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CBSE Board
Class XI
Chemistry
Sample Paper 3

Q1. Dissolving 120g of urea (mol. Wt 60) in 1000g of water gave a solution of density 1.15g/mL. The molarity of the solution is

(a) 1.78 M
(b) 2.00 M
(c) 2.05 M
(d) 2.22 M

Sol. (c)

Q2. Among the following compounds, the most acidic is

(a) P-nitrophenol
(b) P-hydroxybenzoic zcid
(c) Ohydroxybenzoic acid
(d) P-toluic acid

Sol. (c)

Due to ortho effect

Q3. Extra pure N_2 can be obtained by heating

(a) NH_3 with CuO
(b) NH_4NO_3
(c) $(NH_4)_2Cr_2O_7$
(d) $Ba(N_3)_2$

Sol. (d)

$$Ba(N_3)_2 \xrightarrow{\Delta H} Ba\downarrow + 3N_2$$

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Q4. For the reaction

$$PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}$$

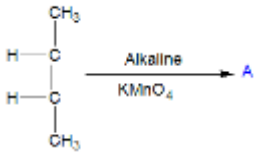
The value of K_c at 250°C is 26. The value of K_p at this temperature will be

(a) 0.61
(b) 0.57
(c) 0.83
(d) 0.46

Sol. (a)

$$K_p = K_c(RT)^{\Delta n} = 26 \times (0.082 \times 523)^{-1} = 0.61$$

Q5. Prob 10.



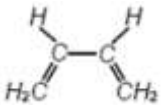
Which is true about this reaction?

(a) A is meso 1, 2 – butan – diol formed by syn addition
(b) A is meso 1, 2 – butan – diol formed by anti addition
(c) A is a racemic mixture of d and f 1, 2 – butan – diol formed by anti addition.
(d) A is a recemic mixture of d and ℓ 1, 2 – butan – diol formed by syn addition.

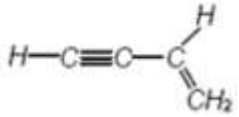
Sol. (c)

Q6. Among the given options, the compound(s) in which all the atoms are in one plane in all the possible conformation (if any), is (are)

(a)



(b)



(c) $H_2C = C = o$
(d) $H_2C = C = CH_2$

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Sol. (a, b, c)

Taking only stable conformers in account

Q7. For which of the following species, Bohr theory doesn't apply

(a) H
(b) He^{+}
(c) $Li^{2+}(D)$
(d) No^{+}

Sol. (d)

Bohr theory is not applicable to multi electron species

Q8. According to kinetic theory of gases

(a) Collisions are always elastic
(b) Heavirer molecules tarfer more momentum to the wall of the container.
(c) Only a small number of molecules have very high velocity
(d) Between collisions the molecules move in straight lines with constant velocities

Sol. (a, d)

Option c is correct but not mentioned in the kinetic theory of gases

Q9. If the radius of 2nd Bohr orbit of hydrogen atom is r_2. The radius of third Bohr orbit will be

(a) $\frac{4}{g}r_2$
(b) $4r_2$
(c) $\frac{9}{4}r_2$
(d) $9r_2$

Sol. (c)

$$r = \frac{n^2h^2}{4\pi^2 mZe^2}$$

$$\therefore \frac{r_2}{r_3} = \frac{2^2}{3^2}$$

$$\therefore r_3 = \frac{9}{4}r_2$$

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Q10. The equilibrium

$2Cu^{I} \Leftrightarrow Cu^{o} + Cu^{II}$

In aqueous medium at 25°C shifts towards the left in the presence of

(a) NO_3^-
(b) Cl^-
(c) SCN^-
(d) CN^-

Sol. (b, c, d)

Cl^-, SCN^- and CN^- form insoluble compound of CuCl, CuSCN and CuCN which drags the equilibrium reaction in backward direction.

