3. MODERN PERIODIC TABLE

SOLUTIONS

TEACHING TASK

JEE MAIN LEVEL QUESTIONS

1. Which of the following electronic configurations in the outermost shell is characteristic of alkali metals?
   A) (n-A)s^2p^6,ns^2p^1 B) (n-A)s^2p^6,d^{10},ns^1 C) (n-A)s^2p^6,ns^1 D) ns^2 p^6d^1

Answer:C

Solution:Alkali metals (Group 1) have 1 electron in their outermost shell (ns^1). Their general configuration is [Noble Gas] ns^1.

2. Which pair of elements of atomic numbers given below will have similar chemical properties?
   A) 13, 22 B) 3, 11 C) 4, 24 D) 2, 4

Answer:B

Solution:Atomic numbers 3 (Li) and 11 (Na) are both alkali metals (Group 1). Elements in the same group have similar chemical properties.

3. Which pair of atomic numbers represent element which are both s-block elements
   A) 7, 15 B) 6, 12 C) 9, 17 D) 3, 12

Answer:D

Solution:Atomic number 3 (Li): [He] $2s^1$ (Group 1).
Atomic number 12 (Mg): [Ne] $3s^2$ (Group 2).
Both are s-block elements.

4. Elements with atomic numbers 9, 17, 35, 53 are collectively known as
   A) chalcogens B) halogens C) lanthanides D) rare gases

Answer:B

Solution:These are Group 17 elements (F, Cl, Br, I).
Halogens are highly reactive non-metals.

5. In iron atom (z=26), the differentiating electron enters.....sublevel
   A) 4d B) 3d C) 4p D) 5p

Answer:B

Solution:Fe's configuration: [Ar] $3d^6$ $4s^2$.
The last electron enters 3d (transition metal characteristic).

6. The elements with atomic numbers 39 to 48 belong to
   A) Forth period B) Fifth period C) Sixth period D) Third period

Answer:B

Solution:These are 5th period transition metals (Y to Cd).

7. The atomic numbers of Lanthanides are from
   A) 58 to 71 B) 90 to 103 C) 21 to 30 D) 39 to 48

Answer:A

Solution:Lanthanides span Ce (58) to Lu (71).

8. The 4f level is successively filled up in
   A) Alkali metals B) Lanthanides C) actinides D) Halogens

Answer:B

Solution:Lanthanides fill the 4f orbitals (e.g., Ce: [Xe] $4f^1$ $5d^1$ $6s^2$).

9. Most of the radio active elements are in
   A) Lanthanides B) Actinides
   C) Representative elements D) Second transitional series

Answer:B

Solution:Actinides (e.g., Uranium, Plutonium) are predominantly radioactive.

10. The elements with atomic numbers 2, 10, 18, 36, 54, and 86 are collectively known as
    A) Alkaline earth metals B) Inert gases C) Halogens D) Rare earths

Answer:B

Solution:These are Noble Gases (He, Ne, Ar, Kr, Xe, Rn).

11. The general electronic configuration (n-A) d^3ns^2 indicates that particular element belongs to
    A) VB B) IVB C) VIB D) IIIB

Answer:A

Solution:VB (Group 5) elements (e.g., Vanadium) have this configuration.

12. Which one of the following belongs to representative group of elements in the periodic table
    A) Lanthanum B) Argon
    C) Chromium D) Aluminium

Answer:D

Solution:Al (Z=13) is in Group 13 (p-block), a representative element.

13. Transition metals are often paramagnetic owing to
    A) their high m.p. and b.p.
    B) the presence of vacant d-orbitals
    C) the presence of one or more unpaired d-electrons
    D) their being less electropositive than the elements of groups IA and IIA

Answer:C

Solution:Paramagnetism arises from unpaired electrons in d-orbitals.

14. The electron configuration of the starting and ending elements of fourth period are
    A) $4s^1$ and $3d^{10}4s^2$ $4p^6$ B) $4s^1$ and $4s^2$ $3d^{10}$
    C) $4s^2$ $3d^1$ and $4s^2$ $4p^6$ D) $4s^2$ $3d^1$ and $4s^2$ $3d^{10}$

Answer:A

Solution:Start (K, Z=19): [Ar] $4s^1$.
End (Kr, Z=36): [Ar] $3d^{1°}$ $4s^2$ $4p^6$.

