the number of neutrons is 2x:

2x=10

x=5

20. Sum of the number of neutrons and protons in an isotope of hydrogen (Deuterium) is _____

Answer:2

Solution:Deuterium (^2H or D): 1 proton, 1 neutron.

Sum = 1 (proton) + 1 (neutron) = 2

21. The mass number of an anion, X^{3-}, is 14. If there are ten electrons in the anion, the number of neutrons in the nucleus of atom, X_2 of the element will be

Answer:7

Solution:The anion is X^{3-}, meaning it has 3 extra electrons compared to the neutral atom X

The mass number (A) of X^{3-} is 14.

Number of electrons in X=10-3=7

In a neutral atom, the number of electrons = number of protons.

Atomic number (Z)=7

A=Number of protons (Z)+Number of neutrons (N)

14=7+Number of neutrons

Number of neutrons=14-7=7

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1. Among the following which is not isoelectronic with others

A) HF B) H_2O C) NH_3 D) CO

Answer:D

Solution:Isoelectronic species have the same number of electrons.
Let's calculate the total number of electrons in each:
HF: 1 (H) + 9 (F) = 10 electrons
H_2O: 2 (H) + 8 (O) = 10 electrons
NH_3: 7 (N) + 3 (H) = 10 electrons
CO: 6 (C) + 8 (O) = 14 electrons

2. Set of iso electronic ions among the following is
   A) Na^+, Cl^-, O^{-2} B) K^+, Ca^{+2}, F^- C) Cl^-, K^+, S^{-2} D) H^+, Be^{+2}, Na^+

Answer:C

Solution:Isoelectronic ions have the same number of electrons.
Let's calculate the number of electrons in each ion:
A) Na^+ (11-1=10), Cl^- (17+1=18), O^{2-} (8+2=10) $\rightarrow$ Not isoelectronic
B) K^+ (19-1=18), Ca^{2+} (20-2=18), F^- (9+1=10) $\rightarrow$ Not isoelectronic
C) Cl^- (17+1=18), K^+ (19-1=18), S^{2-} (16+2=18) $\rightarrow$ All have 18 electrons
D) H^+ (1-1=0), Be^{2+} (4-2=2), Na^+ (11-1=10) $\rightarrow$ Not isoelectronic

3. The total number of protons in one molecule of nitrogen dioxide
   A)23 B)46 C)69 D)92

Answer:A

Solution:NO_2 consists of 1 Nitrogen (N) and 2 Oxygen (O) atoms.
Protons in N = 7, Protons in O = 8.
Total protons in NO_2 = 7 (N) + 2 × 8 (O) = 7 + 16 = 23.
Since 1 molecule has 23 protons

4. Number of neutrons in heavy hydrogen atom is
   A)0 B)1 C)2 D)3

Answer:B

Solution:Heavy hydrogen (Deuterium, ^2H) has:
1 proton
1 neutron (unlike normal hydrogen, which has 0 neutrons).

5. The nucleus of helium contains
   A) Four protons B)Four neutrons
   C)Two neutrons and two protons D) Four protons and two electrons

Answer:C

Solution:Helium nucleus ($_2He^4$) has:
2 protons,2 neutrons (since mass number = 4).

6. An atom has 26 electrons and its atomic weight is 56. The number of neutrons in the nucleus of the atom will be
   A)26 B)30 C)36 D)56

Answer:B

Solution:Atomic number (Z) = Number of protons = Number of electrons = 26.
Mass number (A) = 56.

Number of neutrons = A - Z = 56 - 26 = 30.

7. The atomic number of an element represents
   A) Number of neutrons in the nucleus (b)Number of protons in the nucleus
   C) Atomic weight of element (d)Valency of element

Answer:B

Solution:Atomic number (Z) = Number of protons.

8. The mass of an atom is constituted mainly by
   A)Neutron and neutrino B)Neutron and electron
   C)Neutron and proton D)Proton and electron

Answer:C

Solution:Most of the mass comes from protons and neutrons (electrons contribute negligibly).

9. An element with mass number 120 contains 40% more neutrons as compared to protons. Then element is
   A) Mn^{120} B) Sn^{120} C) Fe^{56} D) None of these

Answer:B

Solution:Let number of protons = p.

Number of neutrons = p + 0.4p = 1.4p.

