TEST PAPER OF JEE(MAIN) EXAMINATION – 2019

(Held On Wednesday 09th JANUARY, 2019) TIME : 9 : 30 AM To 12 : 30 PM

CHEMISTRY

1. Which one of the following statements regarding Henry's law not correct ?

(1) The value of K_H increases with function of the nature of the gas

(2) Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids.

(3) The partial of the gas in vapour phase is proportional to the mole fraction of the gas in the solution.

(4) Different gases have different K_H (Henry's law constant) values at the same temperature.

Ans. (2)

Sol. Liquid solution

$P_{gas} = K_H \times X_{gas}$

More is K_H less is solubility, lesser solubility is at higher temperature. So more is temperature more is K_H.

2. The correct decreasing order for acid strength is :-

(1) $NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > CICH_2COOH$

(2) $FCH_2COOH > NCCH_2COOH > NO_2CHCOOH > CICH_2COOH$

(3) $NO_2CH_2COOH > FCH_2COOH > CNCH_2COOH > CICH_2COOH$

(4) $CNCH_2COOH > O_2NCH_2COOH > FCH_2COOH > CICH_2COOH$

Ans. (1)

Sol. EWG increasea acidic strength

$NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > CICH_2COOH$

3. Two complexes $[Cr(H_2O_6)Cl_3]$ (A) and $[Cr(NH_3)_6]Cl_3$ (B) are violet and yellow coloured, respectively. The incorrect statement regarding them is :

(1) Δ_0 value of (A) is less than that of (B).

(2) Δ_0 value of (A) and (B) are calculated from the energies of violet and yellow light, respectively

(3) Bothe absorb energies corresponding to their complementary colors.

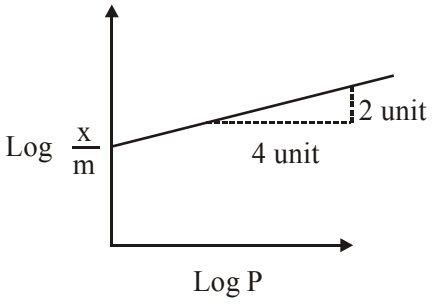
(4) Bothe are paramagnetic with three unpaired electrons.

Ans. (2)

Sol. Δ_0 order will be compared by spectro chemical series not by energies of violet & yellow light so Δ_0 order is

$[Cr(H_2O)_6]Cl_3 < [Cr(NH_3)_6]Cl_3$

4. Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the adsorbent at pressure p. $\frac{x}{m}$ is proportional to



(1) $P\frac{1}{4}$ (2) P^2 (3) P (4) $P\frac{1}{2}$

Ans. (4)

Sol. $\frac{x}{m} = K \times P^{1/n}$

$\log\frac{x}{m} = \log K + \frac{1}{n}\log P$

$m = \frac{1}{n} = \frac{2}{4} = \frac{1}{2} \Rightarrow n = 2$

So, $\frac{x}{m} = K \times P^{1/2}$

5. Correct statements among a to d regarding silicones are :

(a) They are polymers with hydrophobic character

(b) They are biocompatible.

(c) In general, they have high thermal stability and low dielectric strenth.

(d) Usually, they are resistant to oxidation and used as greases.

(1) (a), (b) and (c) only

(2) (a), and (b) only

(3) (a), (b), (c) and (d)

(4) (a), (b) and (d) only

Ans. (3)

Sol. These are properties and uses of silicones.

6. For emission line of atomic hydrogen from $n_i = 8$ to $n_f =$ the plot of wave number $(\bar{\nu})$ against $\left(\frac{1}{n^2}\right)$ will be (The Ry dberg constant, R_H is in wave number unit).

(1) Linear with slope - R_H

(2) Linear with intercept - R_H

(3) Non linear

(4) Linear with sslope R_H

Ans. (4)

Sol. $$\frac{1}{\lambda} = \bar{\nu} = R_H z^2 \left(\frac{1}{\eta_1^2} - \frac{1}{\eta_2^2}\right)$$

$$\bar{\nu} = R_H \times \left(\frac{1}{\eta_1^2} - \frac{1}{8^2}\right)$$

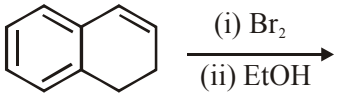
$$\bar{\nu} = R_H \times \frac{1}{\eta^2} - \frac{R_H}{8^2}$$

