JEE MAIN 2023

JAN ATTEMPT

PAPER-1 (B.Tech / B.E.)

SHIFT - 2

QUESTIONS & SOLUTIONS

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24 JANUARY, 2023

03:00 PM to 06:00 PM

Duration : 3 Hours Maximum Marks : 300

SUBJECT - CHEMISTRY

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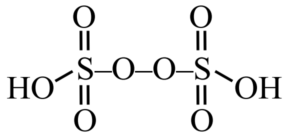
CHEMISTRY

1. Sum of π-bonds in one molecule each of Peroxydisulphuric acid & Pyrosulphuric acid is:

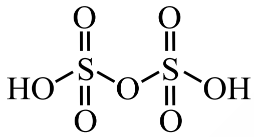
Ans. 8 **(Chemical Bonding)**

Sol. Peroxydisulphuric acid



π-bonds = 4

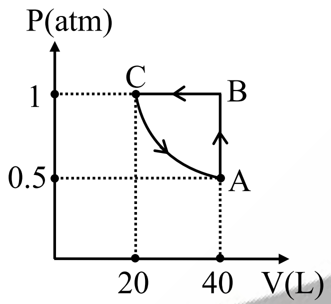
Pyrosulphuric acid



π-bonds = 4

Sum = 4 + 4 = 8

2.



1 mole of ideal gas undergoes above cyclic process.

Value of work done (in J) is : (ℓn2 = 0.7)

Ans. 608 **(Thermodynamics)**

Sol. $W = W_{AB} + W_{BC} + W_{CA}$

$$= 0 - 1(20 - 40) + \left[-20\ell n\left(\frac{40}{20}\right)\right]$$

$$= 20 - 20\ \ell n2$$

$$= 20\ (1 - 0.7)$$

$$= 6 \text{ L-atm}$$

$$= 6 \times 101.3$$

$$= 607.8 \text{ J} \approx 608 \text{ J}$$

3. $\begin{array}{c} CH_3 \\ | \\ H\text{–}C\text{–}COOH \\ | \\ OH \end{array}$ (Lactic acid) has $K_a = 10^{-5}$

pH of a solution containing 0.005M anionic form of above acid $\left(\begin{array}{c} CH_3 \\ | \\ H\text{–}C\text{–}COO^- \\ | \\ OH \end{array}\right)$ is :

(Nearest integer)

Ans. **8** **(Ionic Equilibrium)**

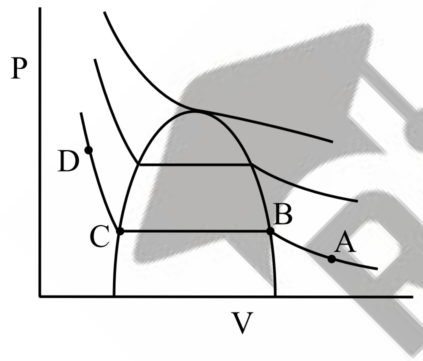
Sol. Salt of WA & SB

$$pH = \frac{1}{2}(pK_w + pK_a + \log C)$$

$$= \frac{1}{2}(14 + 5 - 3 + \log 5)$$

$$= 8.35 \approx 8$$

4. Which of the following statements are correct for given Andrew isotherm of CO_2



(i) Formation of liquid starts at point C.

(ii) From point B to C amount of liquid decreases.

(iii) Formation of liquid starts from point B.

(iv) At points B & C, both liquid & vapour coexist.

(1) i, ii (2) ii, iii (3) iii, iv (4) i, iv

Ans. **(3)** **(Real gas)**

Sol. (i) Formation of liquid ends at point C.

(ii) From B to C, amount of liquid increases.

5. Which of the following are concentration terms.

Mole, Mass%, Molality, Molarity, Mole fraction, ppm.

Ans. 5 **(Mole Concept)**

Sol. All other than mole.

