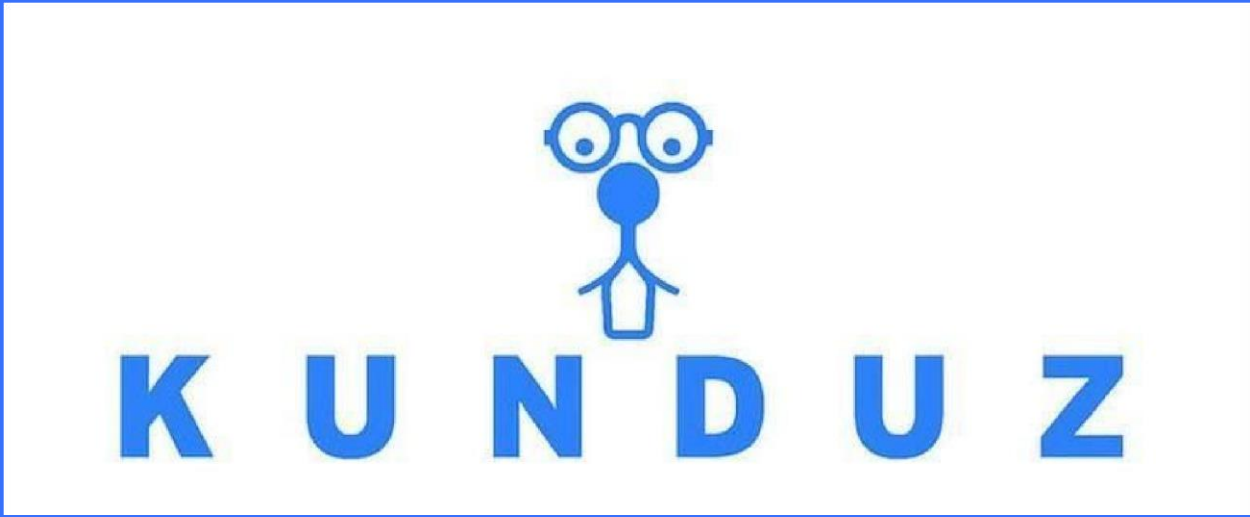


JEE Mains 3rd September 2020 shift 1 Chemistry solutions prepared by KUNDUZ tutors

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Question number

1

Question and Answers

JEE MAIN

3rd - September

1st Shift.

Gyan DATE PAGE

Question 1.

The mechanism of S_N1 reaction is given as

$$R-X \longrightarrow \underset{\text{Ion pair}}{R^{\oplus}X^{\ominus}} \rightarrow \underset{\text{Solvent seperated ion pair}}{R^{\oplus} \,||\, X^{\ominus}} \xrightarrow{Y^{\ominus}} R-Y + X^{\ominus}$$

A student writes general characteristics based on the given mechasim as :

(a) The reaction is favoured by weak nucleophiles.

(b) R^+ would be easily formed if the substituents are bulky

(c) The reaction is accompained by racemisation

(d) The reaction is favoured by non-polar solvents.

Which observations are correct

(i) (b) and (d) (ii) (a) and (c)

(iii) (a) and (b) (iv) (a), (b) and (c)

S_{N_1} reaction characteristics are that it is undergone by weak nucleophiles, racemisation favoured if substituents are bulky as then incoming nucleophile can't go by S_{N_2}

Also this is favoured by polar-solvents as they help in seperating ion-pair.
so (a), (b), (c) are correct.
Hence option (4.) Concept based question.

