

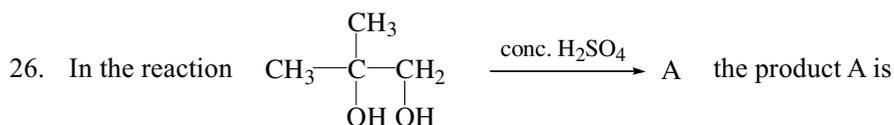
# Practice Test Paper-II

## Select the Correct Choice

- Amongst the following, identify the species with an atom in +6 oxidation state.  
(a)  $\text{MnO}_4^-$  (b)  $\text{Cr}(\text{CN})_6^{3-}$  (c)  $\text{CrO}_2\text{Cl}_2$  (d)  $\text{NiF}_6^{2-}$
- The temperature of a given mass of a gas is increased from  $19^\circ\text{C}$  to  $21^\circ\text{C}$  at constant pressure. The volume  $V$  of the gas is increased  
(a) to  $V(21/19)$  (b) by  $2/273.15$  of its volume at  $0^\circ\text{C}$   
(c) by  $2/273.15$  of its volume at  $0\text{ K}$  (d) by a factor of  $2/273.15$
- Which of the following expressions is correct for CsCl unit cell (edge length  $a$ )?  
(a)  $r_c + r_a = a$  (b)  $r_c + r_a = a/\sqrt{2}$  (c)  $r_c + r_a = \sqrt{3} a/2$  (d)  $r_c + r_a = a/2$
- Which of the following statements is correct?  
(a) Energy of electron in first Bohr orbit of hydrogen atom is more negative than that of first orbit of lithium dipositive ion  
(b) Energy of electron in first Bohr orbit of hydrogen atom is the same as that of third orbit of lithium dipositive ion  
(c) Velocity of electron in first Bohr orbit of hydrogen atom is nine times that in the first orbit of lithium dipositive ion  
(d) Radius of first orbit of hydrogen atom is three times that of first orbit of lithium dipositive ion
- The type of hybrid orbitals used by chlorine atom in  $\text{ClO}_2^-$  is  
(a)  $sp^3$  (b)  $sp^2$  (c)  $dsp^2$  (d)  $sp$
- Molar heat capacity of water in equilibrium with ice at constant pressure is  
(a) zero (b)  $40.45\text{ kJ K}^{-1}\text{ mol}^{-1}$  (c) infinity (d)  $75.48\text{ kJ K}^{-1}\text{ mol}^{-1}$
- For a concentrated solution of a weak electrolyte  $\text{A}_x\text{B}_y$ , the degree of dissociation is given by  
(a)  $\alpha = \sqrt{K_{\text{eq}} / c(x+y)}$  (b)  $\alpha = \sqrt{K_{\text{eq}} / c(xy)}$   
(c)  $\alpha = (K_{\text{eq}}/c^{x+y-1} x^y y^x)^{1/(x+y)}$  (d)  $\alpha = (K_{\text{eq}}/c^{x+y-1} x^x y^y)^{1/(x+y)}$
- The standard potentials of  $\text{Cu}^{2+}|\text{Cu}$  and  $\text{Cu}^{2+}|\text{Cu}^+$  are  $0.337\text{ V}$  and  $0.153\text{ V}$ , respectively. The standard potential of  $\text{Cu}^+|\text{Cu}$  would be  
(a)  $0.184\text{ V}$  (b)  $0.827\text{ V}$  (c)  $0.521\text{ V}$  (d)  $0.490\text{ V}$
- The hydrolysis of an ester was carried out separately with  $0.05\text{ M HCl}$  and  $0.05\text{ M H}_2\text{SO}_4$ . Which of the following expressions is correct?  
(a)  $k_{\text{HCl}} > k_{\text{H}_2\text{SO}_4}$  (b)  $k_{\text{HCl}} < k_{\text{H}_2\text{SO}_4}$  (c)  $k_{\text{HCl}} = k_{\text{H}_2\text{SO}_4}$  (d)  $k_{\text{H}_2\text{SO}_4} = 2k_{\text{HCl}}$
- The correct order of ionization energy is  
(a)  $\text{Si} > \text{P} > \text{S}$  (b)  $\text{Si} > \text{P} < \text{S}$  (c)  $\text{Si} < \text{P} > \text{S}$  (d)  $\text{Si} < \text{P} < \text{S}$
- The bond angle  $\text{P—P—P}$  in  $\text{P}_4$  is about  
(a)  $60^\circ$  (b)  $90^\circ$  (c)  $109^\circ 28'$  (d)  $120^\circ$
- The thermal stability of carbonates of alkaline earth metals follows the order  
(a)  $\text{MgCO}_3 < \text{CaCO}_3 < \text{BeCO}_3$  (b)  $\text{BeCO}_3 < \text{CaCO}_3 < \text{MgCO}_3$   
(c)  $\text{BeCO}_3 < \text{MgCO}_3 < \text{CaCO}_3$  (d)  $\text{CaCO}_3 < \text{MgCO}_3 < \text{BeCO}_3$
- The number of oxygen atoms attached to each P in  $\text{P}_2\text{O}_5$  is  
(a) 2 (b) 2.5 (c) 3 (d) 4