Q11. The equilibrium constant for the reaction,

$N_{2(g)} + O_{2(g)} \rightleftharpoons 2N\ O$ is 4×10^{-4} at 2000 K

In presence of a catalyst, equilibrium is attained ten times faster. Therefore, the equilibrium constant, in presence of the catalysts at 2000K is

(a) 40×10^{-4}
(b) 4×10^{-4}
(c) 4×10^{-5}
(d) Difficulty to compute

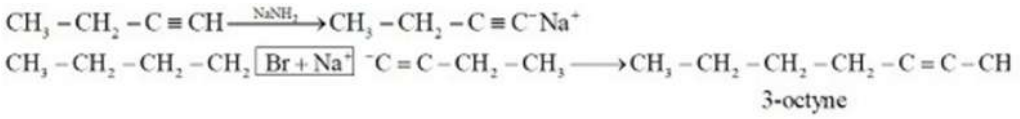
Sol. (b)

Equilibrium is constant at constant temperature for a reaction

Q12. The synthesis of 3- octyne is achieved by adding a bromoalkane into a mixture of solium amide a alkyne. The bromoalkane and alkyne respectively are

(a) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3CH_2C \equiv CH$
(b) $BrCH_2CH_2CH_2$ and $CH_3CH_2CH_2C \equiv CE$
(c) $BrCH_2CH_2CH_2CH_2CH_3$ and $CH_3C \equiv CH$
(d) $BrCH_2CH_2CH_2CH_3$ and $CH_3CH_2C = CE$

Sol. (d)



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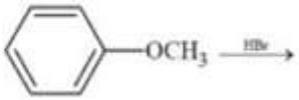
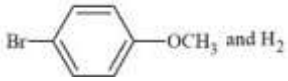
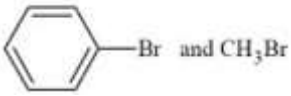
Q13.

In the reaction  the products are

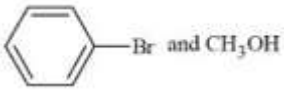
(a)



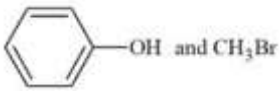
(b)



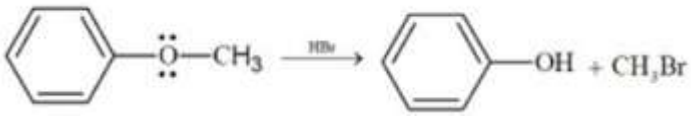
(c)



(d)



Sol. (d)



Q14. The species which by definition bas ZERO standard molar enthalpy of formation at 298 K is

(a) $Br_2(g)$
(b) $Cl_2(g)$
(c) $H_2O(g)$
(d) $CH_4(g)$

Sol. (b)

Cl_2 is gas at 298 K while Br_2 is a liquid.

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Q15. The hydrolysis constant for $ZnCl_2$ will be

(a) $K_n = \frac{K_w}{K_b}$

(b) $K_n = \frac{K_w^2}{K_b}$

(c) $K_n = \frac{K_w^2}{K_b^2}$

(d) $K_h = \frac{K_b}{K_w^2}$

Where K_b is effective dissociation constant of base Zn^{++}

Sol. (b)

$Zn^{++} + 2H_2O \rightleftharpoons Zn(OH)_2 + 2H^+$

$$\therefore K_h = \frac{\left[Zn(OH)_2\right]\left[H^+\right]^2}{\left[Zn^{++}\right]} \quad \ldots (1)$$

$Zn(OH)_2 \rightleftharpoons Zn^{++} + 2OH^-$

$$\therefore K_b = \frac{\left[Zn^{++}\right]\left[OH^-\right]^2}{\left[Zn(OH)_2\right]}, \quad K_w = [H^+]\,[OH^-]$$

$$\therefore \frac{K_w^2}{K_b} = K_h$$

Q16. The bond energy (in kcal mol^{-1}) of a C – C single bond is approximately

(a) 1
(b) 10
(c) 100
(d) 1000

Sol. (c)

Q17. $M(OH)_x$ has K_{SP} 4×10^{-12} and solubility 10^{-4}M. Then the value of x is

(a) 1
(b) 2
(c) 3
(d) –4

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Sol. (b)