2

2. The atomic number of element unnilennium is :
(i) 119 (ii) 109 (iii) 108 (iv) 102

Split unnilennium to give un, nil, enn
now un = 1, nil = 0, enn = 9 so 109 is correct. It is out of box memory-used question. option (ii)

3

3. Thermal power plants can lead to :
(1) Eutrophication (2) Acid rain
(3) Ozone layer depletion (4) Baby blue syndrom

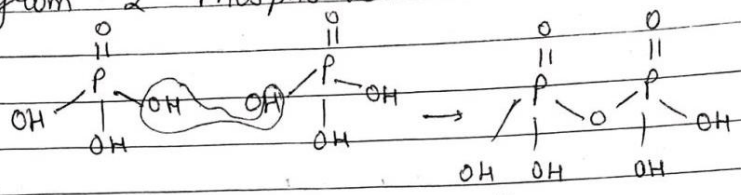
Thermal power plant releases harmful SO_2 and CO_2 along with CO, NO_2 which causes acid rain. Easy question.

4

4:- In molecule of pyrophosphoric acid, the no. of P-OH, P=O and P-O-P bonds respectively are :-

1) 4, 2 and 1
2) 3, 3, 3
3) 4, 2 and 0
4) 2, 4 and 1.

Pyro implies remove a water molecule from 2 Phosphoric acid molecules.



So this is pyrophosphoric acid now it has 2 - P=O bond, 4 P-OH bond and 1 P-O-P bond so (1) is correct answer.

5

5. It is true that

(1) A first order reaction is always a single step reaction

(2) A second order reaction is always multistep reaction.

(3) A zero order reaction is single step reaction.

(4) A zero order reaction is multistep reaction.

Always remember order has nothing to do with steps involved. Order is sum of powers appearing in rate law expression. so (1) and (2) containing word always is straightaway wrong. And all zero order reactions are multistep because here rate law do not depend on any concentration so it takes place in multistep. For ex bromination of hydrocarbons. Option 4 is correct.

6

6. Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and $BaSO_4$ respectively, at a temp. T. which of the following is false ?

(1) Ionic mobilities of ions from both salts increase with T.

(2) $C_{NaCl} >> C_{BaSO_4}$ at a given T.

(3) $C_{BaSO_4}(T_2) > C_{BaSO_4}(T_1)$ for $T_2 > T_1$

(4) $C_{NaCl}(T_2) > C_{NaCl}(T_1)$ for $T_2 > T_1$

NaCl is completely soluble and $BaSO_4$ is not so $C_{BaSO_4} << C_{NaCl}$

On temp. increase conductance increase so $C_{NaCl}(T_2) < C_{NaCl}(T_1)$ option (4) is correct

Also ionic mobility decrease with temp. decrease due to increased random motion and net decrease in drift speed.

7

Tyndall effect is observed when:
(1) The diameter of dispersed particles is similar to wavelength of light used
(2) The refractive index of dispered phase is greater than that of dispersion medium.
(3) The diameter of dispersed particle is much smaller than wavelength of light used.
(4) The diameter of dispersed particles is much larger than wavelength of light used.

The diameter of dispereed particle is not much smaller than wavelength of light used. The intensity of scattered light depends on difference b/w refractive index of D.P and D.M. In lyophobic colloids this diff is appriciable and therefore the tyndall effect is quite well defined. According to NCERT (1) is correct.

8

An acidic buffer is obtained on mixing
(1) 100 ml of 0.1 M CH_3COOH and 200 ml of 0.1 M NaOH
(2) 100 ml of 0.1 M CH_3COOH and 100 ml of 0.1 M NaOH
(3) 100 ml of 0.1 M HCl and 200 ml of 0.1 M CH_3COO
(4) 100 ml of 0.1 M HCl and 200 ml of 0.1 M NaCl
For acidic buffer → mixture of weak acid and its salt with strong base. and strong acid so CH_3COONa → weak acid & strong base salt so option 3 is correct.

