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8. ATOMIC MODELS

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

Mutliple Choice Question type:

1. If one electron is removed from a neutral atom of sodium (Na, Z = 11), what will be the number of protons and electrons in the resulting ion?

 A) 11 protons, 10 electrons   B) 10 protons, 11 electrons

C) 11 protons, 11 electrons   D) 12 protons, 10 electrons

Answer:A

Solution:Sodium (Na) has 11 protons (atomic number = 11) and 11 electrons when neutral.

Removing 1 electron forms Na?, with 11 protons and 10 electrons.

2. The isotope of carbon used in radiocarbon dating has mass number 14. How many neutrons are present in a carbon-14 atom?

A) 6 B) 8 C) 12 D) 14

Answer:B

Solution: Carbon-14: Mass number (A) = 14, Atomic number (Z) = 6.

Neutrons = A - Z = 14 - 6 = 8.

3. Which of the following isotopes has 7 protons and 8 neutrons?

 A) $_8^{15}O$ B) $_7^{15}N$ C) $_7^{14}N$ D) $_6^{15}C$

Answer:B

Solution:Nitrogen-15 ($_7^{15}N$):

Protons = 7 (atomic number).

Neutrons = 15 - 7 = 8.

4. If two atoms have the same mass number but different atomic numbers, they are:

 A) Isotopes B) Isobars C) Isotones D) Isomers

Answer:B

Solution:Isobars: Same mass number (A), different atomic numbers (Z).

5. Which of the following triads of nuclei are isotones?

 A) $_9^{19}F$, $_{10}^{20}Ne$, $_{11}^{21}Na$ B) $_{12}^{24}Mg$, $_{11}^{23}Na$, $_{10}^{22}Ne$

C) $_{14}^{28}Si$, $_{15}^{29}P$, $_{16}^{30}S$ D) $_8^{16}O$, $_7^{15}N$, $_6^{14}C$

Answer:A,B,C,D

Solution:Isotones are nuclei with the same number of neutrons but different atomic numbers (protons).

6.In the gold foil experiment, most alpha particles passed undeflected because:
A) The nucleus is very small compared to the atom.
B) The nucleus is negatively charged.
C) Electrons neutralized the alpha particles.
D) The gold foil was too thin.
Answer:A
Solution:The nucleus occupies a tiny volume, so most alpha particles missed it and passed undeflected.

7.The sum of protons and neutrons in tritium $^3_1$H is:
A) 1   B) 2   C) 3   D) 4
Answer:C
Solution:Tritium ($^3_1$H): 1 proton + 2 neutrons = 3 nucleons.

8.If the mass of each proton is doubled and neutrons are tripled, the atomic mass of $^{16}_8$O) will:
A) Remain the same   B) Double   C) Triple   D) Increase by a factor of 5/2
Answer:D
Solution: Original $^{16}_8$O: 8p + 8n = 16 amu.
Modified masses:
Protons: 8 × 2 = 16 amu.
Neutrons: 8 × 3 = 24 amu.
New mass = 16 + 24 = 40 amu (40/16 = 2.5=5/2)

9.The charge-to-mass ratio ((e/m)) of cathode rays when helium is used in the discharge tube (compared to hydrogen) will be:
A) The same   B) Half   C) Double   D) One-fourth
Answer:A
Solution:Cathode rays are electrons, so their e/m ratio is constant

10.Alpha particles are projected with the same kinetic energy towards nuclei of $^{197}_{79}$Au, $^{238}_{92}$U, $^{27}_{13}$Al, and $^4_2$He). The distance of closest approach is maximum for:
A) $^{197}_{79}$Au   B) $^{238}_{92}$U   C) $^{27}_{13}$Al   D) $^4_2$He
Answer:D

Solution:Distance of closest approach (r) depends on the nuclear charge (Z): $r\alpha\dfrac{1}{Z}$

$^4_2$He has the smallest Z (2), so r is maximum.