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14. Which of the following is a reducing agent?  
 (a) Orthophosphorous acid (b) Hypophosphoric acid  
 (c) Orthophosphoric acid (d) Pyrophosphoric acid
15. Which of the following statements is correct?  
 (a)  $\text{XeF}_4$  is tetrahedral while  $\text{XeO}_4$  is square planar  
 (b)  $\text{XeF}_4$  is square planar while  $\text{XeO}_4$  is tetrahedral  
 (c) Both  $\text{XeF}_4$  and  $\text{XeO}_4$  are square planar  
 (d) Both  $\text{XeF}_4$  and  $\text{XeO}_4$  are tetrahedral
16. Molecular shapes of  $\text{SF}_4$ ,  $\text{CF}_4$  and  $\text{XeF}_4$  are  
 (a) the same with 2, 0 and 1 lone pairs of electrons, respectively.  
 (b) the same with 1, 1 and 1 lone pairs of electrons, respectively.  
 (c) different with 0, 1 and 2 lone pairs of electrons, respectively.  
 (d) different with 1, 0 and 2 lone pairs of electrons, respectively.
17. The spin magnetic moment of  ${}_{24}\text{Cr}^{3+}$  is  
 (a)  $1.73 \mu_B$  (b)  $2.83 \mu_B$  (c)  $3.87 \mu_B$  (d)  $4.90 \mu_B$
18. Which of the following anions interferes with the systematic analysis of cations?  
 (a)  $\text{SO}_4^{2-}$  (b)  $\text{PO}_4^{3-}$  (c)  $\text{NO}_3^-$  (d)  $\text{I}^-$
19. Ammonia can be dried by  
 (a) conc.  $\text{H}_2\text{SO}_4$  (b)  $\text{P}_4\text{O}_{10}$  (c)  $\text{CaO}$  (d) anhydrous  $\text{CaCl}_2$
20. Which of the following fluorides of Xe is not known?  
 (a)  $\text{XeF}_2$  (b)  $\text{XeF}_3$  (c)  $\text{XeF}_4$  (d)  $\text{XeF}_6$
21. The major product obtained in the photobromination of 2-methylbutane is  
 (a) 1-bromo-2-methylbutane (b) 3-bromo-2-methylbutane  
 (c) 2-bromo-2-methylbutane (d) 2-bromo-3-methylbutane
22. An alkene on oxidative ozonolysis gives adipic acid. The alkene is  
 (a) cyclohexene (b) 1-methylcyclopentene  
 (c) 1, 2-dimethylcyclobutene (d) 3-hexene
23. Which of the following statements is not correct?  
 (a) The number of isomers (including structural and stereoisomers) of alkyne  $\text{C}_6\text{H}_{10}$  is eight  
 (b) The treatment of 1, 1-dibromopentane with  $\text{KOH}(\text{s})$  at  $200^\circ\text{C}$  produces 2-pentyne  
 (c) Acetylene, like ethylene, is soluble in concentrated  $\text{H}_2\text{SO}_4$   
 (d) Alkynes are less reactive than alkenes toward addition of  $\text{Br}_2$
24. Which of the following statements is correct?  
 (a) The reaction of benzene with *n*-propyl chloride in the presence of  $\text{AlCl}_3$  gives 1-phenylpropane as the only product  
 (b) Though  $-\text{N}(\text{CH}_3)_2$  is an *ortho*- and *para*-director yet it gives *meta* nitrated product with the more powerful electrophilic reagent  $\text{HNO}_3/\text{H}_2\text{SO}_4$   
 (c) Phenyl cation is more stable than cyclohexyl cation  
 (d) Benzene-water forms a higher boiling azeotrope
25. Which of the following statements is not correct?  
 (a) Cyclohexanol is more soluble in water than 1-hexanol  
 (b) Alcohol is slightly more acidic than water  
 (c) The reaction of  $\text{HBr}$  with tertiary butyl alcohol follows  $\text{S}_{\text{N}}1$  mechanism  
 (d)  $\text{S}_{\text{N}}1$  nucleophilic substitution in  $\text{ROH}$  may lead to the rearrangement of carbon skeleton