Mass number (A) = p + 1.4p = 2.4p = 120.

p = 120 / 2.4 = 50.

Element with atomic number 50 is Tin (Sn).

10 The average atomic mass of Boron is 10.2 whose isotopes are in 4 : 1 abundance. The isotopic mass of isotopes are
   A) 10 & 11 B) 9 & 11 C) 11 & 10 D) 11 & 9

Answer:A

Solution: Let the abundance ratio be 4x : x (total = 5x).

Let the isotopic masses be M1 and M2.

Average mass = (4x × M1 + x × M2) / 5x = 10.2.

Simplifying: 4M1 + M2 = 51.

Checking options:

A) 10 & 11 $\rightarrow$ 4×10 + 11 = 51 (matches).

JEE MAIN LEVEL QUESTIONS

1. The molecular weight of an oxide of nitrogen is 30. What should be the number of electrons in it ?
   A) 15 B) 30 C) 45 D) 20

Answer:A

Solution:The oxide of nitrogen with molecular weight 30 is NO (Nitric Oxide).

Nitrogen (N) has 7 protons and 7 electrons.

Oxygen (O) has 8 protons and 8 electrons.

Total electrons in NO = 7 (N) + 8 (O) = 15 electrons.

2. A dipositive ion has 16 protons. What should be the number of electrons in its tetrapositive ion.

A)16 B) 14 (C) 12 D) 10

Answer:C

Solution: Dipositive ion (X^{2+}) has:

Protons = 16 (atomic number Z = 16, element is Sulfur (S)).

Electrons = 16 - 2 = 14 (since it lost 2 electrons).

Tetrapositive ion (X^{4+}) will lose 2 more electrons:

Electrons = 14 - 2 = 12.

3. Rutherford's alpha particle scattering experiment eventually led to the conclusion that:

(A) mass and energy are related.

(B) electrons occupy space around the nucleus'

(C) neutrons are buried deep in the nucleus

(D) the point of impact with matter can be precisely determined.

Answer:B

Solution:Rutherford's experiment proved that:

Most of the atom is empty space.

Electrons orbit around a tiny, dense nucleus.

4. Rutherford's scattering experiment is related to the size of the

(A) nucleus B) atoms C) electron D) neutron

Answer:A

Solution:The experiment determined the size of the nucleus relative to the atom.

5. Among ${}_{10}A^{20}$ ${}_{11}B^{21}$ ${}_{11}C^{22}$ and ${}_{12}D^{22}$ the isobar combination is

A) A & B B) B & C C) C & D D) A & D

Answer:C

Solution:Isobars have the same mass number but different atomic numbers.

C (${}_{11}C^{22}$) and D (${}_{12}D^{22}$) both have mass number = 22.

6. The wrong statement among the following is

A) Nitrogen atom, nitride ion have same atomic number

B) Aluminium atom and its ion have same mass number

C) Iron atom, ferrous ion have same electron configuration

D) Nuclear charge is same in both chlorine atom, chloride ion

Answer:C

Solution:Iron atom (Fe) has electron configuration [Ar] 3d6 $4s^2$.

Ferrous ion (Fe^{2+}) loses 2 electrons $\rightarrow$[Ar] $3d^6$ (different configuration).

7. An ion with mass number 56 contains 3 units of positive charge and 30.4% more neutrons than electrons. Assign the symbol to this ion

A) ${}^{55}_{26}Fe^{3+}$ B) ${}^{57}_{26}Fe^{3+}$ C) ${}^{59}_{26}Fe^{3+}$ D) ${}^{56}_{26}Fe^{3+}$

Answer:D

Solution:Mass number (A) = 56 (protons + neutrons)

Charge = +3 (means 3 electrons lost compared to neutral atom)

Neutrons are 30.4% more than electrons

For a neutral atom: electrons = protons

For the ion: electrons = protons - 3---(1)
e = p - 3
Given that neutrons are 30.4% more than electrons:
n = e + 0.304e = 1.304e----(2)
Mass number (A) = protons + neutrons
p + n = 56
p + 1.304e = 56
But from (1), e = p - 3, so:
p + 1.304(p - 3) = 56
p + 1.304p - 3.912 = 56
2.304p = 59.912
p = 59.912 / 2.304 ˜ 26
Determine Electrons and Neutrons:
From (1): e = p - 3 = 26 - 3 = 23
From (2): n = 1.304 × 23 ˜ 30
Verify Mass Number:
p + n = 26 + 30 = 56 (matches given mass number)
Identify the Element:
Atomic number (Z) = number of protons = 26
The element with Z = 26 is Iron (Fe)
Mass number = 56
Charge = +3
Symbol: $_{26}{}^{56}Fe^{3+}$