Statement Type:
   A) Both statement- I and statement- II are correct, and statement-2 is the correct explanation of the statement-I.
   B) Both statement-I and statement-II are correct, and statement-II is the not correct explanation of the statement-I.
   C) statement- I is correct, but statement- II is incorrect.
   D) statement- II is incorrect, but statement-2 is correct.

11.Statement I: The atomic radius of sodium (Na) is larger than that of magnesium (Mg).

Statement II: Effective nuclear charge increases across a period, pulling electrons closer to the nucleus

Answer:A

Solution:Sodium (Na) is to the left of magnesium (Mg) in Period 3.
Atomic radius decreases across a period (left to right) due to increasing effective nuclear charge.
Thus, Na > Mg in atomic radius.

12.Statement I: The first ionization energy of nitrogen (N) is greater than that of oxygen (O).

Statement II: Nitrogen has a half-filled p-orbital configuration (2p³), which provides extra stability.

Answer:A

Solution:Nitrogen's half-filled $2p^3$ configuration is symmetrical and stable (Hund's rule).
Oxygen ($2p^4$) must lose an electron from a paired orbital, which is easier due to electron-electron repulsion.

Comprehension Type :

Comprehension - I

   The sum of proton and neutrons present in the nucleus is called mass number.
   Mass number (A) = Number of protons + Number of neutrons or Atomic number (Z) or Number of neutrons = $A - Z$.

13.The mass number of an atom is defined as:

A) The total number of electrons in the atom.

B) The sum of protons and neutrons in the nucleus.

C) The number of protons only.

D) The number of neutrons only.

Answer:B

Solution:Mass number (A) = Protons (Z) + Neutrons (N).

14.An element has an atomic number (Z) of 17 and a mass number (A) of 35. The number of neutrons in its nucleus is:

A) 17   B) 18   C) 35   D) 52

Answer:B

Solution:Neutrons (N) = A - Z = 35 - 17 = 18.

Comprehension - II

The nuclides of same element having same atomic number but different mass numbers are called isotopes.

Isotopes show similar chemical properties but different physical and radioactive properties.

Fractional atomic masses of elements is due to the presence of Isotopes.

Avg.atomic mass or average isotopic weight

$$= \frac{\sum \% \, abundance \, of \, isotope \times atomic \, weight}{total \, ratio}$$

15.Isotopes of an element have:
A) The same mass number but different atomic numbers.
B) The same atomic number but different mass numbers.
C) Different atomic numbers and different mass numbers.
D) The same number of neutrons but different protons.
Answer:B
Solution:Isotopes are atoms of the same element (same atomic number/Z) but with different numbers of neutrons, resulting in different mass numbers (A).

16.The fractional atomic mass of an element is observed because:
A) Electrons contribute to the mass.
B) Different isotopes of the element exist in nature.
C) The element is radioactive.
D) The nucleus contains only protons.
Answer:B
Solution:Most elements are mixtures of isotopes with different masses.
The average atomic mass (fractional value) accounts for the relative abundances of these isotopes.

INTEGER TYPE

17.   The number of electrons in 4.8 grams of Mg²⁺ ion is _____.
Answer: 12×10^{23}
Solution:

$$Moles = \frac{4.8}{24} = 2 moles$$

$$Mg^{2+} = 10 \, Electrons$$

$$TotalElectrons = 0.2 \times 10 \times 6 \times 10^{23} = 12 \times 10^{23}$$

18.   How many grams of phosphorus (P³¹) contain the same number of neutrons as 3 grams of carbon (C¹²)?.
Answer:3
Solution:3 grams of carbon,No.of moles=3/12=0.25moles
Neutrons in 3gms of Carbon=6x0.25x6x10²³

$$31 gms of Phophorus = 16 \times 6 \times 10^{23} neutrons$$

$$31 gms \rightarrow 16 \times 6 \times 10^{23}$$

$$x gms \rightarrow 1.5 \times 6 \times 10^{23}$$

$$x = \frac{31 \times 1.5 \times 6 \times 10^{23}}{16 \times 6 \times 10^{23}} = 2.9 \approx 3$$