- (a)  $\text{CH}_3-\overset{\text{CH}_3}{\text{C}}=\text{CH}_2$  (b)  $\text{CH}_3-\overset{\text{H}}{\text{C}}=\overset{\text{H}}{\text{C}}-\text{CH}_3$  (c)  $\text{CH}_3\text{CH}_2-\overset{\text{CH}_3}{\text{C}}=\text{O}$  (d)  $\text{CH}_3-\overset{\text{CH}_3}{\text{CH}}-\text{CHO}$

27. Which of the following statements is correct?  
 (a) 1° amide liberates N<sub>2</sub> when treated with HNO<sub>2</sub>  
 (b) 2° amide liberates N<sub>2</sub> when treated with HNO<sub>2</sub>  
 (c) 3° amide liberates N<sub>2</sub> when treated with HNO<sub>2</sub>  
 (d) None of 1°, 2° and 3° amides liberate N<sub>2</sub> when treated with HNO<sub>2</sub>
28. Which of the following statements is not correct?  
 (a) Phenol is stronger acid than an alcohol  
 (b) Decreasing order of acidic character of chlorophenols is  
 $p\text{-ClC}_6\text{H}_4\text{OH} > o\text{-ClC}_6\text{H}_4\text{OH} > m\text{-ClC}_6\text{H}_4\text{OH}$   
 (c) Sulphonation of phenol is a reversible reaction.  
 (d) *p*-Hydroxyacetophenone can be converted to *o*-hydroxyacetophenone on increasing the temperature from 25°C to 165°C.
29. The correct sequence regarding base strength of aliphatic amines in aqueous solution is  
 (a) R<sub>3</sub>N > R<sub>2</sub>NH > RNH<sub>2</sub> (b) R<sub>2</sub>NH > RNH<sub>2</sub> > R<sub>3</sub>N  
 (c) R<sub>2</sub>NH > R<sub>3</sub>N > RNH<sub>2</sub> (d) RNH<sub>2</sub> > R<sub>2</sub>NH > R<sub>3</sub>N
30. Which of the following is a linear polymer?  
 (a) Amylopectin (b) Glycogen (c) Starch (d) Amylose



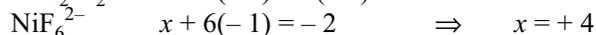
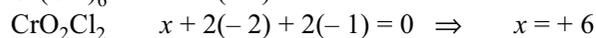
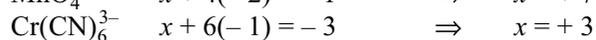
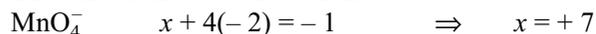
## ANSWERS

- |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|
| 1. (c)  | 2. (b)  | 3. (c)  | 4. (b)  | 5. (a)  | 6. (c)  |
| 7. (d)  | 8. (c)  | 9. (b)  | 10. (c) | 11. (a) | 12. (c) |
| 13. (d) | 14. (a) | 15. (b) | 16. (d) | 17. (c) | 18. (b) |
| 19. (c) | 20. (b) | 21. (c) | 22. (a) | 23. (c) | 24. (b) |
| 25. (b) | 26. (d) | 27. (a) | 28. (b) | 29. (b) | 30. (d) |



## HINTS AND SOLUTIONS

1. The oxidation states are as follows.

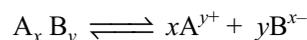


2. Since  $V_t = V_0 + (V_0/237.15^\circ\text{C}) t$ , we have

$$V_{t_2} - V_{t_1} = \frac{V_0}{273.15^\circ\text{C}} (t_2 - t_1) = \frac{2V_0}{273.15}$$

Here  $V_0$  is the volume of gas at 0°C.