8. Two isotopes of Boron are found in the nature with atomic weights 10.01(I) and 11.01(II). The atomic weight of natural Boron is 10.81. The percentage of (I) and (II) isotopes in it are respectively-
(A) 20 and 80 (B) 10 and 90 (C) 15 and 75 D) 30 and 70

Answer:A

Solution:Let % of isotope I = x, then % of isotope II = 100 - x.
Average atomic mass:

$$10.01\frac{x}{100}+11.01\frac{100-x}{100}=10.81$$
$$10.01x+1101-11.01x=1081$$
$$-x=-20$$
$$x=20$$

Isotope I = 20%, Isotope II = 80%.

9. An isotope of zirconium has 25% more neutrons as campared with protons. Atomic mass number of isotope is
A) 40 B) 50 C) 10 D) 90

Answer:D

Solution:Zirconium (Zr) has atomic number (Z) = 40 (protons = 40).

Neutrons = 40 + 0.25 × 40 = 50.

Mass number (A) = protons + neutrons = 40 + 50 = 90.

10. The abundance of Ne^{20}, Ne^{21} & Ne^{22} are 0.98, 0.015 & 0.005 respectively the average atomic mass of Neon is

A) 20 B) 20.025 C) 20.25 D) 21.25

Answer:B

Solution:Average atomic mass:

(20×0.98)+(21×0.015)+(22×0.005)=19.6+0.315+0.11=20.025

JEE ADVANCED QUESTIONS

MULTIPLE CORRECT ANSWER TYPE

11. An isostone of $^{76}_{32}Ge$ is/are:

(A) $^{77}_{32}Ge$ (B) $^{77}_{33}As$ (C) $^{77}_{34}Se$ (D) $^{78}_{34}Se$

Answer:B,D

Solution:Isostones: Nuclides with the same neutron number

$^{76}_{32}Ge$:n=76-32=44

(A) $^{77}_{32}Ge$:77-32=45

(B) $^{77}_{33}As$:77-33=44

(C) $^{77}_{34}Se$:77-34=43

(D) $^{78}_{34}Se$:78-34=44

12. Many elements have non-integral masses because:

(A) they have isotopes (B) their isotopes have non-integral masses

(C) their isotopes have different masses

(D) the constituents, neutrons, protons and electrons, combine to give fractional masses.

Answer:A,C

Solution:Option A: "They have isotopes"

While having isotopes is a prerequisite for non-integral masses, this alone doesn't explain why the average is non-integral.

Option C: "Their isotopes have different masses"

This is the core reason. The weighted average of different isotopic masses (e.g., $^{3}5Cl$ ~35 amu and $^{3}7Cl$ ~37 amu) results in a non-integral value (Cl = 35.45 amu).

Even if isotopes had integral masses, their differing masses and abundances would still produce a non-integral average.

13. When α- particles are sent through a thin metal foil, most them go straight through the foil because:

(A) α- particles are much heavier than electrons

(B) α- particles are positively charged (C) most part of the atom is empty space

(D) α- particle move with high velocity.

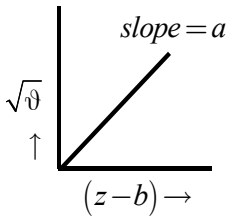
Answer:A,C

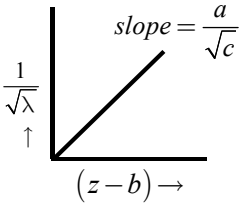
Solution:Alpha particles passes mostly undeflected when sent through thin metal foil mainly, because

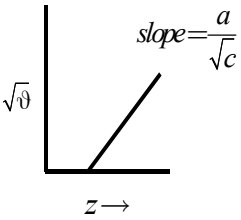
(i) it is much heavier than electrons.

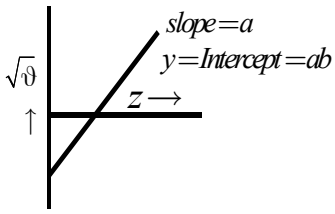
(ii) most part of atom is empty space.