19. In Moseley's equation, $\sqrt{\upsilon} = a(Z-b)$, if a straight line at 45° has a y-intercept of 1 and frequency $\upsilon = 64 \sec^{-1}$, then the atomic number (Z) of the element is _____.
Answer:9

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

For a straight line at 45°, the slope a=1.

y-intercept = 1 $\rightarrow$ Implies b=1

Substitute known values into Moseley's equation:

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

$$\sqrt{64} = 1(Z-1)$$

$$8 = Z-1$$

$$Z = 9$$

20.The atomic mass of an element is 27. The third shell of its atom contains 3 electrons. The number of neutrons in its nucleus is 3x. The value of x is _____.
Answer:5

Solution:Configuration: 2, 8, 3

atomic number = 13

So protons = 13

Atomic mass = 27

 neutrons = 27 – 13 = 14

Given: neutrons = 3x

 14 = 3x

 x = 14 / 3 ˜ 4.66 ----->rounded: 5

21. The sum of the number of neutrons and protons in Tritium ($^3_1$H) is _____.
Answer:3

Solution:Tritium ($^3_1$**H**) has 1 proton + 2 neutrons ---> Sum = 3.

22. The mass number of an anion X^{3-} is 16. If the anion has 10 electrons, the number of neutrons in the nucleus of the neutral atom (X) is _____.
Answer:9

Solution:Since X^{3-} has gained 3 electrons:Electrons = Z + 3 = 10

 Z = 7

Mass number = 16
Neutrons = 16 – 7 = 9

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

Mutliple Choice Question Type :
1.Which of the following is NOT isoelectronic with Ne (10 electrons)?
A) F^- **B) Na^+** **C) Mg^{2+}** **D) Al^{3+}**
Answer:None
Solution:All are isoelectronic with Ne
F^-: 9 + 1 = 10 e^-
Na^+: 11 - 1 = 10 e^-
Mg^{2+}: 12 - 2 = 10 e^-
Al^{3+}: 13 - 3 = 10 e^-

2.Identify the set of isoelectronic ions:
A) Li^+, Be^{2+}, B^{3+} **B) N^{3-}, O^{2-}, F^-** **C) S^{2-}, Cl^-, K^-** **D) P^{3-}, S^{2-}, Cl^-**
Answer:A,B,D
Solution:
A) Li^+, Be^{2+}, B^{3+} $\rightarrow 2e^-$
B) N^{3-}, O^{2-}, $F^- \rightarrow 10e^-$
C) S^{2-} (18e^-), Cl^-(18e^-) , K^-(20e^-)
D) P^{3-}, S^{2-}, $Cl^- \rightarrow 18e^-$

3.Total number of protons in one molecule of carbon dioxide (CO_2) is:
A) 22 **B) 44** **C) 66** **D) 88**
Answer:A
Solution:Carbon (C): 6 protons.
Oxygen (O): 8 protons (×2 = 16).
Total protons: 6 + 16 = 22.

4.Number of neutrons in tritium (^3_1H) is:
A) 0 **B) 1** **C) 2** **D) 3**
Answer:C
Solution:Tritium (^3_1H): Mass number = 3, Atomic number = 1.
Neutrons = 3 - 1 = 2.

5.The nucleus of a carbon-12 atom contains:
A) 6 protons, 6 neutrons **B) 6 protons, 6 electrons**
C) 12 protons, 12 neutrons **D) 6 neutrons, 6 electrons**
Answer:A

Solution:Carbon-12: $_6^{12}C$
Protons = 6, Neutrons = 12 - 6 = 6.