15. The atomic number of an element 'X' is 34. Then it is present in _____ period and _____ in group.
    A) 4th period and IVA group B) 4th period and VIA group
    C) 4th period and VIIA group D) 5th period and VIA group

Answer:B

Solution:Selenium (Se, Z=34): [Ar] $3d^{1°}$ $4s^2$ $4p^4$ → Group 16 (VIA), Period 4.

JEE ADVANCED LEVEL QUESTIONS

Multi Correct Choice Type:

16. Which of the following is correct about s-block elements?
A) The elements in which the electron enters the s-subshell of their outermost energy level are called s-block elements.
B) This block is situated at the extreme left of the periodic table.
C) This block contains elements of groups IA and IIA.
D) None of the above

Answer:A,B,C

Solution:A) True: s-block elements are defined by the filling of the outermost s-orbital (ns^1 or ns^2).
B) True: s-block occupies the extreme left of the periodic table (Groups 1 and 2).
C) True: Group IA (Alkali metals) and Group IIA (Alkaline earth metals) are s-block elements.

17. Which of the following is correct for d-block elements?
A) These elements is situated at the extreme right side of the periodic table.
B) General electronic configuration of these elements is ns^2,np^{1-6}
C) They show variable oxidation states.
D) This block elements form alloys.

Answer:C,D

Solution:A) False: d-block elements are in the middle of the periodic table (Groups 3-12), not the extreme right.
B) False: General configuration is $(n-1)d^{1?1^\circ}\ ns^{1?2}$, not $ns^2\ np^{1?6}$ (which is p-block).
C) True: d-block elements exhibit variable oxidation states due to partially filled d-orbitals (e.g., $Fe^{2?}/Fe^{3?}$).
D) True: d-block elements readily form alloys (e.g., Steel = Fe + C, Brass = Cu + Zn).

Statement Type:

18. **Statement I** : In general, the outer electronic configuration of the elements of group 6 (or VI B) is $(n - A)d^4ns^1$.
Statement II : 3 and 11^{th} group pair of the elements will have the same chemical properties.

Answer:Statements I&II are false(E)

Solution:Statement I: False.
Group 6 (VI B) elements (e.g., Cr, Mo, W) have the configuration $(n-1)d^5ns^1$ (not d^4ns^1).
Example: Chromium (Cr): [Ar] $3d^54s^1$.
Statement II:False.
Group 3 (Sc, Y, La) and Group 11 (Cu, Ag, Au) do not have similar chemical properties.
Group 3: Reactive metals (e.g., Sc forms +3 ions).
Group 11: Noble metals (e.g., Cu shows +1/+2 oxidation states).

19. **Statement I** : The number of elements in 2^{nd} and 3^{rd} period is equal.
Statement II : The number of elements in 4^{th} and 5^{th} period is equal.

Answer:B

Solution:Statement I:True
2nd period: 8 elements (Li to Ne).
3rd period: 8 elements (Na to Ar).
Equal in number (8)
Statement II:True.
4th period: 18 elements (K to Kr, including 10 transition metals).
5th period: 18 elements (Rb to Xe, including 10 transition metals
However, Statement-II does not explain Statement-I (they are independent facts).

Matrix Match Type:

20.**Answer:a-2,b-3,c-3,d-4**

Solution:

Column-I	**Column-II**
Period number	**Nature of period**
a) 4	2) Long period
b) 3	3) Short period
c) 2	3) Short period
d) 1	4) Very short period

Comprehension type:

21. Zn is not transitional metal. Because
A)outer most and penultimate shells are incompletely filled.
B)outer most and penultimate shells are completely filled.
C)penultimate shells are completely filled.
D)outer most shells are completely filled.

Answer:C

Solution:Definition of Transition Metals:
Elements must have partially filled d-orbitals in either their ground state or any oxidation state.
Case of Zinc (Zn):
Atomic number = 30
Electronic configuration: [Ar] $3d^{10}$ $4s^2$
The penultimate shell (3d) is completely filled (d^{10}).
In all oxidation states (including Zn^{2}?: [Ar] $3d^{10}$), the d-subshell remains filled.
Thus, Zn does not meet the criteria for transition metals.

