

### PART : CHEMISTRY

1. **Assertion** : Boron has highest melting point in group 13, that is 2453 K.

**Reason** : Boron has solid crystalline lattice structure.

- (1) Both Assertion & Reason are correct and reason is correct explanation of assertion  
 (2) Both Assertion & Reason are correct and reason is not the correct explanation of assertion  
 (3) Assertion is correct and reason is incorrect  
 (4) Assertion is incorrect and reason is incorrect

**Ans.** (1)

**Sol.** Boron is non-metallic in nature. It is extremely hard and black coloured solid. Due to very strong crystalline lattice, boron has unusually high melting point. Rest of the members are soft metals with low melting point and high electrical conductivity.

Property	B	Al	Ga	In	Tl
Melting point / K	2453	933	303	430	576

2. Sum of bond order of  $\text{NO}^+$  and  $\text{CO}$  is \_\_\_\_\_.

**Ans.** (6)

Species	Total number of electrons	Bond order
$\text{NO}^+$	14	3
$\text{CO}$	14	3

3. Which of the following will not show variable oxidation state ?

- (1) Br (2) Cl (3) F (4) I

**Ans.** (3)

**Sol.** Fluorine in its compound shows only  $-1$  oxidation state. As its electronegativity is highest and it has no vacant d-orbital.

4. Among the following, which one is polar molecule \_\_\_\_\_.

- (1)  $\text{CCl}_4$  (2)  $\text{CO}_2$  (3)  $\text{CHCl}_3$  (4)  $\text{CH}_2=\text{CH}_2$

**Ans.** (3)

**Sol.**  $\text{CHCl}_3$  is having permanent dipole moment, therefore it is polar molecule whereas all other given molecules have dipole moment = 0.

5. Which of the following electronic configuration have maximum value of magnetic moment (spin only) ?

- (1)  $[\text{Ar}]3d^3$  (2)  $[\text{Ar}]3d^6$  (3)  $[\text{Ar}]3d^6$  (4)  $[\text{Ar}]3d^7$

**Ans.** (3)

**Sol.**

	Electronic configuration	No. of unpaired electron
1.	$[\text{Ar}]3d^3 \Rightarrow \boxed{1} \boxed{1} \boxed{1} \boxed{\phantom{1}} \boxed{\phantom{1}} \boxed{\phantom{1}}$	3
2.	$[\text{Ar}]3d^6 \Rightarrow \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{1} \boxed{1}$	2
3.	$[\text{Ar}]3d^6 \Rightarrow \boxed{\uparrow\downarrow} \boxed{1} \boxed{1} \boxed{1} \boxed{1} \boxed{1}$	4
4.	$[\text{Ar}]3d^7 \Rightarrow \boxed{\uparrow\downarrow} \boxed{\uparrow\downarrow} \boxed{1} \boxed{1} \boxed{1} \boxed{1}$	3

More are the no. of unpaired electron, more is the magnetic moment (spin only)

6. How many of the following species have sulphur atom in its +4 oxidation state ?

$\text{SO}_3, \text{SF}_4, \text{H}_2\text{SO}_4, \text{BaSO}_4, \text{H}_2\text{S}_2\text{O}_7, \text{SO}_2, \text{SOCl}_2$

Ans. (3)

Sol.

Species	$\text{SO}_3$	$\text{SF}_4$	$\text{H}_2\text{SO}_4$	$\text{BaSO}_4$	$\text{H}_2\text{S}_2\text{O}_7$	$\text{SO}_2$	$\text{SOCl}_2$
Oxidation state of sulphur	+6	+4	+6	+6	+6	+4	+4

7. The correct increasing order of magnetic moment (spin only) of the following species are :

(P) =  $[\text{FeF}_6]^{3-}$  ; (Q) =  $[\text{V}(\text{H}_2\text{O})_6]^{2+}$  ; (R) =  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

(1)  $Q < R < P$  (2)  $P < Q < R$  (3)  $P < R < Q$  (4)  $R < Q < P$

Ans. (1)

Sol.

	Species	Electronic configuration	No. of unpaired electron
(P)	$[\text{FeF}_6]^{3-}$	$[\text{Ar}]3d^5 \Rightarrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$	5
(Q)	$[\text{V}(\text{H}_2\text{O})_6]^{2+}$	$[\text{Ar}]3d^3 \Rightarrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$	3
(R)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	$[\text{Ar}]3d^6 \Rightarrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$	4

More are the no. of unpaired electrons more is the magnetic moment (spin only).  $\text{H}_2\text{O}$  is weak field ligand therefore magnetic properties of central metal ion and complex will be same.

8.  $\text{PbCrO}_4 \xrightarrow{\text{Hot NaOH}} \text{complex}$   
(Yellow)

Complex is having :

(1) CN = 4, Dianion (2) CN = 6, Dianion  
(3) CN = 3, Dianion (4) CN = 5, Dianion

Ans. (1)

Sol. Yellow ppt. of  $\text{PbCrO}_4$  ↓ is soluble in hot NaOH, forming  $[\text{Pb}(\text{OH})_4]^{2-}$  as  $\text{Pb}^{2+}$  is amphoteric in nature.