6.An atom has 20 electrons and a mass number of 40. The number of neutrons is:
A) 20   B) 40   C) 60   D) 10
Answer:A
Solution:Electrons = 20 $\rightarrow$ Protons = 20 (neutral atom).
Neutrons = 40 - 20 = 20.

7.The atomic number (Z) of an element represents:
A) Number of neutrons   B) Number of protons
C) Mass number   D) Number of isotopes
Answer:B
Solution:Atomic number = Protons in the nucleus.

8.Most of the mass of an atom is concentrated in:
A) Electrons   B) Protons only   C) Neutrons only   D) Protons and neutrons
Answer:D
Solution:Electrons contribute negligible mass.
Nucleons (protons + neutrons) account for >99.9% of the mass

9.An element with mass number 90 has 50% more neutrons than protons. The element is:
A) Zr-90   B) Sr-90   C) Mo-90   D) Y-90
Answer:Kr
Solution:
Let protons = x,
then neutrons = 1.5x
So:x + 1.5x = 90
 2.5x = 90
 x = 36
Z = 36, N = 54
Zr = 40, Sr = 38, Mo = 42, Y = 39
None of the above match exactly, but the math gives Z = 36
For Z=36 (Kr), p=36, n=54

10.The average atomic mass of chlorine is 35.5. Its isotopes Cl-35 and Cl-37 occur in nature in the ratio:
A) 1:1   B) 3:1   C) 1:3   D) 2:1
Answer: B
Solution:Let x = abundance of Cl-35,
1-x = Cl-37.
Average mass: 35x+37(1-x)=35.5.
Solving gives
x=0.75 (75% Cl-35, 25% Cl-37) $\rightarrow$ 3:1 ratio.

JEE MAINS LEVEL QUESTIONS

Mutliple Choice Question Type:

1.The molecular weight of carbon monoxide (CO) is 28. The total number of electrons in it is:
A) 14   B) 28   C) 42   D) 56
Answer:A
Solution:CO molecule:
Carbon (C) has 6 electrons.
Oxygen (O) has 8 electrons.
Total electrons = 6 + 8 = 14.

2.A tripositive ion has 13 protons. The number of electrons in its neutral atom is:
A) 10   B) 13   C) 16   D) 26
Answer:B
Solution:Tripositive ion (X^{3+}): Loses 3 electrons $\rightarrow$ 10 electrons (given 13 protons).
Neutral atom: Same as protons $\rightarrow$ 13 electrons.

3.Rutherford's experiment proved that most of an atom's volume is:
A) Occupied by neutrons   B) Empty space
C) Positively charged   D) Filled with electrons
Answer:B
Solution:Most alpha particles passed undeflected, showing atoms are mostly empty space.
The dense, positively charged nucleus occupies a tiny volume.

4.The size of the nucleus compared to the atom is approximately:
A) 1/10   B) 1/100   C) 1/10,000   D) 1/100,000
Answer:D
Solution:Nucleus is 10^{-5} times small in size as compared to the total size of atom.

5.Among $_6C^{14}$, $_7N^{14}$, $_8O^{16}$, and $_7N^{15}$ the isobars are:
A) C^{14} & N^{14} B) N^{14} & O^{16} C) O^{16} & N^{15} D) N^{15} & C^{14}
Answer:A
Solution: Isobar Definition: Same mass number (A), different atomic numbers (Z).
A) C^{14} & N^{14}
Both have A=14, different Z $\rightarrow$ Isobars.

6.The incorrect statement is:
A) Isotopes have identical chemical properties.
B) Isobars have different atomic numbers.
C) Isotones have the same neutron number.
D) Isoelectronic species have the same mass number.
Answer:D
Solution: Isoelectronic species have the same number of electrons , but their mass numbers can differ.