$M(OH)_x$ will ionize in the way

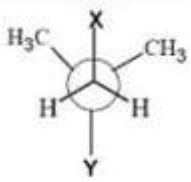
$$M(OH)_x \rightleftharpoons M^{+x} + x\,OH^-$$

$$10^{-4} \qquad x \times 10^{-4}$$

$\therefore K_{sp} = [M^{+x}]\,[OH^-]^x \therefore (10^{-4})\,(x \times 10^{-4})^x = 4 \times 10^{-12}$

by inspection we get this relation will hold good when x = 2

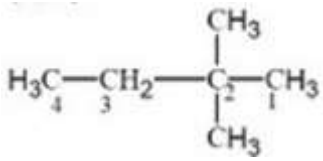
Q17. In the Newman projection for 2,2-dimethylbutane



X and Y can respectively be

(a) H and H
(b) H and C_2H_5
(c) C_2H_5 and H
(d) $CH_3$and CH_3

Sol. (b, d)



On $C_2 - C_3$ bond axis

$X = CH_3$

$Y = CH_3$

On $C_1 - C_2$ bond aixs

$X = H$

$Y = C_2H_5$

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Q19. Among the following compounds, the most acidic is

(a) P-nitrophenol
(b) P-hydroxybenzoic zcid
(c) Ohydroxybenzoic acid
(d) P-toluic acid

Sol. (c)

Due to ortho effect

Q20. Number of waves made by an electron in one complete revolution in 3^{rd} Bohr orbit is

(a) 2
(b) 6
(c) 4
(d) 1

Sol. (b)

Circumference of 3^{rd} orbit = $2\pi r_3$

According to Bohr's angular momentum of electron in 3^{rd} orbit is

$$mvr_3 = 3\frac{h}{2\pi} \qquad \text{or} \quad \frac{h}{mv} = \frac{2\pi r_3}{3}$$

By de-Broglie equation,

$$\lambda = \frac{h}{mv}$$

$$\therefore \lambda = \frac{2\pi r_3}{3}$$

$$\therefore 2\pi r_3 = 3\lambda$$

i.e. circumference of 3^{rd} orbit is three times the wavelength of electron or number of waves made by Bohr electron in one complete revolution in 3^{rd} orbit is three.

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Q21. According to kinetic theory of gases

(a) Collisions are always elastic
(b) Heavirer molecules tarfer more momentum to the wall of the container.
(c) Only a small number of molecules have very high velocity
(d) Between collisions, the molecules move in straight lines with constant velocities,

Sol. (a, d)

Option c is cored but not mentioned in the kinetic theory of gases

Q22. The pH of an aqueous solution of 0.1M solution of weak monoprotic acid which is 1% ionized is

(a) 1
(b) 3
(c) 2
(d) 11

Sol. (c)

$$HA \rightleftharpoons H^+ + A^-$$

0.1	0	0
$0.1\left(1-\frac{1}{100}\right)$	$\frac{1\times 0.1}{100}$	$\frac{1\times 0.1}{100}$

$[H^+] = 10^{-3} \therefore pH = 3$

Q23. Statement – 1: Boron always forms covalent bond. Because

Statement -2: The small size of B^{3+} favours formation of covalent bond.

(a) Statement -1 is True, Statement -2 is True; statement -2 is a correct explanation for statement-1.
(b) Statement -1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement-1 is True, Statement -2 is True.
(d) Statement -1 is False, Statement -2 is True.

Sol. (a)

According to Fajan's rule small cations having high charge density always have tendency to form covalent bond.

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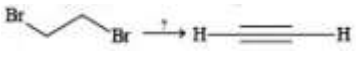
Q24. The correct statement(s) about the compound $H_3C(HO)HC-CH=CH-CH(OH)CH_3(X)$ is (are)

(a) The total number of stereoisomers possible for X is 6
(b) The total number of diastercomers possible for X is 3
(c) If the stereochemistry about the double bond in X is trans, the number of enantiomers possible for X is 4
(d) If the stereochemistry about the double bond in X is cis, the number of enantiomers possible for X is 2

Sol. (a, d)

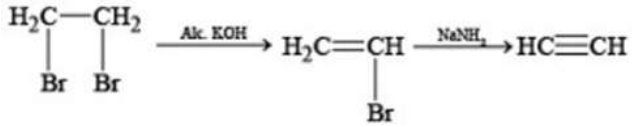
Q25. The reagents(s) for the following conversion,



is/are

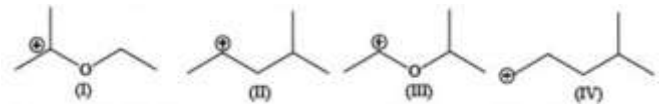
(a) Alcoholic KOH
(b) Alcoholic KOH followed by $NaNH_2$
(c) Aqueous KOH followed by $NaNH_2$
(d) Zn/CH_3OH