9

9. Antifertility drug "Novestrol" can react with :

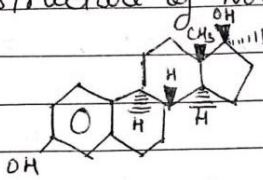
(1) $ZnCl_2$ / HCl ; $FeCl_3$; Alcoholic HCN

(2) Alcoholic HCN ; NaOCl ; $ZnCl_2$ / HCl

(3) Br_2 / water ; $ZnCl_2$ / HCl ; NaOCl

(4) Br_2 / water ; $ZnCl_2$ / HCl ; $FeCl_3$

Structure of Novestrol is



has ≡CH group
phenolic group
alcohol

So it shows $FeCl_3$; $ZnCl_2$ / HCl ; Br_2 / H_2O tests. So option (4) is correct.

10

10. The electronic spectrum of $[Ti(H_2O)_6]^{3+}$ shows a single peak of with a maximum at 20,300 cm^{-1}. The CFSE of complex ion, in ($1\ kJ\ mol^{-1} = 83.7\ cm^{-1}$)

(1) 242.5 (2) 145.5 (3) 83.7 (4) 97

for $[Ti(H_2O)_6]^{3+} \Rightarrow Ti^{+3} = 3d^1\ 4s^0$

now $3d^1\ 4s^0 \Rightarrow t_{2g}^{1,0,0}, eg^{0,0}$

$CFSE = [-0.4n + 0.6m]\Delta_o + n(p)$

($n(p)$: pairing energy)

as there is no pair up with just 1 e^- so $n(p) = 0$.

C.F.S.E. $= [-0.4 \times 1] \times 20300\ cm^{-1}$

$= -8120\ cm^{-1}$

as $1\ kJ\ mol^{-1} = 83.7\ cm^{-1}$

so

$8120\ cm^{-1} = \frac{8120}{83.7} = 97\ kJ/mol$

option (4)

11

11. Glycerol is seperated in soap industries by :

(1) Steam distillation (2) Differential distillat.

(3) Fractional distillation (4) Distillation under reduced pressure.

This is just information related question the answer is (4). This is given in NCERT – 11th class.

12

12. Henry's constant (in Kbar) for four gases α, β, γ and δ in water at 298 K is given below:

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water $= 10^3$ kg m^{-3} at 298 K). This table implies that :

1.) Solubility of γ at 308 K is lower than at 298 K.

2.) Pressure of 55.5 molar solution of γ is 1 bar.

3.) The pressure of 55.5 molal solution of δ is 250 bar

4.) α has the heighest solubility in water at a given pressure.

(i) In reality with increase in temp. solubility of gas decreases but for γ K_H is less that 1 than in this case is increases with temp. (By henry law $P_{gas} = K_H \cdot X_{gas}$)

(ii) $P_\gamma = K_{H\gamma} \cdot (X)_\gamma \Rightarrow 2\times10^{-2} \times \dfrac{55.5}{55.5 + \frac{1000}{18}} = 10^{-2}$

(K_H ↑, mole fraction of γ ↑)

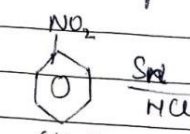
(iii) $P_\delta = (K_H)_\delta \cdot X_\delta = 0.5 \times 10^3 \times \frac{1}{2} = 250$

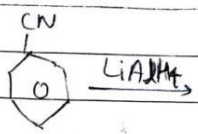
(v) γ is most soluble as $X \propto \dfrac{P}{K_H}$ so less K more solubility.

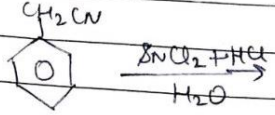
Hence (3) is correct.

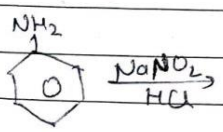
13

13: The Kjeldahl method of N_2 estimation fails with which of the following reaction products ?

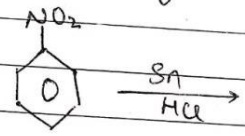
(a) 

(b) 

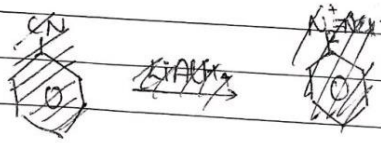
(c) 

(d) 

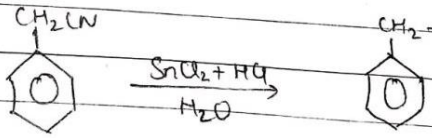
if NH_2 group is present in product it will give Kjeldahl's test.