7.An ion with mass number 65 has 2+ charge and 25% more neutrons than electrons. The ion is:
A) $_{30}Zn^{2+}$ B) $_{29}Cu^{2+}$ C) $_{28}Ni^{2+}$ D) $_{27}Co^{2+}$
Answer:A
Solution: Let electrons = e, protons = p, neutrons = n.
For a 2+ ion: e=p-2.
Given n=1.25e (25% more neutrons than electrons).
Mass number A=p+n=65.
Substitute n=1.25(p-2) into p+n=65
P+1.25(p-2) =65
2.25P-2.5=65
2.25P=67.5
P=675/2.25=30
$30Zn^{2+}$

8.Natural boron has two isotopes (B^{10}: 20%, B^{11}: 80%). Its average atomic mass is:
A) 10.2   B) 10.8   C) 11.2   D) 10.5
Answer:B
Solution: Average mass=(10×0.20)+(11×0.80)=2+8.8=10.8.

9.An isotope of iron (Fe) has 20% more neutrons than protons. Its mass number is:
A) 54   B) 56   C) 58   D) 60
Answer:C
Solution:Fe atomic number (Z) = 26
 protons = 26
Neutrons = 1.2 × 26 = 31.2
Mass number = 26 + 31.2 = 57.2

10.The average atomic mass of magnesium (Mg^{24}: 80%, Mg^{25}: 10%, Mg^{26}: 10%) is:
A) 24.3   B) 25.0   C) 24.8   D) 24.0
Answer:A
Solution: Average mass=(24×0.80)+(25×0.10)+(26×0.10)=19.2+2.5+2.6=24.3.

JEE ADVANCED LEVEL QUESTIONS
Mutli Correct Answer Type :
11.   Isotones of $_{36}Kr^{84}$ (neutrons = 48) include:
A) $_{34}Se^{82}$ (48n)
B) $_{38}Sr^{86}$ (48n)
C) $_{32}Ge^{76}$ (44n)
D) $_{40}Zr^{90}$ (50n)
Answer:A,B
Solution:Isotones are nuclides with the same number of neutrons.
For $_{36}Kr^{84}$: Neutrons = 84 - 36 = 48.

Check options:
A) $_{34}Se^{82}$: 82 - 34 = 48n
B) $_{38}Sr^{86}$: 86 - 38 = 48n
C) $_{32}Ge^{76}$: 76 - 32 = 44n
D) $_{40}Zr^{90}$: 90 - 40 = 50n

12. Fractional atomic masses occur due to:
A) Presence of isotopes with different masses.
B) Neutron-proton mass difference.
C) Energy-mass equivalence (E=mc²).
D) Weighted average of isotopic abundances.
Answer:A,B,C,D
Solution: A) Presence of isotopes with different masses
B) Neutron-proton mass difference (minor contributor, but technically valid)
C) Energy-mass equivalence (E = mc²) (Binding energy causes small mass defects)
D) Weighted average of isotopic abundances (Primary reason for fractional atomic mass

13. In alpha-particle scattering experiments, most particles pass undeflected because:
A) The nucleus occupies negligible volume.
B) Electrons neutralize a-particle charge.
C) a-particles have high kinetic energy.
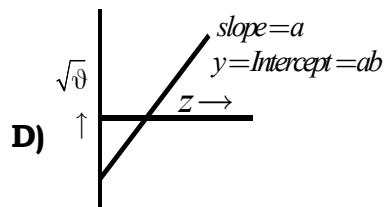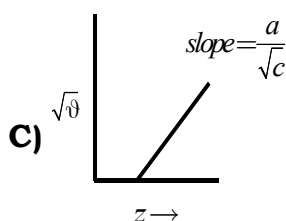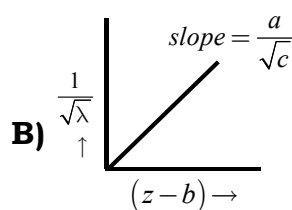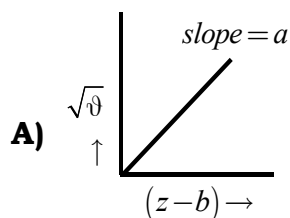**D) Atomic electrons are too light to deflect a-particles.**
 Answer:A,C,D
Solution: A) The nucleus occupies negligible volume (Correct – atoms are mostly empty space)
B) Electrons neutralize alpha-particle charge (Incorrect – no effect on alpha's path)
C) Alpha-particles have high kinetic energy (Partially true – helps them penetrate)
D) Atomic electrons are too light to deflect alpha particles (Alpha particles are heavy)