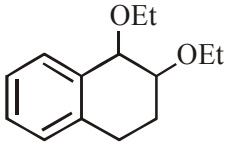
$$\bar{\nu} = R_H \times \frac{1}{\eta^2} - \frac{R_H}{64}$$

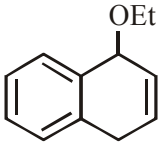
$m = R_H$

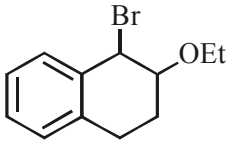
Linear with slope R_H

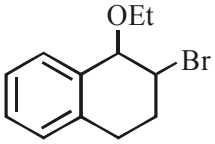
7. The major product the following reaction is :



(1) 

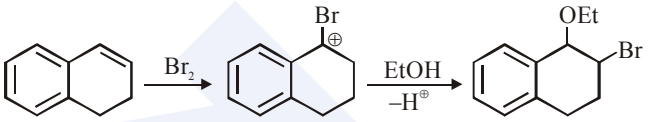
(2) 

(3) 

(4) 

Ans. (4)

Sol.



8. The alkaline earth metal nitrate that does not crystallise with water molecules, is :

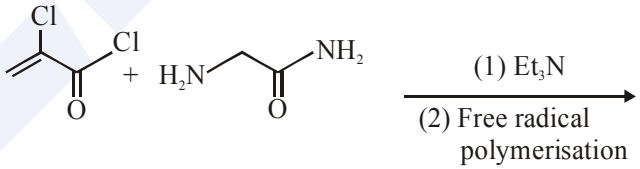
(1) $Sr(NO_3)_2$ (2) $Mg(NO_3)_2$

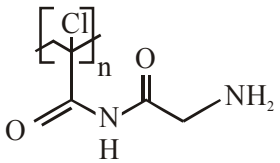
(3) $Ca(NO_3)_2$ (4) $Ba(NO_3)_2$

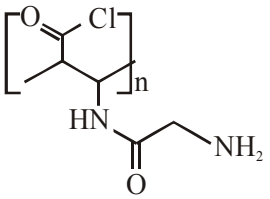
Ans. (4)

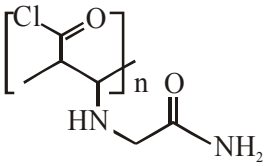
Sol. Smaller in size of center atoms more water molecules will crystallize hence $Ba(NO_3)_2$ is answer due to its largest size of '+ve' ion.

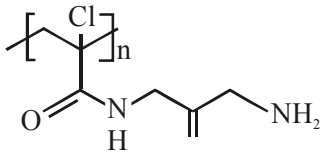
9. Major product of the following reaction is :



(1) 

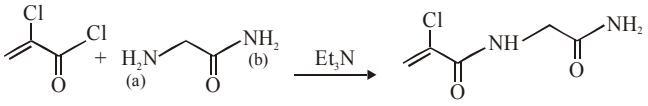
(2) 

(3) 

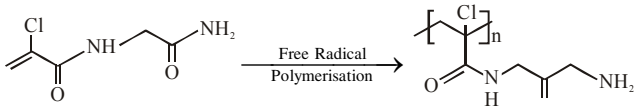
(4) 

Ans. (4)

Sol.



NH_2(a) will wact as nucleophile as (b) is having delocalised lonepair.



10. The highest value of the calculated spin only magnetic moment (in BM) among all the transition metal complexs is :

(1) 5.92 (2) 3.87 (3) 6.93 (4) 4.90

Ans. (1)

Sol. $\mu = \sqrt{n(n+2)}$ B.M.

n = Number of unpaired electrons

n = Maximum number of unpaired electron = 5

Ex : Mn^{2+} complex.

11. 20 mL of 0.1 MH_2SO_4 solution is added to 30 mL of 0.2 M NH_4OH solution. The pH of the resulatant mixture is : [pk_b of NH_4OH = 4.7].