9. Identify the correct electronic configuration of an element with atomic number (Z) = 60.

(1)  $[\text{Xe}]4f^4 6s^2$  (2)  $[\text{Xe}]4d^1 4f^3 6s^2$   
(3)  $[\text{Xe}]4d^1 4f^4 6s^1$  (4)  $[\text{Xe}]4d^1 4f^5 6s^0$

Ans. (1)

Sol.  $\text{Nd}_{60} = [\text{Xe}]4f^4 6s^2$

10. **Statement-1** :  $(\text{NH}_4)_2\text{CO}_3$  is basic in nature.

**Statement-2** : Acidic or basic nature of salt of WBWA depends on  $K_a$  &  $K_b$ .

(1) Both **Statement-1** & **Statement-2** are correct.  
(2) Both **Statement-1** & **Statement-2** are incorrect.  
(3) **Statement-1** is correct whereas **Statement-2** is incorrect.  
(4) Both **Statement-1** and **Statement-2** are incorrect.

Ans. (1)

Sol.  $\text{pH}_{\text{WBWA}} = 7 + \frac{1}{2}\text{p}K_a - \frac{1}{2}\text{p}K_b$

The above equation shows that pH depends on  $K_a$  &  $K_b$  value.

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11. In the given reaction :



	[HI]	Rate of reaction
I	0.05 M	$7.5 \times 10^{-4} \text{ M sec}^{-1}$
II	0.1 M	$3 \times 10^{-3} \text{ M sec}^{-1}$
III	0.2 M	$1.2 \times 10^{-2} \text{ M sec}^{-1}$

order of reaction is :

- (1) 1                      (2) 0                      (3) 2                      (4) 3

Ans. (3)

Sol. As we see, on doubling the concentration, rate becomes four times therefore  $n = 2$ .

12. Total number of electrons having  $n = 4$  and  $s = +\frac{1}{2}$ .

Ans. (16)

Sol.

Subshell	4s	4p	4d	4f
	$\uparrow\downarrow$	$\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow$	$\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow$	$\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow$
No. of electrons with $+\frac{1}{2}$	1	3	5	7

13. **Statement-1** : f-block is placed separately in periodic table to preserve the basic classification principle of periodic table.

**Statement-2** : s-block elements can be found in nature in pure elemental state.

- (1) Both **Statement-1** & **Statement-2** are correct.  
 (2) **Statement-1** is correct **Statement-2** is incorrect.  
 (3) **Statement-1** is incorrect whereas **Statement-2** is correct.  
 (4) Both **Statement-1** and **Statement-2** are incorrect.

Ans. (2)

Sol. **Statement-1** is correct while **Statement-2** is incorrect as s-block elements are found in combined form as they are highly reactive.

14. An ideal gas expands isothermally from  $30 \text{ dm}^3$  to  $45 \text{ dm}^3$  against constant external pressure of 80 kPa, then heat involved is \_\_\_\_\_ bar  $\times \text{dm}^3$ .

Ans. (12)

Sol. As process is isothermal ir-reversible expansion of an ideal gas so  $(\Delta U = 0)$  &  $(q = -w)$

pressure = 80 kPa = 0.8 bar

$$q = -w = P\Delta V$$

$$= 0.8 \times [45-30]$$

$$= 0.8 \times 15$$

$$= 12 \text{ bar} \times \text{dm}^3.$$

19. 0.08 kg of an ideal gas is heated from 300 K to 305 K, then change in its internal energy is \_\_\_\_\_  $\times 10^{-3}$  kcal [nearest integer].

(given for ideal gas =  $0.17 \frac{\text{kcal}}{\text{kg} \times ^\circ\text{C}}$ )


Ans. (68)

Sol. For ideal gas change in internal energy ( $\Delta U$ )

$$\Delta U = m.S. \Delta T$$

$$= 0.08 \times 0.17 \times 5$$

$$= 0.068 \text{ kcal} = 68 \times 10^{-3} \text{ kcal}$$

20. IUPAC name of the given compound  is

(1) 3-Ethyl-1,1-dimethylcyclohexane

(2) 1-Ethyl-3,3-dimethylcyclohexane

(3) 1-Ethyl-3-methylcyclohexane

(4) 1,1-Dimethyl-3-Ethylcyclohexane

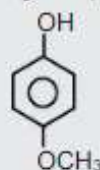
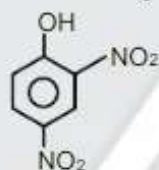
Ans. (1)

Sol.