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

A)

$slope = a$

$\sqrt{\vartheta}$ ↑

$(z-b) \rightarrow$

B)

$slope = \dfrac{a}{\sqrt{c}}$

$\dfrac{1}{\sqrt{\lambda}}$ ↑

$(z-b) \rightarrow$

C)

$slope = \dfrac{a}{\sqrt{c}}$

$\sqrt{\vartheta}$

$z \rightarrow$

D)

$slope = a$
$y = Intercept = ab$

$\sqrt{\vartheta}$ ↑

$z \rightarrow$

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.

15.**An ion X^{3+} has mass number 56 and 30% more neutrons than electrons. Possible symbols:**
A) $26Fe^{3+}$ (e^-=23, n=30 $\rightarrow$ 56-26=30n)
B) $24Cr^{3+}$ (e^-=21, n=27.3 $\rightarrow$ invalid)
C) $27Co^{3+}$ (e^-=24, n=31.2 $\rightarrow$ invalid)
D) $25Mn^{3+}$(e^-=22, n=28.6 $\rightarrow$invalid)
Answer:A

Solution:Let the atomic number (protons) = p.

For X^{3+}, electrons = p-3.

Neutrons = n=1.3×(p-3).

Mass number equation:p+n=56

Substitute n=1.3(p-3):

p+1.3(p-3)=56

p+1.3p-3.9=56

2.3p=59.9

p=26

Verify for p=26:

Electrons = 26-3=23.

Neutrons = 1.3×23=29.9~30.

Mass number =26+30=56.

Comprehension Type
Comprehension - I

The nuclides of different elements having same mass number but different atomic numbers are called isobars.

Isobars show similar physical properties but different chemical properties.

16.   **Isobars are defined as nuclides of different elements that have:**
A) The same atomic number but different mass numbers.
B) The same mass number but different atomic numbers.
C) The same number of neutrons but different protons.
D) The same number of protons but different neutrons.
Answer:B

Slolution:Isobars are atoms of different elements (different atomic numbers, Z) with the same mass number (A).

17.Which of the following statements about isobars is correct?
A) They exhibit identical chemical properties.
B) They have similar physical properties but different chemical properties.
C) They always have the same number of neutrons.
D) They belong to the same element.
Answer:B
Slolution:Physical properties (e.g., density, boiling point) depend on mass number (A), which is the same for isobars.
Chemical properties depend on atomic number (Z), which differs for isobars.

Comprehension - II
The Molecules or ions with same number of electrons are called isoelectronic species.
18.Which of the following pairs are isoelectronic?
A) Na^+ and Ne
B) O^{2-} and F^-
C) Mg^{2+} and Ar
D) N^{3-} and Al^{3+}
Answer:A,B,D
Solution:
Isoelectronic species have the same number of electrons.
A) Na^+ (11 - 1 = 10 e⁻) and Ne (10 e⁻) → Isoelectronic.
B) O^{2-} (8 + 2 = 10 e⁻) and F? (9 + 1 = 10 e⁻) → Isoelectronic.
C) Mg^{2+} (12 - 2 = 10 e⁻) and Ar (18 e⁻) → Not isoelectronic.
D) N^{3-} (7 + 3 = 10 e⁻) and Al^{3+} (13 - 3 = 10 e⁻) → Isoelectronic.