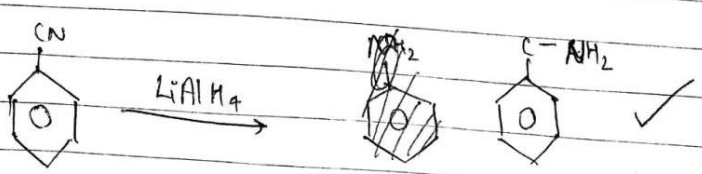
✓



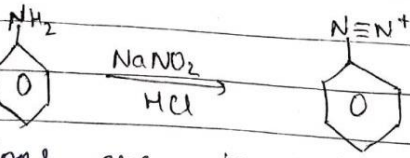
~~NH4Cl (present)~~ ✗



✗



✓



✗

Options are (i) a & d (ii) a, c, d
(iii) b & c (iv) c, d

option (iv) is correct

14

14. If boiling point of H_2O is 373 K, the boiling point of H_2S will be:

1) equal to 373 K
2) greater than 300 K but less than 373 K
3) less than 300 K
4) more than 373 K

at 300 K water is liquid but H_2S is gas. This is because H_2O has stronger H-bonding due to O. so boiling point of H_2S is less than 300 K. option 3.

15

15. Of the species, NO, NO^+, NO^{2+} and NO^-, the one with minimum bond strength.

(1) NO (2) NO^{2+} (3) NO^- (4) NO^+

This is found by molecular orbital theory. From this bond order is found as

$$\text{Bond order} = \frac{(\text{No of } e^- \text{ in bonding orbital} - \text{No. of } e^- \text{ in anti-bonding orbital})}{2}$$

so Bond order is calculated as follows

$NO^+ \longrightarrow 3$
$NO^{2+} \longrightarrow 2.5$
$NO^- \longrightarrow 2$
$NO^- \longrightarrow 2.5$

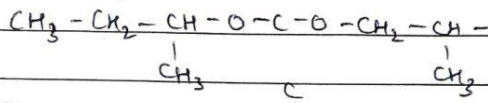
now Bond strength $\propto$ Bond order
so NO^- has minimum bond strength

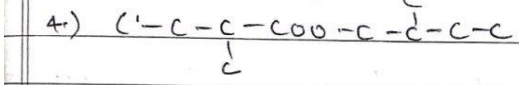
16

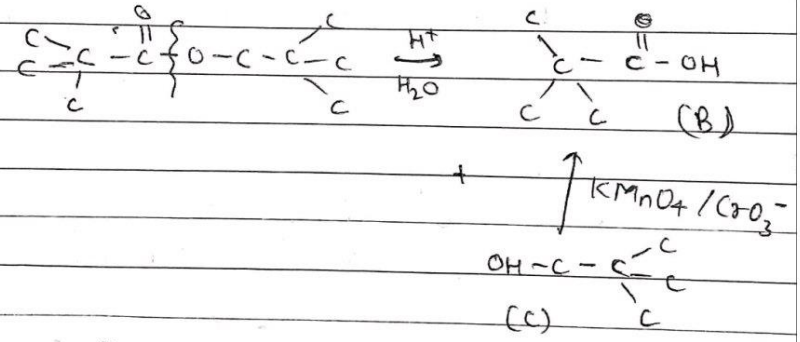
16. An organic compound A, molecular formula $C_{10}H_{20}O_2$ was hydrolysed with dilute Sulphuric acid to given a carboxylic acid B. and an alcohol C. Oxidation of C with $CrO_3-H_2SO_4$ produced B. Which of following structures are not possible for A.