22. The metallic nature of transition metals are
A)intermediate to s - and p - block elements. B)more than s block elements.
C)less than p block elements. D)more than s - and p - block elements.

Answer:A

Solution:Metallic Nature Trends:
s-Block (Group 1 & 2): Most metallic (e.g., Na, K) due to low ionization energy and high electropositivity.
Transition Metals (d-Block): Intermediate metallic character (e.g., Fe, Cu).
Less electropositive than s-block but more than p-block.
p-Block: Least metallic (e.g., Si, P), with non-metals like halogens.

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ'S)

1. The basis for the classification of elements in the modern periodic table is
   A) Electronic configuration B) Atomic weight
   C) Atomic volume D) Equivalent wieght

Answer:A

Solution:The modern periodic table is based on atomic number (Z), which determines the electronic configuration of elements.

2. The plot of $\sqrt{v}$ vs Z is
   A) Straight line B) exponential curve
   C) hyperbolic D) curve with-ve slope

Answer:A

Solution:Plotting $\sqrt{v}$ vs. Z for elements gives a straight line, confirming Moseley's law.

3. Modern periodic table is based on the atomic number of the elements. The experiment which proved the significance of the atomic number was
   A) Mullikan's oil drop experiment B) Moseley's work on X-ray spectra
   C) Bragg's work on X-ray diffraction D) Discovery of X-rays by Rontgen

Answer:B

Solution:Henry Moseley (1913) showed that the square root of X-ray frequency is proportional to atomic number (Z), establishing Z as the basis for the periodic table.

4. The atomicity of a noble gas is
   A) 2 B) 1 C) 4 D) 6

Answer:B

Solution: He, Ne, Ar are monatomic

5. The element with atomic number 19 is
   A) halogen B) chalcogen C) noble gas D) an alkali metal

Answer:D

Solution:Z = 19: Potassium (K), with configuration [Ar] $4s^1$ → Group 1 (Alkali metal)

6. A pair of atomic numbers which belong to s - block are
   A) 7, 15 B) 6, 12 C) 9, 17 D) 3, 12

Answer:D

Solution:3 (Li): [He] $2s^1$ → Group 1.
12 (Mg): [Ne] $3s^2$ → Group 2.
Both are s-block elements.

7. The element with electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^{10}\ 4s^2\ 4p^5$ belongs to
   A) 4th period, VA group B) 5th period, IVA group
   C) 4th period, VIIA group D) 7th period, IVA group

Answer:C

Solution:Bromine (Br, Z=35) has this configuration.
Period 4 (n=4), Group 17 (VIIA) (7 valence electrons: $ns^2\ np^5$).

8. The element with $ns^2\ np^4$ as outer electron configuration is a
   A) alkalimetal B) chalcogen C) noble gas D) halogen

Answer:B

Solution:Group 16 (VIA) elements (O, S, Se, etc.) have this configuration → Chalco-

gens.

9. If the differentiating electron enters (n-A) d-sublevel. The element is
   A) a representative element B) a noble gas
   C) an alkali metal D) a transition element

Answer:D

Solution:Transition metals are defined by partially filled d-orbitals in their ground/ oxidation states.

10. Atoms with three of their outer most orbits incompletely filled with electrons are present in
   A) Lanthanides B) Representative elements
   C) s - block elements D) transitional elements

Answer:D

Solution:Transition metals often have incomplete:
Outer ns
Penultimate (n-1)d
Antepenultimate (n-2)f (for lanthanides/actinides).

JEE MAIN LEVEL QUESTIONS

11. Inner transition elements exhibit different coloured compound on account of unfilled... Orbitals
   A) s B) f C) d D) p

Answer:B

Solutin:Inner transition elements (Lanthanides & Actinides) have partially filled 4f or 5f orbitals.
The f-f electronic transitions absorb visible light, causing color

12. The element with atomic number 12 belongs to .... Group and .... Period
   A) IA, third B) IIIA, third C) IIA, third D) IIA, second

Answer:C

Solutin:Z=12: Magnesium (Mg) $\rightarrow$ Configuration: [Ne] $3s^2$.
Group 2 (IIA), Period 3 (valence electrons: 2, outermost shell: 3).