(1) 9.4 (2) 5.0 (3) 9.0 (4) 5.2

Ans. (3)

Sol. 20 ml 0.1 M H_2SO_4 $\Rightarrow$ $\eta_{H^+} = 4$

30 ml 0.2 M NH_4OH $\Rightarrow$ $\eta_{NH_4OH} = 6$

$NH_4OH + H^+ \rightleftharpoons NH_4^{\oplus} + H_2O$

$\Rightarrow$ 6 4 0 0

$\Rightarrow$ 2 0 4 4

Solution is basic buffer

$$pOH = pK_b + \log \frac{NH_4^+}{NH_4OH}$$

$$= 4.7 + \log 2$$

$$= 4.7 + 0.3 = 5$$

pH = 14 – 5 = 9

12. 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in a a container of volume 10 m^3 at 1000 K. given R is the gas constant in JK^{-1} $mol^{-1}m$, x is :

(1) $\frac{2R}{4+12}$ (2) $\frac{2R}{4-R}$ (3) $\frac{4-R}{2R}$ (4) $\frac{4+R}{2R}$

Ans. (3)

Sol. $n_T = (0.5 + x)$

$PV = n \times R \times T$

$200 \times 10 = (0.5 + x) \times R \times 1000$

$2 = (0.5 + x) R$

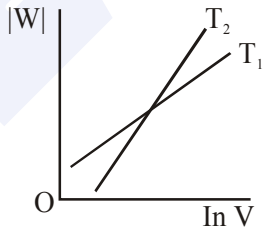
$$\frac{2}{R} = \frac{1}{2} + x$$

$$\frac{4}{R} - 1 = 2x$$

$$\boxed{\frac{4-R}{2R} = x}$$

13. Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures T_1 and T_2 ($T_1 < T_2$). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is:

(1)



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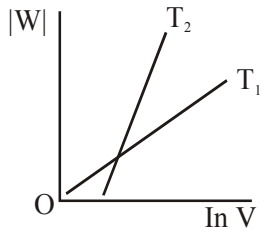

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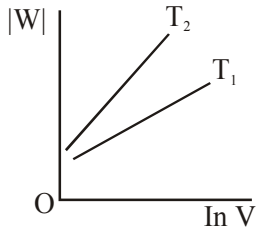

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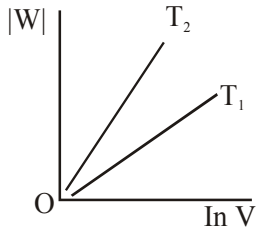


Ans. (2)

Sol. $w = -nRT\ln\frac{V_2}{V_1}$

$w = -nRT\ln\frac{V_b}{V_i}$

$|w| = nRT\ln\frac{V_b}{V_i}$

$|w| = nRT(\ln V_b - \ln V_i)$

$|w| = nRT\ln V_b - nRT\ln V_i$

$Y = m\,x - C$

So, slope of curve 2 is more than curve 1 and intercept of curve 2 is more negative then curve 1.

14. The major product of following reaction is :

$R-C\equiv N \xrightarrow[(2)H_2O]{(1)AlH(i\text{-}Bu_2)} ?$

(1) RCHO (2) RCOOH

(3) RCH_2NH_2 (4) $RCONH_2$

Ans. **(1)**

Sol. $R-C\equiv N \xrightarrow{AlH(i\text{-}Bu_2)} R-CH=N- \xrightarrow{H_2O} R-CH=O$

15. In general, the properties that decrease and increase down a group in the periodic table, respectively, are :

(1) electronegativity and electron gain enthalpy.

(2) electronegativity and atomic radius.

(3) atomic radius and electronegativity.

(4) electron gain enthalpy and electronegativity.

Ans. **(2)**

Sol. Electronegativity decreases as we go down the group and atomic radius increases as we go down the group.

16. A solution of sodium sulfate contains 92 g of Na^+ ions per kilogram of water. The molality of Na^+ ions in that solution in mol kg^{-1} is:

(1) 16 (2) 8 (3) 4 (4) 12

Ans. **(4)**

Sol. $n_{Na^+} = \frac{92}{23} = 4$

So molality = 4

17. A water sample has ppm level concentration of the following metals: Fe= 0.2; Mn = 5.0; Cu = 3.0; Zn = 5.0. The metal that makes the water sample unsuitable drinking is :

(1) Zn (2) Fe (3) Mn (4) Cu

Ans. **(3)**

Sol. (i) Zn = 0.2 (ii) Fe = 0.2

(iii) Mn = 5.0 (iv) Cu = 3.0

18. The increasing order of pKa of the following amino acids in aqueous solution is :

Gly Asp Lys Arg

(1) Asp < Gly < Arg < Lys

(2) Arg < Lys < Gly < Asp

(3) Gly < Asp < Arg < Lys

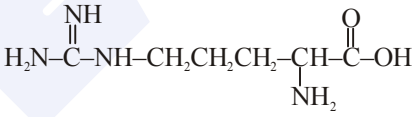
(4) Asp < Gly < Lys < Arg

Ans. **(4)**

Sol. Order of acidic strength :