6. Unipositive ion of an atom containing 55 protons contains how many s electrons?

Ans. 10 **(Atomic Structure)**

Sol. ${}_{55}Cs^{+}$: $1s^2 2s^2 2p^6 3s^2 3p^6\ 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6$

Number of s-electrons = 2 + 2 + 2 + 2 + 2 = 10

7. $[Co(NH_3)_6]^{3+}$ is _______ hybridised and _______.

(1) d^2sp^3, Diamagnetic
(2) d^2sp^3, Paramagnetic
(3) sp^3d^2, Diamagnetic
(4) sp^3d^2, Paramagnetic

Ans. 1 **(Coordination Compounds)**

Sol. $Co^{3+}(3d^6)$ + SFL(CN = 6)

$\Rightarrow t_{2g}^{222} e_g^{00} \Rightarrow d^2sp^3$ and Diamagnetic

8. The metal which is extracted by oxidation and subsequent reduction from its ore is:

(1) Au
(2) Cu
(3) Fe
(4) Al

Ans. **(1)** **(Metallurgy)**

Sol. $Au \xrightarrow[\text{+O}_2 \\ \text{(Oxidation)}]{\text{NaCN}} [Au(CN)_2]^- \xrightarrow[\text{(Reduction)}]{\text{Zn}} Au\downarrow$

9. How many statement/statements is/are correct for physisorption?

(i) physisorption is highly specific in nature.

(ii) physisorption is monolayer in nature.

(iii) physisorption has zero activation energy

(iv) physisorption decreases with increasing temperature.

(v) physisorption has high $\Delta H_{Adsorption}$

Ans. **2 (iii, iv)** **(Surface Chemistry)**

Sol. (i) physisorption is less specific in nature.
(ii) physisorption is multimolecular layer
(iii) physisorption has low $\Delta H_{Adsorption}$

10. An ideal solution containing $X_A = 0.7$ has VP = 350 torr

Another ideal solution containing $X_B = 0.2$ has VP = 410 torr

P_A^o = ? (nearest integer)

Ans. **314** **(Solution & Colligative Properties)**

Sol. $0.7\,P_A^o + 0.3\,P_B^o = 350$

$\&\ 0.2\,P_A^o + 0.8\,P_B^o = 410$

$\therefore\ P_A^o = 314$ torr

11. H_2O_2 behave like reducing agent in which of the following reactions :

(1) $Fe^{+2} + H_2O_2 \longrightarrow Fe^{+3} + H_2O$

(2) $H_2S + H_2O_2 \longrightarrow SO_4^{2-} + H_2O$

(3) $HOCl + H_2O_2 \longrightarrow Cl^- + 2H_2O + O_2$

(4) $Mn^{+2} + H_2O_2 \longrightarrow MnO_2 + H_2O$

Ans. **(3)** **(p-Block (15-16 family))**

Sol. H_2O_2 reduces HOCl to Cl^- and itself gets oxidised to O_2.

12. $AB_3(g)$ dissociates into gaseous products with following data:

$t_{1/2}$	4 sec.	2 sec.	1 sec.	0.5 sec.
$P_o\ (AB_3)$	50 torr	100 torr	200 torr	400 torr

Order of reaction is

Ans. **2** **(Chemical Kinetics)**

Sol. $t_{1/2} \propto \frac{1}{P_o} \Rightarrow$ II order

13. Number of unpaired electron in highest occupied molecular orbital of following species is :

	N_2	$N_2^{\oplus}$	O_2	$O_2^{\oplus}$
(1)	0	1	2	1
(2)	1	0	1	2
(3)	2	2	0	2
(4)	1	1	1	0

Ans. **(1)** **(Chemical Bonding)**

Sol. $N_2 \rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \left[\pi 2p_x^2 = \pi 2p_y^2\right] \underset{\text{HOMO}}{\sigma 2p_z^2}$

$N_2^{\oplus} \rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \left[\pi 2p_x^2 = \pi 2p_y^2\right] \underset{\text{HOMO}}{\sigma 2p_z^1}$

$O_2 \rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, \left[\pi 2p_x^2 = \pi 2p_y^2\right] \underbrace{\left[\pi^* 2p_x^1 = \pi^* 2p_y^1\right]}_{\text{HOMO}}$