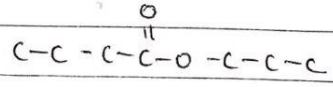
1.) $(CH_3)_3-C-COOCH_2CH_2C(CH_3)_3$

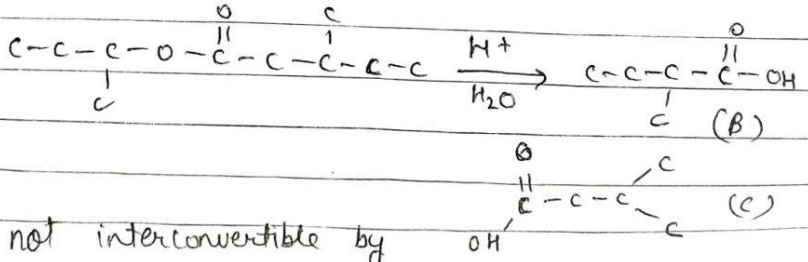
2.) $CH_3-CH_2-CH_2-COO-CH_2-CH_2-CH_2-CH_3$

3.) 

4.) 

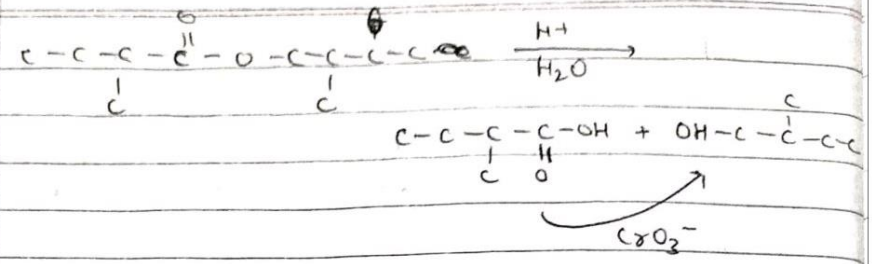
(1.) 

(2)  here there are 8 C so molecular formula $C_{10}H_{20}O_2$ does not match.

(3.) 

not interconvertible by oxidation.

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(4) 

so both 2 and 3 are correct.

17

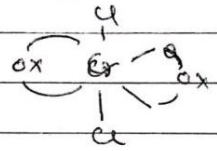
17. The complex that show optical activity is :

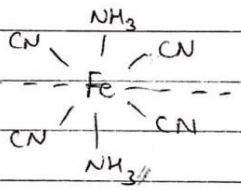
1) trans - $[Cr(Cl_2)(ox)_2]^{3-}$

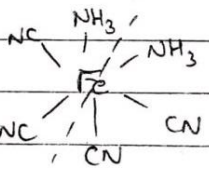
2) trans - $[Fe(NH_3)_2(CN)_4]^-$

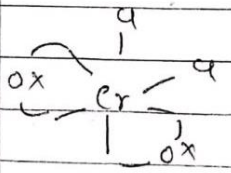
3) cis - $[Fe(NH_3)_2(CN)_4]^-$

4) cis - $[Cr Cl_2 (ox)_2]^{3-}$

1) ⇒  optically inactive. symetric

2)  inactive optically symetric

3)  optically inactive.

4)  optically active.

option 4.

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18

18. Aqua regia is used for dissolving noble metals (Au, Pt etc). The gas evolved in the process is.

(1) N_2 (2) NO (3) N_2O_5 (4) N_2O_3

In aqua regia ratio of HCl & HNO_3 is 3:1

$$HNO_3 + 3HCl \longrightarrow 2H_2O + NO + 3[Cl]$$

(i) $Au + 3[Cl] \longrightarrow AuCl_3 \xrightarrow{HCl} HAuCl_4$

(ii) $Pt + 4[Cl] \longrightarrow PtCl_4 \xrightarrow{HCl} H_2PtCl_4$

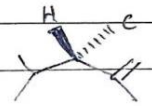
$HAuCl_4$ → Auric acid.

H_2PtCl_4 → Platinic acid.