13. The outer most orbit of an element "X" is partially filled with electrons in 's' and 'p' subshells. Then that element is
   A) an Inert gas B) a Representative element
   C) a Transition element D) an Inner transition element

Answer:B

Solutin:Representative (main-group) elements have incomplete s or p subshells in their valence shell.
Transition metals have incomplete d, and inner transition metals have incomplete f

14. Which is the atomic number of another element present in the same group as the element with Z=13 is present
   A) Z=14 B) Z=32 C) Z=49 D)Z=20

Answer:C

Solutin:Z=13 (Al): Group 13 (III A).
Other Group 13 elements: B (Z=5), Ga (Z=31), In (Z=49), Tl (Z=81)

15. Which of the following pairs of ions have the same electronic configuration
   A) Cr^{+3}, Fe^{+3} B) Fe^{+3}, Mn^{+2} C) Fe^{+3}, Co^{+3} D) Sc^{+3}, Cr^{+3}

Answer:B

Solutin:Fe^{3+}(Z=26): [Ar] $3d^5$

Mn^{2+} (Z=25): [Ar] $3d^5$

Both have identical configurations ($3d^5$).

16. The statement that is false for the long form of the periodic table is
    A) it reflects the sequence of filling the electrons in the order of sub-energy levels s, p, d and f
    B) it helps to predict the stable valency states of the elements
    C) it reflects trends in physical and chemical properties of the elements
    D) it helps to predict the relative ionicity of the bond between any two elements.

Answer:D

Solutin:The periodic table shows trends in electronegativity, but ionicity depends on electronegativity differences, which the table alone doesn't quantify.

17. In a period, elements are arranged in strict sequence of
    A) Decreasing charges in the nucleus
    B) Increasing charges in the nucleus
    C) Constant charges in the nucleus D) Equal charges in the nucleus

Answer:B

Solutin:Across a period, atomic number (Z) increases → nuclear charge increases.

18. Which one of the following pairs of atomic numbers, represents elements belonging to the same group?
    A) 11, 20 B) 13, 30 C) 13, 31 D) 14, 33

Answer:C

Solution:Z=13 (Al): Group 13.

Z=31 (Ga): Group 13.

Both are in the boron family.

19. All elements of the same group will have
    A) same electron configuration
    B) similar outer electron configuration
    C) same ionization potential value
    D) different chemical properties

Answer:B

Solution:Elements in a group share the same valence shell configuration

JEE ADVANCED LEVEL QUESTIONS

Multi answer type :

20. Which oif the following statements are correct merits of long form of periodic table?
    A) It eliminates the even and odd series of IV,V and VI periods of Mendeleeff's periodic table.
    B) This periodic table can be divided into four blocks namely s,p,d and f-block elements.
    C) In this, classification of elements is based on the atomic number which is a more fundamental property of the elements.
    D)None of the above.

Answer:A,B,C

Solution:A) Eliminates even/odd series of Mendeleev's table
The modern table removes Mendeleev's dual series (e.g., VIII groups) by arranging elements strictly by atomic number (Z).
B) Divides into s, p, d, and f-blocks:
Clearly categorizes elements based on electron filling (e.g., s-block: Groups 1–2, p-block: Groups 13–18).
C) Based on atomic number (fundamental property):
Atomic number (Z) determines an element's identity and properties, making the classification more scientific.

21. The statement that is true for the long from of the periodic table is:
    A) It reflects the sequence of filling the electrons in the order of sub - energy levels s, p, d and f.
    B) It helps to predict the stable valency states of the elements.
    C) It reflects trends in physical and chemical properties of elements.
    D) None of the above.

Answer:A,B,C

Solution:A) Reflects electron filling order (s, p, d, f):
The table's structure mirrors the Aufbau principle (e.g., 4s fills before 3d).
B) Predicts stable valency states:
Groups indicate common valencies (e.g., Group 1: +1, Group 16: -2).
C) Reflects trends in properties:
Shows periodic trends like atomic radius, electronegativity, and ionization energy.

Statement Type:

22. **Statement I** : The number of elements in each period is equal to twice the number of orbitals available in the energy level that is being filled.
    Statement II : The longest period is the sixth period.