$O_2^{\oplus} \rightarrow \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_z^2, \left[\pi 2p_x^2 = \pi 2p_y^2\right] \underbrace{\left[\pi^* 2p_x^1 = \pi^* 2p_y^0\right]}_{\text{HOMO}}$

14. Which is good oxidising agent ?

(i) Sm^{+2} (ii) Ce^{+2} (iii) Ce^{+4} (iv) Tb^{+4}

(1) Sm^{+2} only (2) Ce^{4+}, Tb^{4+} (3) Ce^{+4} only (4) Ce^{2+} only

Ans. (2) **(f-Block)**

Sol. Ce^{4+} & Tb^{4+} are good oxidising agents (both get reduced to +3).

15. $K_2Cr_2O_7$ paper acidified with dil. H_2SO_4 turns green when exposed to :

(1) SO_2 (2) SO_3 (3) CO_2 (4) H_2S

Ans. (1) **(d-Block)**

Sol. $SO_2 \xrightarrow[H^+]{K_2Cr_2O_7} \underset{\text{(green)}}{Cr^{3+}} + SO_4^{2-}$

16. α-particle, proton & electron have same kinetic energy. Select correct order of their de-Broglie wavelength.

(1) $\lambda_e > \lambda_p > \lambda_\alpha$ (2) $\lambda_\alpha > \lambda_e > \lambda_p$ (3) $\lambda_p = \lambda_\alpha = \lambda_e$ (4) $\lambda_p > \lambda_e > \lambda_\alpha$

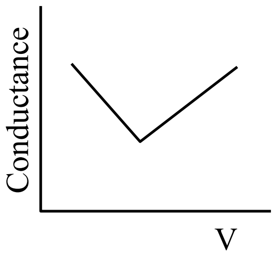
Ans. (1) **(Atomic Structure)**

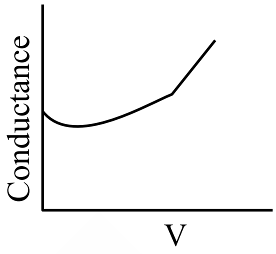
Sol. $\lambda = \dfrac{h}{m \cdot v} = \dfrac{h}{\sqrt{2 \cdot m \cdot K.E.}}$

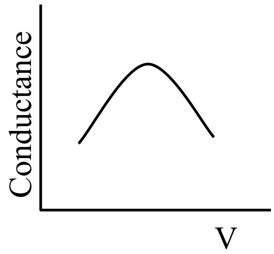
as K.E. is same $\Rightarrow \lambda \propto \dfrac{1}{\sqrt{m}}$

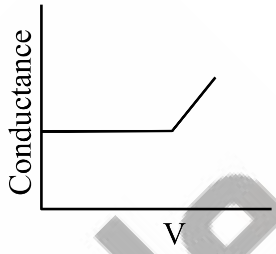
mass of electron = 9.1×10^{-31} kg
mass of proton = 1.67×10^{-27} kg
mass of α-particle = 6.68×10^{-27} kg
$\Rightarrow \lambda_e > \lambda_p > \lambda_\alpha$

17. Which of the following is correct graph for conductometric titration between benzoic acid & NaOH ?

(1) 

(2) 

(3) 

(4) 

Ans. (2) **(Electrochemistry)**

18. S_1 : Be^{+2} has higher SRP than other alkaline earth metals.

S_2 : Be^{+2} has higher hydration energy and greater Δ_aH (atomisation enthalpy) than other alkaline earth metals.

(1) Both S_1 & S_2 are true

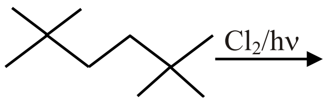
(2) S_1 is true ; S_2 is false

(3) S_1 is false ; S_2 is true

(4) Both S_1 & S_2 are false

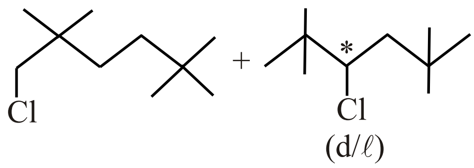
Ans. (1) **(s-Block)**

Sol. Be has least –ve SRP value because of high Δ_aH (atomisation enthalpy), inspite of maximum hydration energy.