$HOOC-CH_2-\underset{\displaystyle NH_2}{\underset{|}{CH}}-COOH > NH_2-CH_2-COOH >$

Aspartic acid Glycine



Arginine

So, pK_a

Asp < Gly < Arg < Lys

19. According to molecular orbital theory, which of the following is true with respect to Li_2^+ and Li_2^- ?

(1) Both are unstable

(2) Li_2^+ is unstable and Li_2^- is stable

(3) Li_2^+ is stable and Li_2^- is unstable

(4) Both are stabel

Ans. **(4)**

Sol. Both Li_2^+ and Li_2^- has 0.5 bond order and hence both are stable.

20. The following results were obtained during kinetic studies of the reaction :
$2A + B \rightarrow$ Products

Experment	[A] (in mol L^{-1})	[B] (in mol L^{-1})	Initial Rate of reaction (in mol L^{-1} min^{-1})
(I)	0.10	0.20	6.93×10^{-3}
(II)	0.10	0.25	6.93×10^{-3}
(III)	0.20	0.30	1.386×10^{-2}

The time (in minutes) required to consume half of A is :
(1) 10 (2) 5 (3) 100 (4) 1

Ans. (2)

Sol. $6.93 \times 10^{-3} = K \times (0.1)^x (0.2)^y$

$6.93 \times 10^{-3} = K \times (0.1)^x (0.25)^y$

So $y = 0$

and $1.386 \times 10^{-2} = K \times (0.2)^x (0.30)^y$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^x \quad \boxed{x = 1}$$

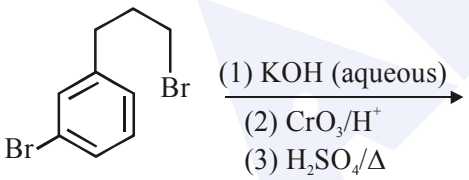
So $r = K \times (0.1) \times (0.2)^0$

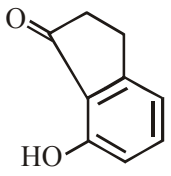
$6.93 \times 10^{-3} = K \times 0.1 \times (0.2)^0$

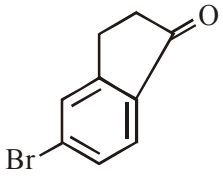
$$\boxed{K = 6.93 \times 10^{-2}}$$

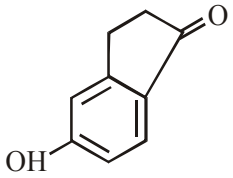
$$t_{1/2} = \frac{0.693}{2K} = \frac{0.693}{0.693 \times 10^{-1} \times 2} = \frac{10}{2} = 5$$

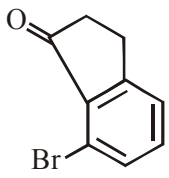
21. The major product of the following reaction is:



(1) 

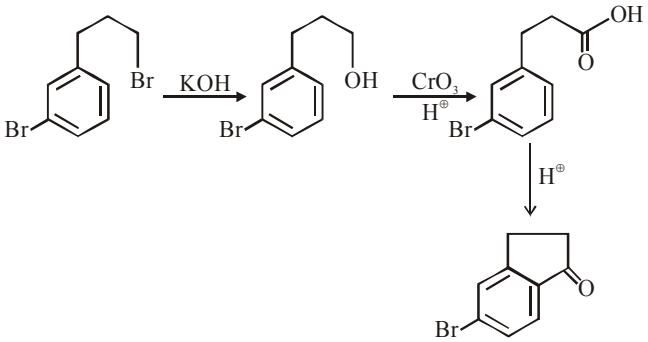
(2) 

(3) 

(4) 

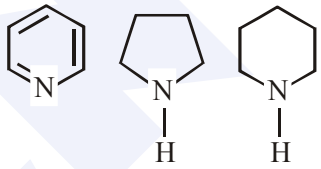
Ans. (2)

Sol.