Answer:D

Solution:Statement I:False.
The number of elements in a period is determined by the number of electrons that fill the available orbitals, not twice the orbitals.
Statement II:True.
6th period has 32 elements (due to 14 lanthanides + 10 transition metals + 6 p-block).
Longer than the 7th period (incomplete).

23. **Statement I** : In the long form of periodic table, position of hydrogen is not fixed.
    Statement I : In the long form of periodic table, arrangement of elements is easy to remember and reproduce.

Answer:B

Solution:Statement I:True.
Hydrogen is placed both in Group 1 (alkali metals) and Group 17 (halogens) due to its unique properties (can lose or gain 1 electron).
Some tables place it separately to avoid confusion.
Statement II: True.

The long-form table is systematic:
s-block (left), p-block (right), d-block (middle), f-block (bottom).
Groups and periods are clearly labeled.

Matching type:

24.**Answer:a-4,b-3,c-2,d-1**

Solution:

Column-I	**Column-II**
a) Shortest period	4) H to He
b) Short period	3) Li to Ne
c) Long period	2) Rb to Xe
d) Longest period	1) Cs to Rn

25. **Answer:a-4,b-3,c-2,d-1**

Solution:

Column-I	**Column-II**
a) First transition series	4) $3d^{1-10}\ 4s^{1-2}$
b) Second transition series	3) $4d^{1-10}\ 5s^{1-2}$
c) Third transition series	2) $5d^{1-10}\ 6s^{1-2}$
d) Fourth transition series	1) Incomplete series

Comprehension type:

26. Which of the following is not the electronic configuration of a representative element.

A) ns^2 B) ns^2np^5 C) ns^2np^1 D) ns^2np^6

Answer:D

Solution:Representative (main-group) elements have valence electrons in s or p orbitals, but not fully filled p-subshells (which defines noble gases).

27. Which of the following electronic configuration corresponds to an inert gas?

A) $1s^12s^22p^5$ B) $1s^22s^22p^6$ C) $1s^22s^1$ D) $1s^22s^22p^63s^1$

Answer:B

Solution:Inert gases (noble gases) have fully filled s and p orbitals in their outermost shell:

B) $1s^2\ 2s^2\ 2p6$: Neon (Ne), a noble gas.

Integer type:

28. Number of elements in longest period is _____

Answer:32

Solution:The 6th period is the longest period in the periodic table.
It includes:
2 elements in the s-block (Cs, Ba).
14 lanthanides (f-block) (La-Lu, Ce-Lu excluding La).
10 transition metals (d-block) (Hf-Hg).
6 p-block elements (Tl-Rn).
Total: 2+14+10+6=32 elements.

29. If 7th period is also completed, then the final element of this period would be with an atomic number is _____

Answer:118

Solution:The 7th period follows the same pattern as the 6th peri

s-block: 2 elements (Fr, Ra).

Actinides (f-block): 14 elements (Ac-Lr, but officially Th-Lr).

d-block: 10 elements (Rf-Cn).

p-block: 6 elements (Nh-Og).

Total elements:

2+14+10+6=32.

The last element in the completed 7th period is Oganesson (Og) with atomic number 118.

KEY

				TEACHING TASK					
				JEE MAIN LEVEL QUESTIONS					
1	2	3	4	5	6	7	8	9	10
C	B	D	B	B	B	A	B	B	B
11	12	13	14	15					
A	D	C	A	B					
				JEE ADVANCED LEVEL QUESTIONS					
16	17	18	19	20		21	22		
A,B,C	C,D	E	B	a-2,b-3,c-3,d-4		C	A		
				LEARNERS TASK					
				CUQ'S					
1	2	3	4	5	6	7	8	9	10
A	A	B	B	D	D	C	B	D	D
				JEE MAIN LEVEL QUESTIONS					
11	12	13	14	15	16	17	18	19	
B	C	B	C	B	D	B	C	B	
				JEE ADVANCED LEVEL QUESTIONS					
20	21	22	23	24		25		26	27
A,B,C	A,B,C	D	B	a-4,b-3,c-2,d-1		a-4,b-3,c-2,d-1		D	B
28	29								
32	118								