3-Ethyl-1,1-dimethylcyclohexane

21. Correct order of acidic strength of following compound is :



(1)  $c > d > a > b$

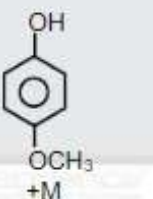
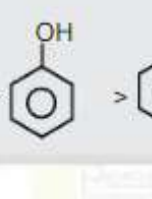
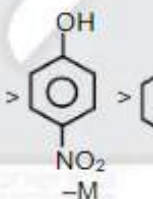
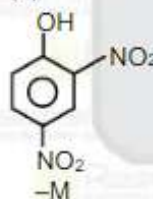
(2)  $b > a > c > d$

(3)  $b > a > d > c$

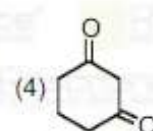
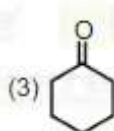
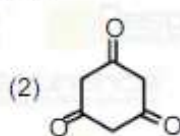
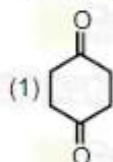
(4)  $c > b > a > d$

Ans. (3)

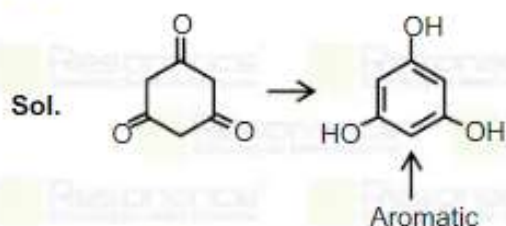
Sol.



22. Which has maximum enol %



Ans. (2)



23. Number of polar solvents in  
 $\text{CH}_2=\text{CH}_2$ ,  $\text{CCl}_4$ ,  $\text{CHCl}_3$ ,  $\text{CO}_2$  is  
 a b c d

Ans. (1)

Sol. Only  $\text{CHCl}_3$  is polar solvent whereas  $\text{CH}_2=\text{CH}_2$ ,  $\text{CCl}_4$  and  $\text{CO}_2$  is non polar.

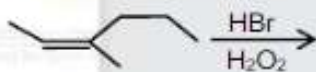
24. Correct statement about  is

- (1) Aromatic (2) Benzoid aromatic  
 (3) Non benzoid aromatic (4) Alicyclic

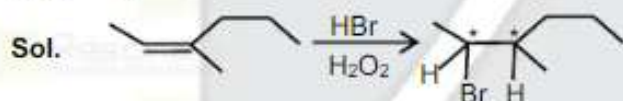
Ans. (4)

Sol. Given compound is cyclic as well as aliphatic, hence it is alicyclic.

25. Count the number of stereoisomers formed in the product :



Ans. (4)



Since the product has two chiral carbon, hence overall 4 stereoisomers [RR, RS, SR and SS] will be formed.

26. Nucleotide pairs are joined together by

- (1) Glycosidic linkage (2) Peptide linkage  
 (3) Phosphate diester linkage (4) Hydrogen bond

Ans. (3)

27. Correct option of following is

- (1)  $\text{SN}^1$  ----- Racemisation ;  $\text{SN}^2$  ----- Inversion  
 (2)  $\text{SN}^1$  ----- Racemisation ;  $\text{SN}^2$  ----- Retention  
 (3)  $\text{SN}^1$  ----- Inversion ;  $\text{SN}^2$  ----- Racemization  
 (4)  $\text{SN}^1$  ----- Retention ;  $\text{SN}^2$  ----- Inversion

Ans. (1)

Sol. Since  $\text{SN}^1$  reaction occurs via carbocation intermediate hence racemization takes place, whereas in  $\text{SN}^2$ , due to basic side back side attack inversion of configuration takes place.



28. Which of the given is most basic.



Ans. (4)

Sol. Lone pair of N is being used in aromatic ring, whereas in A and B, lone pair is being delocalised in aromatic ring, whereas in 'D' lone pair is localised.

29. **Statement-I** : Ethanol gives immediate turbidity in Lucas test.

**Statement-II** : p-nitro phenol is more acidic than m and o-nitro phenol.

(1) Only Statement-I is correct.

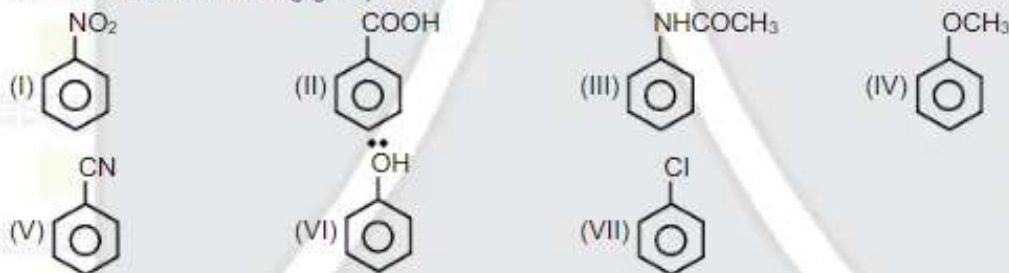
(2) Only Statement-II is correct.

(3) Both Statement-I and II is correct.

(4) Both Statement-I and II is incorrect.

Ans. (2)

30. Number of meta directing group are :



Ans. (3)

Sol. (I), (II) and (V) are classified as meta directing group in electrophilic aromatic substitution reaction.