3. The unit cell of CsCl is body centred. Hence  $2(r_+ + r_-) = \sqrt{3} a$   
 4. We have  $E \propto -Z^2/n^2$ ;  $r \propto n^2/Z$  and  $v \propto Z/n$   
 5. There are four unpaired electrons around Cl in  $\text{ClO}_2^-$ . Hence, Cl involves sp<sup>3</sup> hybrid orbitals.  
 6. Heat added to the system does not increase its temperature.  
 7. We have



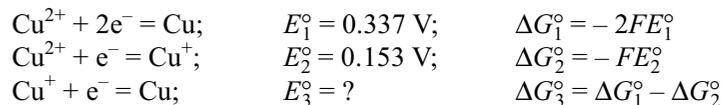
$$K_{\text{eq}} = \frac{[\text{A}^{y+}]^x [\text{B}^{x-}]^y}{[\text{A}_x\text{B}_y]} = \frac{(c x \alpha)^x (c y \alpha)^y}{c(1-\alpha)} = c^{x+y-1} x^x y^y \alpha^{x+y}$$

Hence,

$$\alpha = (K_{\text{eq}}/c^{x+y-1} x^x y^y)^{1/(x+y)}$$

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8. We have

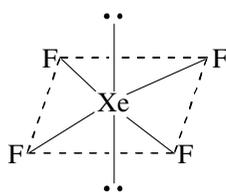


$$E_3^\circ = \frac{\Delta G_3^\circ}{-F} = 2E_1^\circ - E_2^\circ = [2(0.337) - 0.153] \text{V} = 0.521 \text{ V}$$

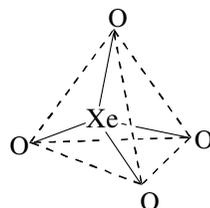
9. We will have  $[\text{H}^+]_{0.05\text{M H}_2\text{SO}_4} > [\text{H}^+]_{0.05\text{M HCl}}$

Since the rate constant is directly proportional to  $[\text{H}^+]$ , it follows that  $k_{\text{HCl}} < k_{\text{H}_2\text{SO}_4}$ .

- Within a period, there is a tendency to increase the ionization energy with increase in atomic number of the element. The elements of group 15 (P in the present case) are exceptional as they contain stable half-filled electronic configuration.
- The bond angle in  $\text{P}_4$  is  $60^\circ$ . This makes the tetrahedron arrangement of phosphorus atoms less stable.
- Thermal stability increases on descending the group.
- Each phosphorus atom is surrounded by four oxygen atoms.
- The orthophosphorous acid contains hydrogen atom directly attached to phosphorus atom.
- The structure of  $\text{XeF}_4$  and  $\text{XeO}_4$  are

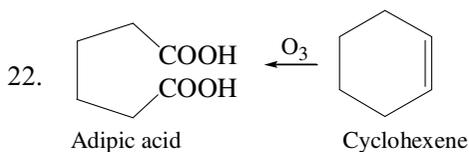


Square planar

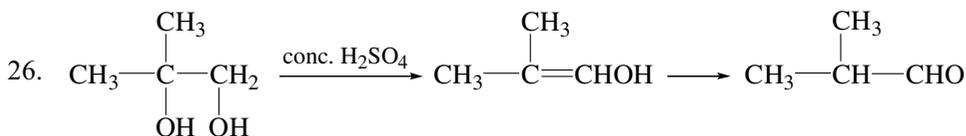


Tetrahedron

- The shapes are different.  $\text{SF}_4$  has one lone pair of electrons,  $\text{CF}_4$  has none, and  $\text{XeF}_4$  has two lone pairs of electrons.
- The electronic configuration of Cr is  $(3d)^5(4s)^1$ . Thus,  $\text{Cr}^{3+}$  has  $(3d)^3$  configuration with three unpaired electrons. Its spin magnetic moment is  $\sqrt{n(n+2)} \mu_B$ , i.e.  $\sqrt{15} \mu_B = 3.87 \mu_B$ .
- The phosphate anion interferes with the systematic analysis of cations.
- Ammonia does not react with  $\text{CaO}$ .
- $\text{XeF}_3$  is not known.
- Tertiary radical is most stable. Hence, the product will be 2-bromo-2-methylbutane.



- In the presence of  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ,  $-\text{N}(\text{CH}_3)_2$  is converted into electron-seeking cation which directs the incoming group to meta position.



- Although Cl is electron-donating by resonance, its electron-withdrawing inductive effect that decreases with increasing separation of Cl and OH, predominates, making all the chlorophenols more acidic than phenol. The correct sequence of acidic character is



- The base strength of aliphatic amines is decided by the following two factors.

**Induction factor** Increasing replacement of H by R (electron-releasing group) increases electron density on N, thus making it more basic.

**Solvation factor** Stabilization of conjugate acid through H-bonding with water. More the number of H atoms, more the stability and thus more basic the amine.

Thus, induction and solvation operate in opposite directions. Induction dominates to make all three alkylamines more basic than ammonia. However, adding a third R as in  $R_3N$  does not further enhance the basicity because now the opposing solvation effect assumes more importance.