Sol. (b)



Because $CH_2-CH-Br$ has partial C –Br double bond character, it requires more stronger base to remove

Q26. The correct stability order for the following species is



(a) (II) > (IV) > (I) > (III)
(b) (I) > (II) > (III) > (IV)
(c) (II) > (I) > (IV) > (III)
(d) (I) > (III) > (II) > (IV)

Sol. (d)

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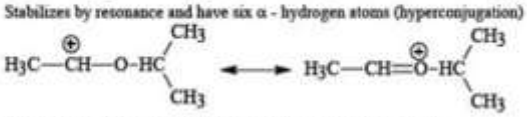
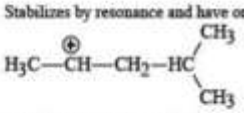
(I) 

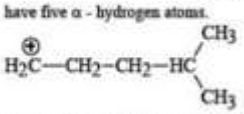
Stabilizes by resonance and have six α - hydrogen atoms (hyperconjugation)

(III) 

Stabilizes by resonance and have only three α - hydrogen atoms.

(II) 

have five α - hydrogen atoms.

(IV) 

have only two α - hydrogen atoms.

$\therefore$ I > III > II > IV

Q27. STATEMETN -1: for every chemical reaction at equilibrium, standard Gibbs energy of reaction is zero. And

STATEMENT – 2: At constant temperature and pressure, chemical reactions are spontaneous in the direction of decreasing Gibbs energy.

(a) STATEMENT -1 is True, STATEMENT -2 is True; STATEMENT -2 is correct explanation for STATEMET -1
(b) STATEMENT -1 is True, STATEMENT -2 is True; STATEMENT -2 is NOT a correct explanation for STATEMENT -1
(c) STATEMENT -1 is True, STATEMENT -2 is False
(d) STATEMENT -1 is False, STATEMENT -2 is True

Sol. (d)

At equilibrium $\Delta G = 0$, ΔG° of a reaction or may be zero.

For a spontaneous process $\Delta G < 0$

Q28. STATEMENT -1: p-Hydroxybenzoic acid has a lowr boiling point than o-hydroxybenzoic acid. Because

(a) STATEMENT -1 is True, statement-2 is True; Statement -2 is a correct explanation for statement-1.
(b) Statement -1 is True, statement -2 is True; statement-2 is NOT a correct explanation for statement-1.
(c) Statement -1 is True, statement -2 is False.
(d) Statement -1 is False, statement -2 is True.

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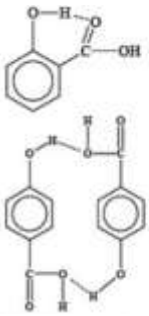
Sol. (d)



More stabilized by intramolecular hydrogen bonding

More stronger intermolecular forces increases the boiling point.

Q29. $B(OH)_3 + N_{aOH} \rightleftharpoons NaBO_2 + N_a[B(OH)_4] + H_2O$

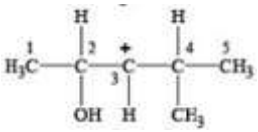
How can this reaction is made to proceed in forward direction?

(a) Addition of cis 1, 2 diol
(b) Addition of borax
(c) Addition of trans 1, 2 diol
(d) Addition of Na_2HPO_4

Sol. (a)

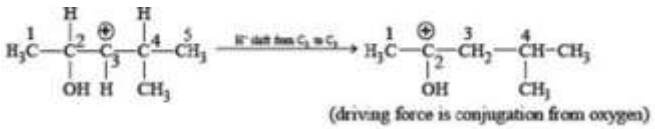
Due to formation of chelated complex, the reaction moves in forward direction.

Q30. In the following carbocation.H/CH_3 that is most likely to migrate to the positively charged carbon is



(a) CH_3AT $C-4$
(b) H at $C-4$
(c) CH_3at $C-2$
(d) H at $C-2$

Sol. (d)



(driving force is conjugation from oxygen)