During AES Br is o/p directing and major product will be formed on less hindrance p position :

22. Arrange the following amines in the decreasing order of basicity:

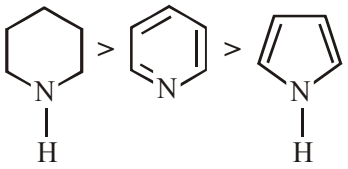


(I) (II) (III)

(1) I > II > III (2) III > II > I
(3) I > III > II (4) III > I > II

Ans. (4)

Sol. Order of basic strength :



sp^3N sp^2N delocalised ℓp of N

23. Which amongst the following is the strongest acid ?
(1) CHI_3 (2) $CHCl_3$
(3) $CHBr_3$ (4) $CH(CN)_3$

Ans. (4)

Sol. CN makes anino most stable so answer is $CH(CN)_3$

24. The anodic half-cell of lead-acid battery is recharged unsing electricity of 0.05 Faraday. The amount of $PbSO_4$ electrolyzed in g during the process in : (Molar mass of $PbSO_4$ = 303 g mol^{-1})
(1) 22.8 (2) 15.2 (3) 7.6 (4) 11.4

Ans. (2)

Sol. (A) $PbSO_4(s) + 2OH^- \longrightarrow PbO_2 + H_2SO_4 + 2e^-$
0.05/2 mole 0.05F

(C) $PbSO_4 + 2e^- + 2H^+ \longrightarrow Pb(s) + H_2SO_4$
0.05/2 mole 0.05 F

$n_T(PbSO_4) = 0.05$ mole

$m_{PbSO_4} = 0.05 \times 303 = 15.2$ gm

25. The one that is extensively used as a piezoelectric material is :
(1) Quartz
(2) Amorphous silica
(3) Mica
(4) Tridymite

Ans. **(1)**

Sol. Quartz (Information)

26. Aluminium is usually found in +3 oxidation stagte. In contarast, thallium exists in +1 and +3 oxidation states. This is due to :
(1) lanthanoid contraction
(2) lattice effect
(3) diagonal relationship
(4) inert pair effect

Ans. **(4)**

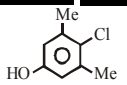
Sol. Inert pair effect is promenent character of p-block element.

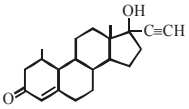
27. The correct match between Item -I and Item-II is :

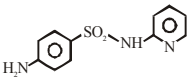
Item – I (drug)		Item – II (test)	
(A)	Chloroxylenol	**(P)**	Carbylamine Test
(B)	Norethindrone	**(Q)**	Sodium Hydrogen carbonateTest
(C)	Sulphapyridine	**(R)**	Ferric chloride test
(D)	Penicillin	**(S)**	Bayer's test

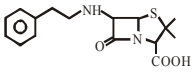
(1) A→Q ; B→P ; C→S ; D→R
(2) A→R ; B→P ; C→S ; D→Q
(3) A→R ; B→S ; C→P ; D→Q
(4) A→Q ; B→S ; C→P ; D→R

Ans. **(3)**

Sol. (A) Chloroxylenol  $FeCl_3$ test

(B) Norethindrone  Bayer's test

(C) Sulphapyridine  Carbylamine test

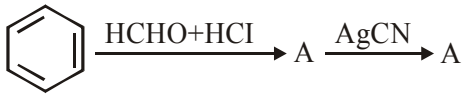
(D) Penicllin  Sodium hydrogen carbonate test

28. The ore that contains both iron and copper is:
(1) malachite
(2) dolomite
(3) azurite
(4) copper pyrites

Ans. **(4)**

Sol. Copper pyrites : $CuFeS_2$
Malachite : $Cu(OH)_2 . CuCO_3$
Azurite $Cu(OH)_2 . 2CuCO_3$
Dolomite $CaCO_3 . MgCO_3$

29. The compounds A and B in the following reaction are, respectively:



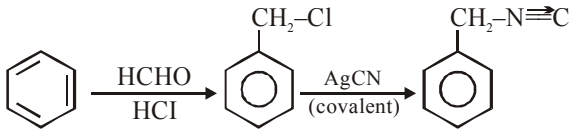
(1) A = Benzyl alcohol, B = Benzyl isocyanide

(2) A = Benzyl alcohol, B = Benzyl cyanide

(3) A = Benzyl chloride, B = Benzyl cyanide

(4) A = Benzyl chloride, B = Benzyl isocyanide

Ans. (4)

Sol. 

30. The isotopes of hydrogen are :

(1) Tritium and protium only

(2) Deuterium and tritium only

(3) Protium and deuterum only

(4) Protium, deuterium and tritium

Ans. (4)

Sol. Isotopes of hydrogen is :

Proteium Deuterium Tritium