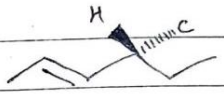
option 2 is correct.

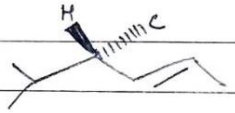
19

19. Which of the following produces optically inactive compound on hydrogenation.

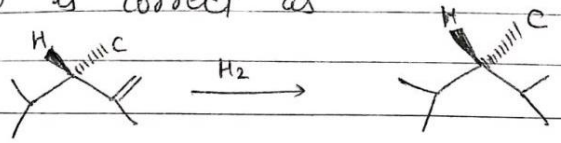
(1) 

(2) 

(3) 

(4) 

(1) is correct as

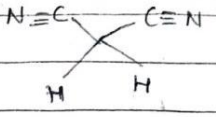


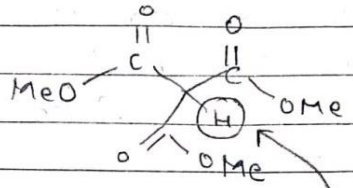
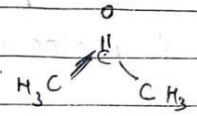
this is optically inactive.

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20

20. Which of the following posses most acidic hydrogen ?

(1) $C-C\equiv C-H$ (2) 

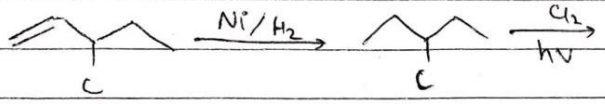
(3)  (4) 

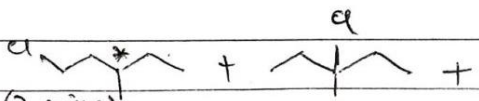
⇒ in (3) we have 3 (-M) groups i.e. 3 (C(=O)-O-(CH3)) group which makes central H very much acidic so 3 is correct.

21

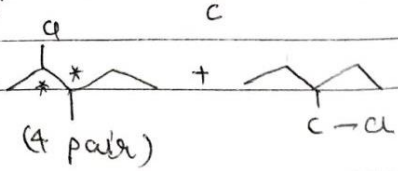
21. The total no. of monohalogenated organic products in following (including stereoisomers) reaction is _____. answer is 8.

A (simplest optically active alkene) $\xrightarrow[\text{(ii) } X_2/\Delta]{\text{(i) } H_2/Ni\,\Delta}$

A is 



(2 pairs)



(4 pair)

so total 8.

22

22. The photoelectric current from Na (work function, $w_o = 2.3$ eV) is stopped by the output voltage of the cell

$Pt(s) | H_2(g, 1\ bar) | HCl(aq, pH = 1) | AgCl(s) | Ag$

the pH of aq. HCl required to stop the photoelectric current from K ($w_o = 2.25$ eV) all other conditions remaining the same is ..... $\times 10^{-2}$

Given

$2.303 \frac{RT}{F} = 0.06\ V$; $E^\circ_{Ag|AgCl|Cl^-} = 0.22V$

$\frac{1}{2} H_2 \longrightarrow H^+ + e$

$e + AgCl \longrightarrow Ag + Cl^-$

$\frac{1}{2} H_2 + AgCl \longrightarrow H^+ + Ag + Cl^-$

$$E = E^\circ - \frac{0.06}{1} \log \frac{[H^+][Cl^-]}{P_{H_2}^{1/2}}$$

$E = 0.22 + 0.12 = 0.34$ volt

total energy of photon will be

$= 2.3 + 0.34 = 2.64$ eV

$\Rightarrow$ stopping potential required for K

$= 2.64 - 2.25 = 0.39$ volt.

$$E = E^\circ - \frac{0.06}{1} \log \frac{[H^+][a^-]}{P_{H_2}^{1/2}}$$

as $[H^+] = [a^-]$ so

$0.39 = 0.22 - 0.06 \log \frac{[H^+]^2}{I^{1/2}}$

$0.17 = 0.12\ pH$

$\Rightarrow pH = 1.4166 = 1.42 = 142 \times 10^{-2}$

so answer is 142

(a hard question)

23

23. Mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it to the nearest integer is _____.

Answer is 47.