14. Which of the following graphs represents Moseley's Law

A) 

B) 

C) 

D) 

Answer:A,B,C,D

Solution:Moseley's Law relates the frequency of X-rays emitted by an element to its atomic number Z. It is mathematically expressed as:

$\sqrt{\upsilon} = a(Z-b)$

The equation resembles the straight-line form:y=mx+c

y= $\sqrt{\upsilon}$, x=(Z-b), slope = a

Option A is correct:It plots $\sqrt{\upsilon}$ " on the y-axis vs (Z-b) on the x-axis.

The slope is labeled as a, matching the equation.

This exactly represents Moseley's Law in its proper linear form.

COMPREHENSION TYPE

Comprehension - I

15. Atomic number (z) of an element is

A) equal to charge of atom

B) equal to total charge of all electrons present in an ion of element

C) equal to charge of nucleus

D) equal to number of neutrons present in nucleus

Answer:C

Solution:The atomic number Z is fundamentally the number of protons, which directly equals the nuclear charge in units of +e.

Moseley's law experimentally tied X-ray frequency to Z, proving it represents nuclear charge.

Comprehension - II

Electron, proton & neutron are said to be fundamental particles the charge of fundamental particles calculated by mullikan oil drop experiment.

16. The total number of fundamental particle in ${}_{8}O^{17}$

A) 8 B) 17 C) 16 D) 25

Answer:D

Solution:Understanding the Notation ${}_{8}O^{17}$

The subscript 8 = Atomic number (Z) = Number of protons.
The superscript 17 = Mass number (A) = Protons + Neutrons.
Calculating Fundamental Particles:
Protons (p^+): Z = 8
Neutrons (n°): A - Z = 17 - 8 = 9
Electrons (e^-): In a neutral atom, electrons = protons = 8
Total Fundamental Particles:
Protons + Neutrons + Electrons = 8 (p^+) + 9 (n°) + 8 (e^-) = 25

17. The isotope doesnot consists of neutron
A) $_1H^2$ B) $_1H^1$ C) $_2He^4$ D) None of these.

Answer:B

Solution: $^1H^1$ It is the only isotope that does not contain a neutron.

INTEGER TYPE

18. The no . of electrons in 8 gm of O^{-2} ion is $x \times 10^{24}$ then x is _____

Answer:3

Solution:Molar mass of O=16 g/mol.

Moles of O^{2-} in 8 g: $\frac{8g}{16g/mol} = 0.5 moles$

Each O^{2-} ion has: 8 protons + 2 extra electrons = 10 electrons.
Total electrons:0.5 x 10 x 6.022 x10 ^{23}=3.011 x 10^{24}
xx10^{24} =3.011 x 10^{24}
x=3.011

MATRIX MATCHING TYPE

19.**Answer:A-S,B-R,C-P,D-Q**

Solution:

Column-I	**Column-II**
A) Thomson atomic model	S) No existence of orbitals
B) Rutherford's atomic model	R) Existence of Nucleus
C) Atomic Number	P) Protons or electrons in Neutral atom
D) Mass Number	Q) Protons + Neutrons Collectively

20. Answer:**A-R,B-P,C-S,D-Q**

Column-I	**Column-II**
A) Isosters	R) C_6H_6 & $B_3N_3H_6$
B) Isodiaphers	P) F_9^{19}, Na_{11}^{23}
C) Isotones	S) $^{23}_{11}Na, ^{24}_{12}Mg$
D) Isobars	Q) $_6C^{14}$, $_7N^{14}$

KEY

				TEACHING TASK					
1	2	3	4	5	6	7	8	9	10
A	A	A	D	A	D	D	D	A	C
11	12	13	14	15	16	17	18	19	20
A	C	D	B	A	3	6	4	5	2
21									
7									
				LEARNERS TASK					
				CUQ'S					
1	2	3	4	5	6	7	8	9	10
D	C	A	B	C	B	B	C	B	A
				JEE MAIN&ADVANCED LEVEL QUESTIONS					
1	2	3	4	5	6	7	8	9	10
A	C	B	A	C	C	D	A	D	B
11	12	13	14	15	16	17	18	19	
B,D	A,C	A,C	A,B,C,D	C	D	B	3	A-S,B-R,C-P,D-Q	
20									
A-R,B-P,C-S,D-Q									