19.Identify the set of isoelectronic species from the following:
A) Cl^-, K^+, Ca^{2+}
B) S^{2-}, Ar, K^+
C) Li^+, Be^{2+}, B^{3+}
D) P^{3-}, S^{2-}, Cl^-
Answer:A,B,C,D
Solution:
Option A:
Cl^-(17 + 1 = 18 e⁻), K^+ (19 - 1 = 18 e⁻), Ca^{2}? (20 - 2 = 18 e⁻) ?All have 18 electrons (like Ar). ?
B) S^{2-} (18 e⁻), Ar (18 e⁻), K^+ (18 e⁻) isoelectronic
C) Li^+ (2 e⁻), Be^{2+} (2 e⁻), B^{3+} (2 e⁻) Isoelectronic
D) P^{3-}(18 e⁻), S^{2-} (18 e⁻), Cl^- (18 e⁻) Isoelectronic
INTEGE TYPE
20.The number of electrons in 5.6 grams of N^{3-} ion is _____

Answer: 24×10^{23}
Solution:Moles of N^{3-} in 5.6 g:

$$Moles = \frac{5.6}{14} = 0.4 moles$$

N^{3-} ion: Gains 3 electrons ,Total electrons = 7+3=10 e$^-$ per ion.

$TotalElectrons = 0.4 \times 10 \times 6 \times 10^{23} = 24 \times 10^{23}$

Matrix Matching Type

21. **Column-I**   **Column-II**

A) Bohr's Atomic Model   **P) Energy levels are quantized**

B) Isotopes of Oxygen (O-16, O-18)   **Q) Same atomic number, different mass**

C) Isobars (Ca-40, Ar-40)   **R) Same mass number, different elements**

D) Isotones (Ne-22, F-21)   **S) Same number of neutrons**

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

Solution:

A) Bohr's Atomic Model   P) Energy levels are quantized

B) Isotopes of Oxygen (O-16, O-18)   Q) Same atomic number, different mass

C) Isobars (Ca-40, Ar-40)   R) Same mass number, different elements

D) Isotones (Ne-22, F-21)   S) Same number of neutrons

22. **Column-I**   **Column-II**

A) Isotopes   **P) $_{17}^{35}Cl$ and $_{17}^{37}Cl$**

B) Isobars   **Q) $_{18}^{40}Ar$ and $_{20}^{40}Ca$**

C) Isodiaphers   **R) $_{9}^{19}F$ and $_{11}^{23}Na$ (N–Z = 10)**

D) Isosters   **S) CO and N$_2$ (Same total number of electrons)**

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

Solution:

A) Isotopes   P) $_{17}^{35}Cl$ and $_{17}^{37}Cl$

B) Isobars   Q) $_{18}^{40}Ar$ and $_{20}^{40}Ca$

C) Isodiaphers   R) $_{9}^{19}F$ and $_{11}^{23}Na$ (N–Z = 10)

D) Isosters   S) CO and N$_2$ (Same total number of electrons)

KEY

				Teaching Task					
1	2	3	4	5	6	7	8	9	10
A	B	B	B	A,B,C,D	A	C	D	A	D
11	12	13	14	15	16	17	18	19	20
A	A	B	B	B	B	12×10^{23}	3	9	5
21	22								
3	9								
				Learners Task					
				CUQ'S					
1	2	3	4	5	6	7	8	9	10
NONE	A,B,D	A	C	A	A	B	D	Kr	B
		JEE MAINS LEVEL QUESTIONS							
1	2	3	4	5	6	7	8	9	10
A	B	B	D	A	D	A	B	C	A
		JEE ADVANCED LEVEL QUESTIONS							
11	12	13	14	15	16	17	18	19	20
A,B	A,B,C,D	A,C,D	A,B,C,D	A	B	B	A,B,D	A,B,C,D	24×10^{23}
21		22							
A-P,B-Q,C-R,D-S		A-P,B-Q,C-R,D-S							