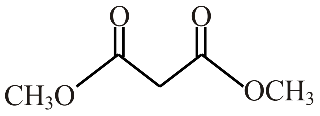
19. 

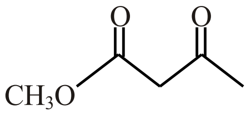
All possible monochloro products **[Hydrocarbons]**

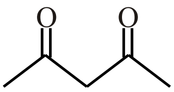
Ans. (3)

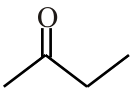
Sol. 

20. Which of the following is most easily deprotonated ?

(a) 

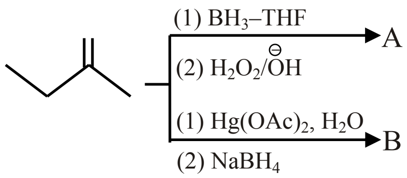
(b) 

(c) 

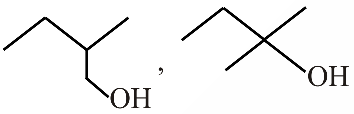
(d) 

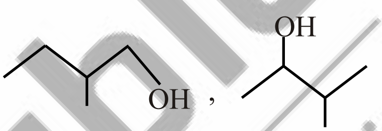
(1) a (2) b (3) c (4) d

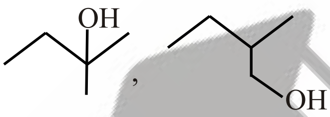
Ans. (3) **[GOC-2]**

21. 

A & B are respectively

(1) 

(2) 

(3) 

(4) 

Ans. (1) **[Hydrocarbons]**

22. Average human being requires nearly ___ times more air than the food

(1) 12–15 (2) 100 (3) 40-50 (4) 75

Ans. (1) **[Environmental]**

23. **Statement-I :** Aniline and other aryl amines are usually colourless

Statement-II : Aniline and other arylamines get coloured on storage due to atmospheric oxidation

(1) Both Statement-I and Statement-II are correct.

(2) Both Statement-I and Statement-II are incorrect.

(3) Statement-I is correct but Statement-II is incorrect.

(4) Statement-I is incorrect but Statement-II is correct.

Ans. (1) **[Aromatic compound]**

Sol. Both are correct

24. **Assertion (A) :** Benzene is more stable than hypothetical cyclohexatriene

Reason (R): The delocalised π-electrons cloud is attracted more strongly by the nuclei of the carbon atoms than the electron cloud localised between two carbon atoms.

(1) Both **(A)** and **(R)** are true but **(R)** is not the true explanation of **(A)**

(2) **(A)** is false but **(R)** is true.

(3) **(A)** is true but **(R)** is false

(4) Both **(A)** and **(R)** are true and **(R)** is the true explanation of **(A)**

Ans. **(4)** **[Hydrocarbon]**

25. Match the column

(P) Antifertility drugs	(A) Norethindrone
(Q) Anti histamines	(B) Seldane
(R) Tranquilizers	(C) Meprobamate
(S) Antibiotics	(D) Penicillin

(1) P $\rightarrow$ (A), Q $\rightarrow$ (B), R $\rightarrow$ (C), S $\rightarrow$ (D)

(2) P $\rightarrow$ (A), Q $\rightarrow$ (C), R $\rightarrow$ (B), S $\rightarrow$ (D)

(3) P $\rightarrow$ (D), Q $\rightarrow$ (C), R $\rightarrow$ (B), S $\rightarrow$ (A)

(4) P $\rightarrow$ (A), Q $\rightarrow$ (D), R $\rightarrow$ (B), S $\rightarrow$ (C)

Ans. **(1)** **[Chemistry in every day life]**

26. How many tripeptides can be formed from the amino acid valine and proline?

Ans. **8** **[Biomolecules]**

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