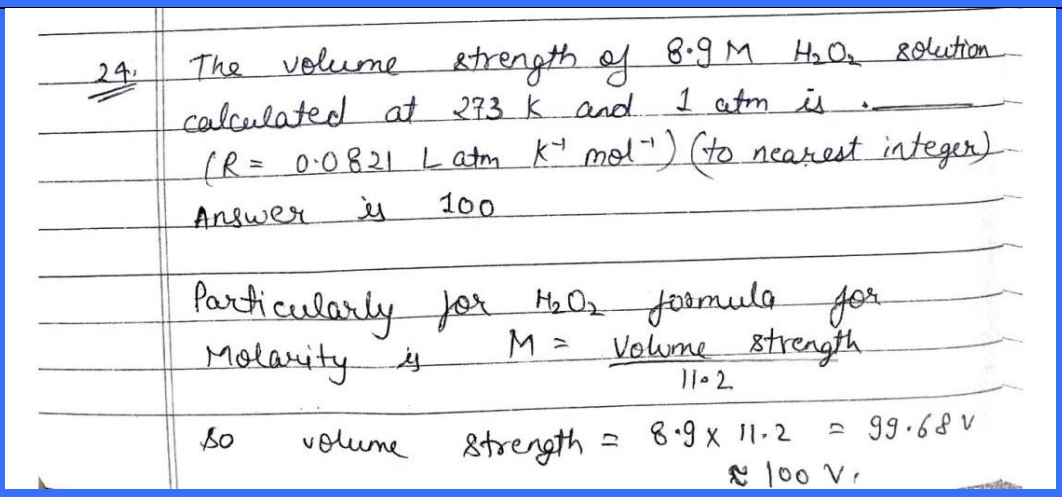
given $X_{glucose} = 0.1$

we know $X_{glucose} + X_{water} = 1$

$\Rightarrow X_{water} = 0.9$. the % mass of water

$\Rightarrow \frac{0.9 \times 18}{0.1 \times 180 + 0.9 \times 18} \times 100 = 47.36.$

24



24. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____ ($R = 0.0821$ L atm K^{-1} mol^{-1}) (to nearest integer)

Answer is 100

Particularly for H_2O_2 formula for Molarity is $M = \frac{\text{Volume strength}}{11.2}$

So volume strength $= 8.9 \times 11.2 = 99.68$ V

≈ 100 V.

25

25 An element with molar mass 2.7×10^{-2} Kg mol^{-1} forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^3 kg m^{-3}. The radius of the element is approximately ____ $\times 10^{-12}$ (to nearest integer)

$$d = \frac{Z \times M}{N_A \times a^3}$$

Z = (no of atoms in unit cell)

$M = 2.7 \times 10^{-2}$ kg/mol

$a = 405 pm = 405 \times 10^{-12}$

$N_A = 6.03 \times 10^{23}$

$d = 2.7 \times 10^3$

& ~~ub~~ substituting gives.

$$2.7 \times 10^3 = \frac{Z \times 2.7 \times 10^{-2}}{6 \times 10^{23} \times 66.43 \times 10^{-30}}$$

$\Rightarrow z = 3.98 \approx 4 \Rightarrow$ fcc unit cell

For fcc $4r = \sqrt{2}a$

$$\Rightarrow r = \frac{1.414 \times 405}{4} = 143.16 \approx 143 \text{ pm.}$$

So answer is 143.

Enrolling yourself for coaching classes has long been considered the first step towards cracking the JEE. However, this trend is starting to slip. Recent studies show that, for the students who cleared the JEE Main/Advance, the number of students who had joined a coaching class is lower than the number of students who managed the feat with self-study.

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